Virginia Department of Environmental Quality

Bacteria Total Maximum Daily Load (TMDL) Development for the Upper York River, the Lower Pamunkey River, and the Lower Mattaponi River (Tidal) Watersheds

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Executive Summary

This report addresses one bacteria impaired segment within the shellfish condemnation area 049-004A that has been listed on the Total Maximum Daily Load Priority List and 303(d) List of Impaired Waters for shellfish since 2002 due to violations of the fecal coliform criteria for shellfish waters. The shellfish impairment includes the most upstream section of the York River mainstem, unsegmented estuaries in F26E, Philbates, Baker, Bakers Ferry, Hockley, and Robinson Creeks. The report also addresses three bacteria recreational impairments within the York River, Lower Pamunkey River, and Lower Mattaponi River.

Description of the Study Area

The bacteria impaired segments and watersheds are located within the borders of King and Queen, New Kent and King William Counties. Within the watershed's boundaries is also the Town of West Point.

Applicable Water Quality Standards

Water quality standards consist of designated uses for a waterbody and water quality criteria necessary to support those designated uses. According to Virginia Water Quality Standards (9 VAC 25-260-5), the term "water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

VA DEQ and VDH specify the following criteria for shellfish waterbodies (VA DEQ, 2008):

"In all open ocean or estuarine waters capable of propagating shellfish or in specific areas where public or leased private shellfish beds are present, and including those waters on which condemnation or restriction classifications are established by the State Department of Health the following criteria for fecal coliform bacteria shall apply: The geometric mean fecal coliform value for a sampling station shall not exceed an MPN (most probable number) of 14 per 100 milliliters. The 90th percentile shall not exceed an MPN of 43 for a 5-tube, 3-dilution test or 49 for a 3 tube, 3 dilution test."

VA DEQ specifies the following criteria for recreational uses (VA DEQ, 2008) of waterbodies located in saltwater or in a transition zone:

- "Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 mL of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 mL of water."

- Enterococci bacteria shall not exceed a geometric mean of 35 counts per 100ml of water for two or more samples over a calendar month nor shall it exceed the single sample maximum of 104 counts per 100mL of water.

The fecal coliform bacteria criteria shall not apply when enterococci bacteria samples are at a minimum of 12 data points, or when sampling was performed after June 30, 2008.

Watershed Characterization

The three bacteria impaired segments within the Upper Tidal York River watershed cover 106,392 acres. The land use characterization for the Upper Tidal York River watershed was based on the latest available land cover data from the National Land Cover Dataset, also known as NLCD 2005 Land Use Dataset. Dominant land uses in the watershed vary depending on the impaired watershed. The impaired segment within the Upper York River including the York river mainstem, the unsegmented estuaries in F26E, Philbates, Baker, Bakers, Ferry, Hockley and Robinson Creeks are forest (44%) and wetlands (19%), within the Lower Pamunkey River forest (38%) and wetlands (27%), and within the Lower Mattaponi River forest (49%) and wetlands (17%).

Potential sources of bacteria include run-off from grazing livestock, agricultural practices, industrial waste, residential waste, and pet waste. Some of these sources are driven by dry weather and others are driven by wet weather. The potential bacteria sources in the watershed were identified and characterized and were found to include permitted point sources, failed septic systems, livestock, wildlife, and pets.

Based on data obtained from VA DEQ, there are as many as 24 total permitted facilities in the Upper Tidal York River watershed. They include two wastewater treatment facilities and one domestic discharger. An inventory of livestock, wildlife, and pets was collected from data provided by Census of Agriculture (2007), the Virginia Department of Game and Inland Fisheries (VDGIF), the Animal Control Office (ACO), the American Veterinary Medical Association (AVMA), as well as from information from other sources.

Bacteria Source Tracking

As part of the TMDL development, Bacteria Source Tracking (BST) sampling was conducted by VDH-DSS over a twelve-month period from October 2005 to September 2006 at one VDH-DSS monitoring station (49-207). These samples were analyzed in order to identify the sources of bacteria found in the listed segment, the results of which were used in the TMDL development. Results from this sampling period indicate that bacteria from human, livestock, wildlife, and pet sources are present in the impaired segments.

TMDL Technical Approach

A simplified volumetric model approach[1], developed for small coastal basins, was selected to estimate current bacteria loads, to calculate allocation, and to determine reductions for each source (VA DEQ, 2006). The model is a Microsoft EXCEL spreadsheet that calculates bacteria loads present in the estuary based on a steady state mass balance in the bay over a tidal period. The model incorporates the volume of water at sea level in the bay, volume of water entering the bay through flood tide, volume of water flowing out of the bay through ebb tide, volume of net freshwater over a tidal cycle, and the maximum bacteria concentration measured in the estuary and at the boundary.

[1] This model was jointly developed by EPA, VA DEQ, Virginia Department of Conservation and Recreation (DCR), Maryland Department of the Environment (MDE), Virginia Department of Shellfish and Sanitary (DSS), Virginia Institute of Marine Sciences (VIMS), United States Geological Survey, Virginia Polytechnic University, James Madison University, and Tetra Tech.

TMDL Calculations

The TMDL represents the maximum amount of a pollutant that the stream can contain without exceeding the water quality standard. The load allocation for the selected scenarios was calculated using the following equation:

$$TMDL = ?\ WLA + ?\ LA + MOS$$

Where,

WLA = wasteload allocation (point source contributions);

LA = load allocation (non-point source allocation); and

MOS = margin of safety.

The margin of safety (MOS) is a required component of the TMDL, which accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. The MOS was implicitly incorporated in this TMDL. Implicitly incorporating the MOS requires that allocations meet the fecal coliform standard geometric mean of 14 MPN/100mL and the 90^{th} Percentile Standard of 49 MPN/100mL and the entercocci standard geometric mean of 35 MPN/100mL and the 90^{th} Percentile Standard of 104 MPN/100mL at any time.

Waste Load Allocation

There are three permitted dischargers located in the Upper Tidal York watershed that discharge bacteria loads. Of the three, two are individual permitted dischargers (VA0088331 and VA0075434) and one is a domestic residential discharger (VAG404212). However, the two individual permitted dischargers (VA0088331 and VA0075434) were not considered in the WLA for shellfish impaired segment in the Upper York, because the immediate area surrounding both treatment plant outfalls are identified by DSS as shellfish condemnation area 2C. The direct harvest of shellfish for human consumption is prohibited because of the location of a municipal wastewater treatment plant in this segment. Therefore, both dischargers are evaluated for primary contact (recreation) use only and are considered (depending on the location) in the WLA for the recreational impaired segment for the Upper York, Lower Pamunkey River, and Lower Mattaponi River. Although two additional point sources dischargers (VA0003115 and VA0090433) are located in the Upper Tidal York River watershed, they were not permitted for bacteria discharge and, therefore, excluded from TMDL allocations. An expansion for future growth factor of 5 was applied to compute the WLA from the permitted dischargers in TMDL watersheds where STPs contributed to bacteria load. In TMDL watersheds, in which no STPs contributed to bacteria load, a 1 percent of the allowable bacteria load for future growth was applied to the WLA.

The allocated loads including the design flow and bacteria concentration are shown in **Tables E-1**, **E-2, E3** and **E-4**. To account for future growth and for streams with permitted facilities, an expansion factor of 5 was applied to calculate the WLA. It should

Table E- 1: Waste Load Allocation for Fecal Coliform in the Upper Tidal York River watershed

Point Source	Facility Name	Design Flow (gallons/day)	Fecal Coliform Concentration (MPN/100ml) [1]	Allocated Load	Percent Reduction
VAG404212	Residence	60	49	1.11E+05	0
1% of the allowable load for future growth in absence of any WWTP				1.14E+12	
Total Allocated Waste Load				1.14E+12	

[1] The effluent fecal coliform concentration is based on the 90th percentile standard for fecal

Table E- 2: Waste Load Allocation for Enterococci in the Upper Tidal York River watershed

Point Source	Facility Name	Design Flow (gallons/day)	Enterococci Concentration (count /100ml) [1]	Allocated Load	Percent Reduction
VAG404212	Residence	60	104	2.36E+05	0
VA0075434	HRSD Town of West Point Sewage Treatment Plant	600,000	104	2.36E+09	0
VA0088331	Parham Landing WWTP	568,000	104	2.24E+09	0
Current Allocated Waste Load				4.60E+09	
Expansion for Future Growth (5X WLA)				2.30E+10	
Total Allocated Waste Load				2.76E+10	

[1] The effluent enterococci concentration is based on the Single Sample Maximum standard for enterococci

Table E- 3: Waste Load Allocation for Enterococci in the Lower Pamunkey River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Enterococci Concentration (count /100ml)** [1]	**Allocated Load**	**Percent Reduction**
VA0088331	Parham Landing WWTP	568,000	104	2.24E+09	0
			Current Allocated Waste Load	2.24E+09	
			Expansion for Future Growth (5X WLA)	1.12E+10	
			Total Allocated Waste Load	1.34E+10	
[1]The effluent entercocci concentration is based on the Single Sample Maximum standard for enterococci					

Table E- 4: Waste Load Allocation for Entercocci in the Mattaponi River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Enterococci Concentration (count /100ml)** [1]	**Allocated Load**	**Percent Reduction**
VAG404212	Residence	60	104	2.36E+05	0
VA0075434	HRSD Town of West Point Sewage Treatment Plant	600,000	104	2.36E+09	0
			Current Allocated Waste Load	2.36E+09	
			Expansion for Future Growth (5X WLA)	1.18E+10	
			Total Allocated Waste Load	1.42E+10	
[1] The effluent entercocci concentration is based on the Single Sample Maximum standard for enterococci					

Load Allocation

The fecal coliform load allocation is based on Bacteria Source Tracking (BST) results for livestock, wildlife, human, and pets. The enterococci load allocations are based on Fecal Tool analyses for livestock, wildlife, human, and pets in the Lower Pamunkey River watershed and the Mattaponi River watershed. The BST results are based on a weighted average of samples collected by VDH-DSS over a twelve-month period from 2005-2006 at the VDH-DSS monitoring station 49-207. The enterococci results are based on the computed fecal coliform loads using the Fecal Tool spreadsheet analyses and the assumption that the distribution of enterococci loads will be the same as the distribution of fecal coliform loads by source categories. A complete reduction of all human sources is required, since fecal coliform and enterococci from human sources are considered a serious concern in estuaries (VA DEQ, 2005). Reductions for wildlife are applied when the reduction of controllable loads (humans, livestock, and pets) does not achieve the water quality standard for the estuary (VA DEQ, 2005). However, the TMDL does not recommend reductions in wildlife populations. Allocations are developed using the proportion of these sources in the BST data. The fecal coliform TMDL allocations by BST source categories that would meet the 90th percentile fecal coliform standard of 49 count/100mL for the Upper Tidal York River watersheds are provided in **Tables E-5**. The enterococci TMDL allocations by different source categories that would meet the Single Sample Maximum percentile enterococci standard of 104 count/100mL for the Upper York, Lower Pamunkey River and the Mattaponi River watersheds are provided in **Tables E-6, E-7** and **E-8**.

Summaries of the TMDL allocation plans for Upper York River, Lower Pamunkey River and Mattaponi River watersheds are presented in **Tables E-9**, **E-10**, **E-11** and **E-12,** respectively. Minor differences in current loads are due to rounding.

Table E- 5: Distribution of Fecal Coliform Under Existing Conditions, TMDL Allocation, and Reduction in the Upper Tidal York River watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (MPN/day)	Allocated Load (MPN/day)	Required Reduction (%)
Livestock	22%	2.52E+14	0.00E+00	100%
Wildlife	55%	6.30E+14	1.13E+14	82%
Human	12%	1.37E+14	0.00E+00	100%
Pets	11%	1.26E+14	0.00E+00	100%
Total		1.15E+15	1.13E+14	90%

* Weighted average of samples taken between 2005 and 2006

Table E- 6: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Upper Tidal York River watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	22%	1.05E+15	0.00E+00	100%
Wildlife	55%	2.63E+15	2.41E+14	91%
Human	12%	5.75E+14	0.00E+00	100%
Pets	11%	5.27E+14	0.00E+00	100%
Total		4.79E+15	2.42E+14	95%

* Weighted average of samples taken between 2005 and 2006

Table E- 7: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Lower Pamunkey Watershed for Nonpoint Sources

Source	Distribution of Allocation by Source* (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	75%	2.36E+15	0.00E+00	100%
Wildlife	8%	2.34E+14	1.63E+14	30%
Human	11%	3.54E+14	0.00E+00	100%
Pets	6%	1.94E+14	0.00E+00	100%
Total		3.14E+15	1.63E+14	95%

* Based on Fecal Tool analysis of bacteria loads

Table E- 8: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Mattaponi River Watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	78%	1.03E+15	2.58E+13	98%
Wildlife	5%	6.62E+13	6.62E+13	0%
Human	11%	1.47E+14	0.00E+00	100%
Pets	6%	8.36E+13	2.09E+12	98%
Total		1.33E+15	9.41E+13	93%

* Based on Fecal Tool analysis of bacteria loads

Table E- 9: The Upper York River TMDL Allocation Plan for Fecal Coliform Loads (count/day)			
WLA (Point Sources)	**LA (Nonpoint sources)**	**MOS (Margin of safety)**	**TMDL**
1.14E+12	**1.13E+14**	**IMPLICIT**	**1.14E+14**

Table E- 10: The Upper York River TMDL Allocation Plan for Enterococci Loads (count/day)			
WLA (Point Sources)	**LA (Nonpoint sources)**	**MOS (Margin of safety)**	**TMDL**
2.76E+10	**2.42E+14**	**IMPLICIT**	**2.42E+14**

Table E- 11: The Lower Pamunkey River TMDL Allocation Plan for Enterococci Loads (count/day)			
WLA (Point Sources)	**LA (Nonpoint sources)**	**MOS (Margin of safety)**	**TMDL**
1.34E+10	**1.63E+14**	**IMPLICIT**	**1.63E+14**

Table E- 12: The Mattaponi River TMDL Allocation Plan for Enterococci Loads (count/day)			
WLA (Point Sources)	**LA (Nonpoint sources)**	**MOS (Margin of safety)**	**TMDL**
1.42E+10	**9.41E+13**	**IMPLICIT**	**9.41E+13**

Consideration of Seasonal Variability

The Clean Water Act requires that a TMDL be established with consideration of seasonable variations. This includes variations of the hydrologic flow regime and the water quality. The seasonable variation was accounted for by the incorporation of monthly sampling and long-term data record in estimating existing conditions.

Consideration of Critical Conditions

The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. The Upper York bacteria TMDL reduction was developed using the maximum measured bacteria concentration within the impaired waterbody and stringent bacteria criteria (90^{th} percentile for shellfish impaired waterbodies and the single sample maxium for recreational impaired waterbodies). These two elements; the use of the maximum measured bacteria concentration along with stringent bacteria criteria insure that the critical conditions are accounted for the Upper York Bacteria TMDL.

Public Participation

Watershed stakeholders had opportunities to provide input and participate in the development of the TMDL during two public meetings held in the watershed. The meetings were held on January 20, 2010 and May 2, 2010 in West Point, VA.

1.0 Introduction

1.1 Background

1.1.1 Regulatory Guidance

Section 303(d) of the Clean Water Act and the Environmental Protection Agency (EPA)'s Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are exceeding water quality standards. TMDLs represent the total pollutant loading that a waterbody can contain without violating water quality standards. The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. By following the TMDL process, states can establish water quality based controls to reduce pollution from both point and non-point sources to restore and maintain the quality of their water resources (EPA, 2001).

The state regulatory agency for Virginia is the Department of Environmental Quality (VA DEQ). VA DEQ works in coordination with the Virginia Department of Conservation and Recreation (DCR), the Department of Mines, Minerals, and Energy (DMME), and the Virginia Department of Health (VDH) to develop and regulate a more effective TMDL process. VA DEQ is the lead agency for the development of TMDLs statewide and focuses its efforts on all aspects of reduction and prevention of pollution of state waters. VA DEQ ensures compliance with the Federal Clean Water Act and the Water Quality Planning Regulations, as well as with the Virginia Water Quality Monitoring, Information, and Restoration Act (WQMIRA), passed by the Virginia General Assembly in 1997, administers the National Pollution Discharge Elimination System (NPDES) permit systems for municipal and industrial facilities, and coordinates public participation throughout the TMDL development process. The role of DCR is to initiate non-point source pollution control programs statewide through the use of federal grant money. DMME focuses its efforts on issuing surface mining permits and National Pollution Discharge Elimination System (NPDES) permits for mining operations. Lastly, VDH monitors waters for fecal coliform, classifies waters for shellfish growth and harvesting, and conducts surveys to determine sources of bacterial contamination (VA DEQ, 2001).

As required by the Clean Water Act and WQMIRA, VA DEQ develops and maintains a listing of all impaired waters in the state that details the pollutant(s) causing each impairment and the potential source(s) of each pollutant. This list is referred to as the 303(d) List of Impaired Waters. In addition to 303(d) List development, WQMIRA directs VA DEQ to develop and implement TMDLs for listed waters (DEQ, 2001a). Once TMDLs have been developed, they are distributed for public comment and then submitted to the EPA for approval.

1.2 Impairment Listing

1.2.1 VADEQ Impairment Listing

This report addresses one bacteria impaired segment within the shellfish condemnation area 049-004A that has been listed on the Total Maximum Daily Load Priority List and 303(d) List of Impaired Waters for shellfish since 2002 due to violations of the fecal coliform criteria for shellfish waters. The shellfish impairment includes the most upstream section of the York River mainstem, unsegmented estuaries in F26E, Philbates, Baker, Bakers Ferry, Hockley, and Robinson Creeks. The report also addresses three bacteria recreational impairments within the York River, Lower Pamunkey River, and Lower Mattaponi River. Overall, the report develops four TMDL allocations, one for shellfish and three for recreational (**Figure 1-1**):

- TMDL #1: Shellfish TMDL allocation for the bacteria impaired segments of the York River mainstem, unsegmented estuaries in F26E, Philbates, Baker, Bakers Ferry, Hockley and Robinson Creeks (VAT-F26E_YRK02A02).

- TMDL #2: Recreational TMDL allocation for the bacteria impaired segments of the York River (VAT-F26E_YRK02A02)

- TMDL #3: Recreational TMDL allocation for the bacteria impaired segments of the Lower Pamunkey River (VAP-F14E_PMK07A04)

- TMDL #4: Recreational TMDL allocation for the bacteria impaired segments of the Lower Mattaponi River (VAP-F25E_MPN06B06)

Table 1-1 lists the waterbodies where a shellfish TMDL will be developed, and **Table 1-2** lists the waterbodies where a bacteria TMDL for recreational use will be developed.

Table 1-1: List of Shellfish Waterbodies Requiring TMDL Development

Cause Group Code	Assessment Unit	Shellfish Condemnation Area	Waterbody Name	Impairment	Estuary Area (mi^2)	Impairment Source
F26E-20-SF	VAT-F26E_BAK01A00 VAT-F26E_BKS01A08 VAT-F26E_FER01A08 VAT-F26E_HCK01A04 VAT-F26E_PHB01A00 VAT-F26E_RBN01A08 VAT-F26E_YRK01A04 VAT-F26E_ZZZ02A06	049-004A (08/25/2005)	York River mainstem, Unsegmented estuaries in F26E, Philbates, Baker, Bakers, Ferry, Hockley, and Robinson Creeks	Fecal Coliform	7.218	Unknown

Table 1-2: List of Recreation Waterbodies Requiring TMDL Development

Cause Group Code	Assessment Unit	Waterbody Name	Impairment	Estuary Area (mi^2)	Impairment Source
F26E-05-BAC	VAT-F26E_YRK02A02	York River	Enterococcus	6.966	Unknown
F14E-03-BAC	VAP-F14E_PMK07A04	Lower Pamunkey River	Enterococcus	4.368	Unknown
F25E-01-BAC	VAP-F25E_MPN06B06	Lower Mattaponi River	Enterococcus	2.535	Unknown
			Total	**13.869**	

The shellfish impaired segment covers a shellfish estuary area of 7.218 square miles and a total recreation impaired segment estuary area of 13.869 square miles of the Upper York River. **Figure 1-1** presents the location of the impaired segments of the Upper York River.

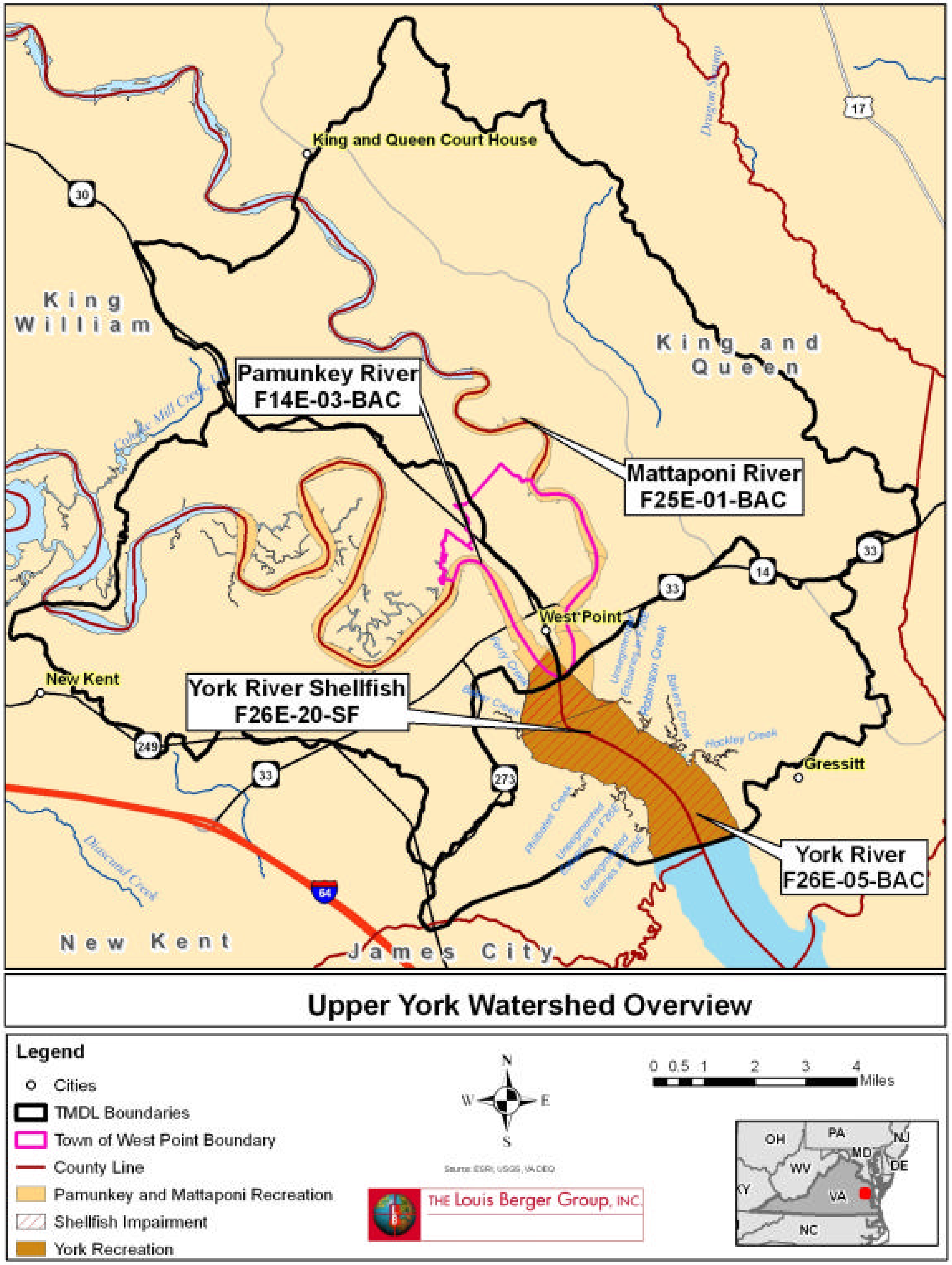

Figure 1-1: Overview of the Bacteria Impaired Segments of the Upper York River

1.3 Applicable Water Quality Standard

Water quality standards consist of designated uses for a waterbody and water quality criteria necessary to support those designated uses. According to Virginia Water Quality Standards (9 VAC 25-260-5), the term "water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

1.3.1 Designated Uses

According to Virginia Water Quality Standards (9 VAC 25-260-10):

"All state waters are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might be reasonably expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)."

1.3.2 Applicable Water Quality Criteria

VA DEQ and VDH specify the following criteria for shellfish waterbodies (VA DEQ, 2008):

- "In all open ocean or estuarine waters capable of propagating shellfish or in specific areas where public or leased private shellfish beds are present, and including those waters on which condemnation or restriction classifications are established by the State Department of Health the following criteria for fecal coliform bacteria shall apply: The geometric mean fecal coliform value for a sampling station shall not exceed an MPN (most probable number) of 14 per 100 milliliters. The 90th percentile shall not exceed an MPN of 43 for a 5-tube, 3-dilution test or 49 for a 3 tube, 3 dilution test."

VA DEQ specifies the following criteria for recreational uses (VA DEQ, 2008) of waterbodies located in saltwater or in a transition zone:

- "Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 mL of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 mL of water."

- Enterococci bacteria shall not exceed a geometric mean of 35 counts per 100ml of water for two or more samples over a calendar month nor shall it exceed the single sample maximum of 104 counts per 100mL of water.

The fecal coliform bacteria criteria shall not apply when enterococci bacteria samples are at a minimum of 12 data points, or when sampling was performed after June 30, 2008.

1.3.3 Classification of Virginia's Shellfish Growing Areas

The Virginia Department of Health, Division of Shellfish Sanitation (VDH-DSS) is responsible for classifying shellfish waters and protecting the health of bivalve shellfish consumers. The VDH- DSS follows the requirements of the National Shellfish Sanitation Program (NSSP), which is regulated by the U.S. Food and Drug Administration. The NSSP conducts a shoreline survey to classify shellfish growing waters. The NSSP shoreline survey locates sources of pollution within the shellfish growing watersheds through a property-by-property inspection of the onsite sanitary waste disposal facilities of most properties on un-sewered sections of watersheds, and investigates other sources of pollution such as wastewater treatment plants (WTP), marinas, livestock operations, landfills, etc. Information from this survey is compiled into a written report with a map showing the location of the sources of real or potential pollution found that is sent to the various agencies responsible for regulating these concerns in the city or county. Once an onsite problem is identified, local health departments (LHDs), and/or other state and local agencies may play a role in the process of correcting the deficiencies.

In addition, fecal coliform concentrations in water samples are analyzed near shellfish beds in order to verify the findings of the shoreline survey and to define the border between approved and condemned (unapproved) waters. The VDH-DSS collects monthly bacteria samples at over 2,000 stations in the shellfish growing areas of Virginia. Though they continuously monitor sample data for unusual events, they formally evaluate shellfish growing areas on an annual basis. The annual review uses data from the 30 most recent samples (typically spanning 30 months), collected randomly with respect to weather. The data are assessed to determine whether the samples are in compliance with the water quality standards. If the water quality standards are exceeded, the shellfish area is closed for the harvest of shellfish that go directly to market. Those areas that marginally exceed the water quality standard and are closed for the direct marketing of shellfish are eligible for harvest of shellfish under permit from the Virginia Marine Resources Commission and VDH-DSS. The permit establishes controls that in part require shellfish be allowed to depurate for 15 days in clean growing areas or specially designed and licensed on-shore facilities. Shellfish in growing areas that may be polluted, such as those in the immediate vicinity of a wastewater treatment facility (prohibited waters), are not allowed to be moved to clean waters for self purification.

2.0 Watershed Description and Source Assessment

In this section, the types of data available and information collected for the development of a TMDL for the bacteria impaired segments of the Upper York River, Lower Mattaponi and Lower Pamunkey watershed are presented. This information was used to characterize the estuary and its watershed and to inventory and characterize the potential point and nonpoint sources of bacteria in the watershed.

2.1 Data and Information Inventory

A wide range of data and information were used in the development of these TMDLs. Categories of data that were used include the following:

(1) Physiographic data that describe physical conditions (i.e., topography, soils, and land use) within the watershed

(2) Hydrographic data that describe physical conditions within the estuary, such as the estuary network and connectivity, and the estuary depth, width, slope, and elevation

(3) Data related to uses of the watershed and other activities in the basin that can be used in the identification of potential fecal coliform sources

(4) Environmental monitoring data that describe estuarine flow and water quality conditions in the estuary

Table 2-1 shows the various data types and the data sources used in the Upper York, Lower Mattaponi and Lower Pamunkey Rivers TMDL development.

Table 2- 1: Inventory of Data and Information Used in the TMDL Development

Data Category	Description	Source(s)
Watershed physiographic data	Watershed boundary	NRCS Watershed Boundary Dataset
	Land use/land cover	NLCD
	Soil data (*soil data mart*)	USGS
	Topographic data (USGS-30 meter DEM)	USGS
Hydrographic data	Stream network and reaches (RF3)	NHD
	Bathymetry Data	VA DEQ
Weather data	Information, data, reports, and maps that can be used to support fecal coliform source identification and loading	NCDC
Watershed activities/ uses data and information related to bacteria production	Livestock inventory	Census of Agriculture 2007
	Wildlife inventory	VA DGIF
	Septic systems inventory and failure rates	VA DEQ, Census Bureau
	Pet estimates	National pet estimates per household, U.S. Census Bureau, ACO
Point sources and direct discharge data and information	Permitted facilities locations and discharge monitoring reports (DMRs)	VA DEQ, EPA Permit Compliance System
Environmental monitoring data	Ambient instream monitoring data	VA DEQ, VDH-DSS
	Bacteria Source Tracking Data	VDH-DSS
	Stream flow data	USGS
	Tidal data	NOAA

Notes:
ACO: Animal Control Office
EPA: Environmental Protection Agency
NCDC: National Climatic Data Center
NHD: National Hydrography Dataset
NLCD: National Land Coverage Data
NOAA: National Oceanic and Atmospheric Association
NRCS: Natural Resources Conservation Service
RF3: EPA Reach File Version 3.0
USGS: U.S. Geological Survey
VDH-DSS: Virginia Department of Health - Department of Shellfish Sanitation
VA DEQ: Virginia Department of Environmental Quality
VA DGIF: Virginia Department of Game and Inland Fisheries

2.2 Watershed Description and Identification

The bacteria impaired segments and watersheds are located within the borders of King and Queen, New Kent and King William Counties. Within the watershed's boundaries is also the Town of West Point. As shown in **Figure 2-1**, the major roadways that run through the watershed are Routes 249, 273, 30 and 33, and Interstate 64. Route 249 runs from west to east through the middle of the watershed. Route 273 runs from south to north in the southern portion of the watershed. Route 30 runs from northwest to southeast in the middle portion of the watershed. Route 33 runs from east to west in the eastern portion of the watershed. Interstate 64 runs east-west outside the southwestern border of the watershed. The watershed has a drainage area of 106,392 acres.

Figure 2-2 presents the existing VA DEQ and VDH-DSS water quality stations located within the bacteria impairments and boundaries.

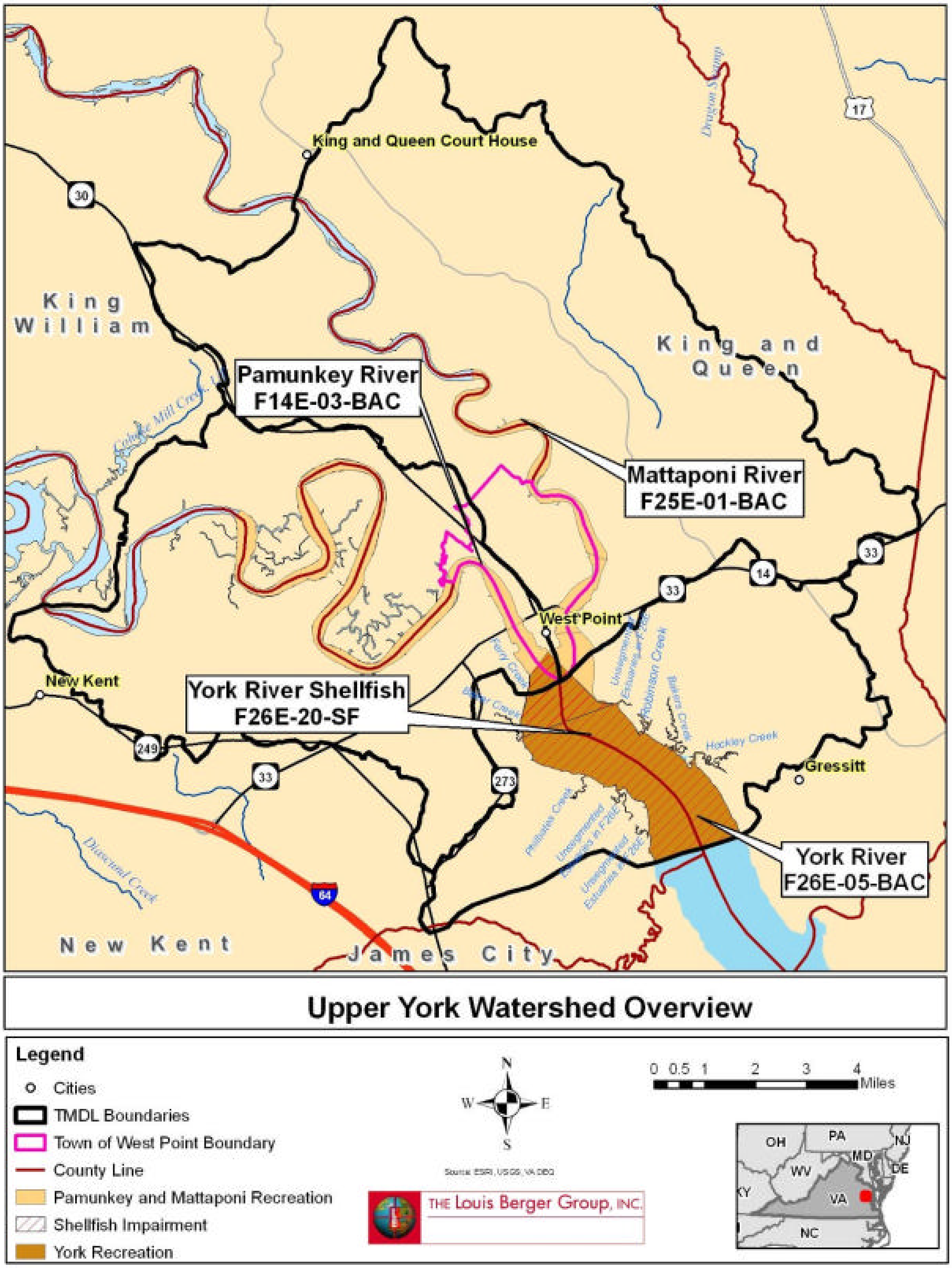

Figure 2-1: Overview Map of the Watersheds Draining into the Bacteria Impaired Segments and Water Quality Stations

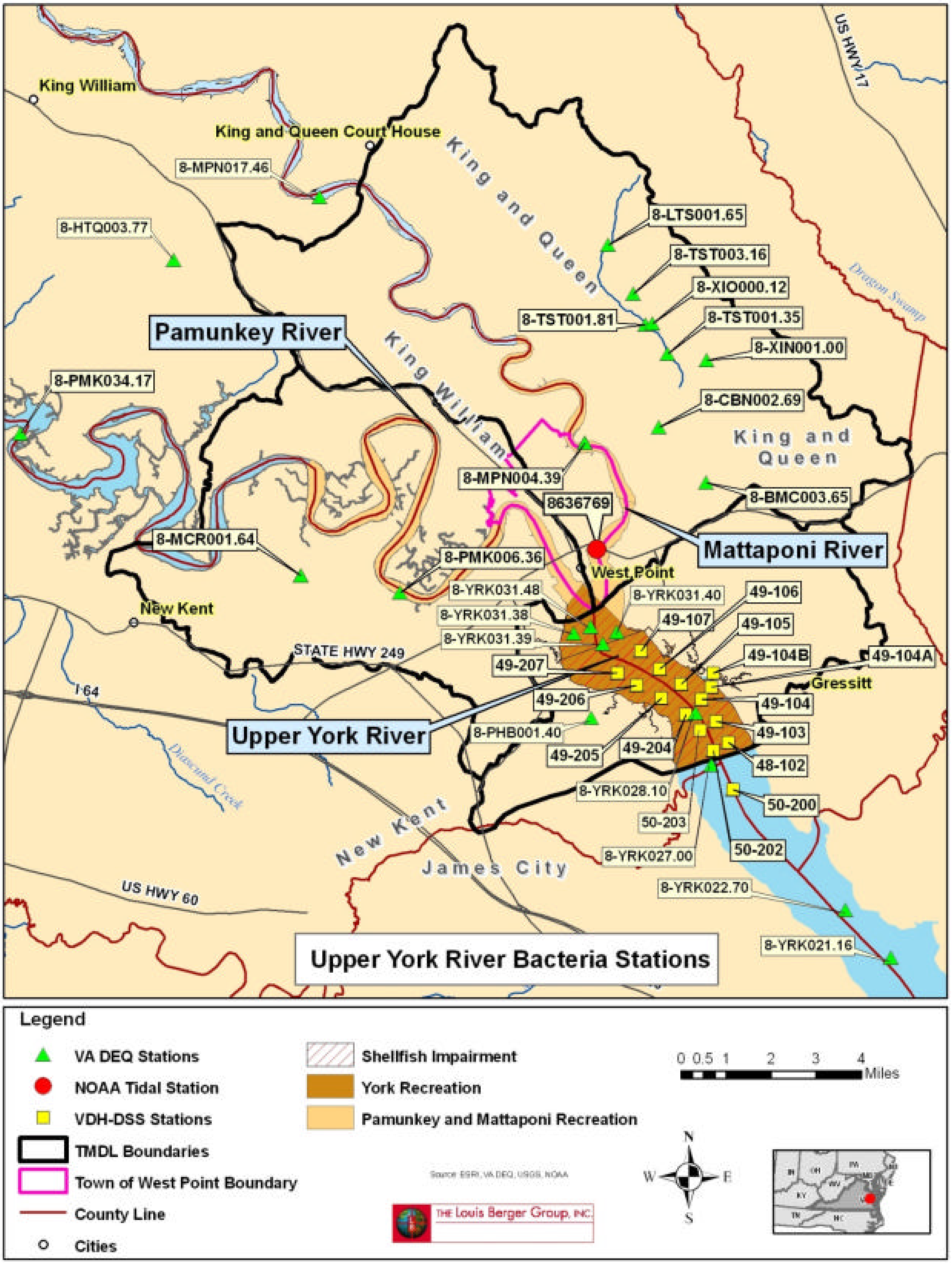

Figure 2-2: Upper Tidal York River watershed VA DEQ and VDH-DSS Bacteria Stations.

2.2.1 Topography

A digital elevation model (DEM) based on USGS National Elevation Dataset (NED) was used to characterize topography in the watershed. NED data were obtained from the National Map Seamless Data Distribution System maintained by the USGS Eros Data Center. Elevation within the TMDL watershed ranges from -5 to 55 feet above mean sea level.

2.2.2 Soils Types and Hydrologic Soil Groups

The following section details soil type and hydrologic group for each TMDL watershed. The soil type characterization is based on data obtained from *soil data mart*, a USGS-approved program that is a multi-purpose environmental analysis system integrating GIS, national watershed data, and environmental assessment and modeling tools.

The hydrologic soil groups are also based on data obtained from *soil data mart*. The hydrologic soil groups represent different levels of infiltration capacity of the soils. Hydrologic soil group "A" designates soils that are well- to excessively well-drained, whereas hydrologic soil group "D" designates soils that are poorly drained. This means that soils in hydrologic group "A" allow a larger portion of the rainfall to infiltrate and become part of the ground water system. On the other hand, compared to the soils in hydrologic group "A," soils in hydrologic group "D" allow a smaller portion of the rainfall to infiltrate and become part of the ground water. Consequently, more rainfall becomes part of the surface water runoff. Descriptions of the hydrologic soil groups are presented in **Table 2-2**. The term "not identified" in the hydrologic group breakdown refers to those classes defined as water, since water does not belong to any group.

Table 2- 2: Descriptions of Hydrologic Soil Groups

Hydrologic Soil Group	Description
A	High infiltration rates. Soils are deep, well-drained to excessively drained sand and gravels.
B	Moderate infiltration rates. Deep and moderately deep, moderately well- and well-drained soils with moderately coarse textures.
C	Moderate to slow infiltration rates. Soils with layers impeding downward movement of water or soils with moderately fine or fine textures.
C/D	Combination of Hydrologic Soil Groups C and D.
D	Very slow infiltration rates. Soils are clayey, have high water table, or shallow to an impervious cover.

2.2.2.1 Upper York River (TMDL #1 and TMDL #2)

There are 50 soil associations located in the watershed (**Table 2-3**). The dominant soil types within the watershed are Emporia (29%) and Nevarc (8.2%).

Table 2- 3: Soil Types within the Upper Tidal York River watershed

Soil Type	Total Acres	Percentage
Altavista	2,852	2.7
Augusta	544	0.5
Bama	475	0.4
Bibb	456	0.4
Bohicket	6,748	6.3
Bojac	1,651	1.6
Caroline	646	0.6
Catpoint	20	0.0
Conetoe	366	0.3
Craven	1,477	1.4
Daleville	978	0.9
Dogue	1,370	1.3
Dragston	12	0.0
Emporia	30,811	29.0
Eulonia	1,544	1.5
Eunola	232	0.2
Johnston	624	0.6
Kempsville	2,990	2.8
Kenansville	73	0.1
Kinston	1,505	1.4
Lanexa	1,124	1.1
Levy	553	0.5
Mattan	1,222	1.1
Mattaponi	18	0.0
Munden	460	0.4
Myatt	21	0.0
Nawney	28	0.0
Nevarc	8,732	8.2
Nimmo	6	0.0
Norfolk	7	0.0
Orangeburg	71	0.1
Pactolus	81	0.1
Pamunkey	695	0.7
Pits, gravel	96	0.1
Rappahannock	2,199	2.1

Table 2-3: Soil Types within the Upper Tidal York River watershed		
Soil Type	**Total Acres**	**Percentage**
Remlik	2,905	2.7
Roanoke	2,074	1.9
Rumford	272	0.3
Seabrook	529	0.5
Slagle	6,960	6.5
State	2,836	2.7
Suffolk	1,017	1.0
Tarboro	948	0.9
Tetotum	3,579	3.4
Tomotley	1,564	1.5
Uchee	81	0.1
Udorthents	432	0.4
Wahee	518	0.5
Wehadkee	213	0.2
Wickham	128	0.1
TOTAL*	**94,743**	**100.0**
*The difference in the total and the watershed drainage area is the area of the watershed that is occupied by water. Water is not included as a soil type.		

The major hydrologic group within the Upper Tidal York River watershed is group C, with 56% of the watershed containing these soils. Soil group C is defined as having moderate to slow infiltration rates. Soils contain layers impeding downward movement of water or soils with moderately fine or fine textures. The second major hydrologic group within the watershed is group D, with 16% of the watershed containing these soils. Soil group D is defined as having very slow infiltration rates. Soils are clayey, have a high water table, as well as shallow to impervious cover. **Table 2-4** summarizes the total percentages of hydrologic groups for the Upper York River.

Table 2-4: Hydrologic Groups Within the Upper Tidal York River watershed		
Hydrologic Soil Group	**Total Acres**	**Percentage of Watershed**
A	4,570	4
B	10,603	10
B/D	3,069	3
C	59,307	56
D	16,763	16
Not Identified	12,080	11
Total	**106,392**	**100**

2.2.2.2 Lower Pamunkey River (TMDL #3)

There are 44 soil associations located in the watershed (**Table 2-5**). The dominant soil types within the watershed are Nevarc (22.7%) and Bohicket (15.2%).

Table 2- 5: Soil Types within the Lower Pamunkey River Watershed		
Soil Type	**Total Acres**	**Percentage**
Altavista	2,111	7.5%
Augusta	113	0.4%
Bama	357	1.3%
Bibb	89	0.3%
Bohicket	4,318	15.2%
Bojac	200	0.7%
Caroline	608	2.1%
Catpoint	1	0.0%
Conetoe	157	0.6%
Craven	462	1.6%
Daleville	74	0.3%
Dogue	973	3.4%
Dragston	11	0.0%
Emporia	312	1.1%
Eulonia	590	2.1%
Eunola	54	0.2%
Johnston	526	1.9%
Kempsville	1,713	6.0%
Kenansville	21	0.1%
Lanexa	1,095	3.9%
Mattan	1,023	3.6%
Munden	59	0.2%
Myatt	10	0.0%
Nawney	28	0.1%
Nevarc	6,426	22.7%
Nimmo	6	0.0%
Norfolk	7	0.0%
Orangeburg	71	0.3%
Pactolus	67	0.2%
Pamunkey	521	1.8%
Remlik	1,030	3.6%
Roanoke	1,073	3.8%

Table 2- 5: Soil Types within the Lower Pamunkey River Watershed		
Soil Type	**Total Acres**	**Percentage**
Seabrook	208	0.7%
Slagle	985	3.5%
State	896	3.2%
Suffolk	166	0.6%
Tarboro	118	0.4%
Tetotum	389	1.4%
Tomotley	479	1.7%
Uchee	13	0.0%
Udorthents	363	1.3%
Wahee	329	1.2%
Wehadkee	176	0.6%
Wickham	107	0.4%
TOTAL*	**28,337**	**100.0%**
*The difference in the total and the watershed drainage area is the area of the watershed that is occupied by water. Water is not included as a soil type.		

The major hydrologic group within the Lower Pamunkey River Watershed is group C, with 40.4% of the watershed containing these soils. Soil group C is defined as having moderate to slow infiltration rates. Soils contain layers impeding downward movement of water or soils with moderately fine or fine textures. The second major hydrologic group within the watershed is group D, with 26.7% of the watershed containing these soils. Soil group D is defined as having very slow infiltration rates. Soils are clayey, have a high water table, as well as shallow to impervious cover. **Table 2-6** summarizes the total percentages of hydrologic groups for the Lower Pamunkey River.

Table 2- 6: Hydrologic Groups Within the Lower Pamunkey River Watershed		
Hydrologic Soil Group	**Total Acres**	**Percentage of Watershed**
A	1,408	4.3%
B	4,097	12.5%
B/D	479	1.5%
C	13,243	40.4%
D	8,748	26.7%
Not Identified	4,819	14.7%
Total	**32,793**	**100.0%**

2.2.2.3 Lower Mattaponi River (TMDL #4)

There are 38 soil associations located in the watershed (**Table 2-7**). The dominant soil types within the watershed are Emporia (50.7%) and Slagle (8.8%).

Table 2-7: Soil Types within the Lower Mattaponi River Watershed

Soil Type	Total Acres	Percentage
Altavista	414	0.8%
Augusta	78	0.2%
Bama	118	0.2%
Bibb	366	0.7%
Bohicket	1,783	3.6%
Bojac	986	2.0%
Catpoint	17	0.0%
Conetoe	209	0.4%
Craven	885	1.8%
Daleville	903	1.8%
Emporia	25,076	50.7%
Eulonia	954	1.9%
Eunola	178	0.4%
Kempsville	510	1.0%
Kenansville	52	0.1%
Kinston	1,014	2.0%
Lanexa	29	0.1%
Levy	427	0.9%
Mattan	198	0.4%
Munden	285	0.6%
Myatt	11	0.0%
Pactolus	13	0.0%
Pits, gravel	96	0.2%
Rappahannock	1,598	3.2%
Remlik	1,875	3.8%
Roanoke	812	1.6%
Rumford	9	0.0%
Seabrook	319	0.6%
Slagle	4,374	8.8%
State	1,509	3.1%

Table 2-7: Soil Types within the Lower Mattaponi River Watershed		
Soil Type	**Total Acres**	**Percentage**
Suffolk	276	0.6%
Tarboro	782	1.6%
Tetotum	2,272	4.6%
Tomotley	829	1.7%
Udorthents	57	0.1%
Wahee	74	0.2%
Wehadkee	36	0.1%
Wickham	21	0.0%
TOTAL*	**49,447**	**100.0%**
*The difference in the total and the watershed drainage area is the area of the watershed that is occupied by water. Water is not included as a soil type.		

The major hydrologic group within the Lower Mattaponi River Watershed is group C, with 66.3% of the watershed containing these soils. Soil group C is defined as having moderate to slow infiltration rates. Soils contain layers impeding downward movement of water or soils with moderately fine or fine textures. The second major hydrologic group within the watershed is group D, with 12.0% of the watershed containing these soils. Soil group D is defined as having very slow infiltration rates. Soils are clayey, have a high water table, as well as shallow to impervious cover. **Table 2-8** summarizes the total percentages of hydrologic groups for the Lower Mattaponi River.

Table 2- 8: Hydrologic Groups Within the Lower Mattaponi River Watershed		
Hydrologic Soil Group	**Total Acres**	**Percentage of Watershed**
A	3,044	5.8%
B	3,714	7.1%
B/D	1,842	3.5%
C	34,551	66.3%
D	6,239	12.0%
Not Identified	2,747	5.3%
Total	**52,138**	100.0%

2.2.3 Land Use

The land use characterization for the Upper York TMDL watershed (TMDL #1 and TMDL #2) was based on the latest available land cover data from the National Land Cover Dataset, also known as NLCD 2005 Land Use Dataset. The distribution of land uses in the watershed, by land area and percentage, are presented in **Table 2-9**. Brief descriptions of land use classifications are presented in **Table 2-12**. Dominant land uses in the watershed are forest (44%) and wetlands (19%). **Figure 2-3** depicts the land use distribution within the Upper Tidal York River watershed.

Table 2- 9: Land Use within the Upper Tidal York River watershed

General Land Use Category	Specific Land Use Type	Acres	Total Acres	Percentage of Watershed	Total Percent
Developed	Developed Open Space	1,217	2,582	1%	2%
	High Intensity Developed	176		<1%	
	Medium Intensity Developed	296		<1%	
	Low Intensity Developed	892		1%	
Agriculture	Cultivated	11,820	15,743	11%	15%
	Pasture/Hay	3,923		4%	
Forest	Deciduous Forest	16,238	46,566	15%	44%
	Evergreen Forest	21,750		20%	
	Mixed Forest	8,578		8%	
Wetlands	Estuarine Emergent Wetland	9,372	20,658	9%	19%
	Estuarine Forested Wetland	4		<1%	
	Estuarine Scrub/Shrub Wetland	20		<1%	
	Palustrine Emergent Wetland	964		1%	
	Palustrine Forested Wetland	9,719		9%	
	Palustrine Scrub/Shrub Wetland	578		1%	
Water	Palustrine Aquatic Bed	9	11,285	<1%	11%
	Open Water	11,276		11%	
Other	Barren Land	32	9,558	<1%	9%
	Grassland	2,410		2%	
	Scrub/Shrub	7,112		7%	
	Unconsolidated Shore	4		<1%	
Total		**106,392**		**100%**	**100%**

The land use characterization for the Lower Pamunkey TMDL watershed (TMDL #3) was based on the latest available land cover data from the National Land Cover Dataset, also known as NLCD 2005 Land Use Dataset. The distribution of land uses in the watershed, by land area and percentage, are presented in **Table 2-10**. Brief descriptions of land use classifications are presented in **Table 2-12**. Dominant land uses in the watershed are forest (38%) and wetlands (27%). **Figure 2-3** depicts the land use distribution within the Lower Pamunkey River watershed.

Table 2-10: Land Use within the Lower Pamunkey River Watershed

General Land Use Category	Specific Land Use Type	Acres	Total Acres	Percentage of Watershed	Total Percent
Developed	Developed Open Space	339	978	1%	3%
	High Intensity Developed	125		<1%	
	Medium Intensity Developed	163		<1%	
	Low Intensity Developed	352		1%	
Agriculture	Cultivated	2,955	4,161	9%	13%
	Pasture/Hay	1,206		4%	
Forest	Deciduous Forest	4,997	12,410	15%	38%
	Evergreen Forest	4,106		13%	
	Mixed Forest	3,306		10%	
Wetlands	Estuarine Emergent Wetland	5,460	9,005	17%	27%
	Estuarine Forested Wetland	3		<1%	
	Estuarine Scrub/Shrub Wetland	8		<1%	
	Palustrine Emergent Wetland	125		<1%	
	Palustrine Forested Wetland	3,183		10%	
	Palustrine Scrub/Shrub Wetland	227		1%	
Water	Palustrine Aquatic Bed	5	4,284	<1%	13%
	Open Water	4,278		13%	
Other	Barren Land	28	1,955	<1%	6%
	Grassland	142		<1%	
	Scrub/Shrub	1,784		5%	
	Unconsolidated Shore	2		<1%	
Total		**32,793**		**100%**	**100%**

The land use characterization for the Lower Mattaponi TMDL watershed (TMDL #4) was based on the latest available land cover data from the National Land Cover Dataset, also known as NLCD 2005 Land Use Dataset. The distribution of land uses in the watershed, by land area and percentage, are presented in **Table 2-11**. Brief descriptions of land use classifications are presented in **Table 2-12**. Dominant land uses in the watershed are forest (49%) and wetlands (17%). **Figure 2-3** depicts the land use distribution within the Lower Mattaponi River watershed.

Table 2-11: Land Use within the Lower Mattaponi River Watershed

General Land Use Category	Specific Land Use Type	Acres	Total Acres	Percentage of Watershed	Total Percent
Developed	Developed Open Space	478	1,031	1%	2%
	High Intensity Developed	33		<1%	
	Medium Intensity Developed	92		<1%	
	Low Intensity Developed	428		1%	
Agriculture	Cultivated	6,186	8,254	12%	16%
	Pasture/Hay	2,068		4%	
Forest	Deciduous Forest	8,337	25,604	16%	49%
	Evergreen Forest	13,606		26%	
	Mixed Forest	3,662		7%	
Wetlands	Estuarine Emergent Wetland	2,755	8,740	5%	17%
	Estuarine Forested Wetland	2		<1%	
	Estuarine Scrub/Shrub Wetland	11		<1%	
	Palustrine Emergent Wetland	804		2%	
	Palustrine Forested Wetland	4,897		9%	
	Palustrine Scrub/Shrub Wetland	270		1%	
Water	Palustrine Aquatic Bed	3	2,440	<1%	5%
	Open Water	2,437		5%	
Other	Barren Land	3	6,069	<1%	12%
	Grassland	1,875		4%	
	Scrub/Shrub	4,189		8%	
	Unconsolidated Shore	2		<1%	
Total		**52,138**		**100%**	**100%**

Table 2-12: Descriptions of Land Use Types	
Land Use Type	**Description**
Open Water	All areas of open water, generally with less than 25 percent cover of vegetation or soil.
Estuarine Emergent Wetlands	Includes all tidal wetlands dominated by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens). Wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent and that are present for most of the growing season in most years. Perennial plants usually dominate these wetlands. Total vegetation cover is greater than 80 percent.
Estuarine Scrub / Shrub Wetland	Includes all tidal wetlands dominated by woody vegetation less than 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent. Total vegetation coverage is greater than 20 percent.
Estuarine Forested Wetland	Includes all tidal wetlands dominated by woody vegetation greater than or equal to 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent. Total vegetation coverage is greater than 20 percent.
Palustrine Emergent Wetland	Includes all tidal and nontidal wetlands dominated by persistent emergent vascular plants, emergent mosses or lichens, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Plants generally remain standing until the next growing season. Total vegetation cover is greater than 80 percent.
Palustrine Forested Wetland	Includes all tidal and nontidal wetlands dominated by woody vegetation greater than or equal to 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent.
Palustrine Scrub/Shrub Wetland	Includes all tidal and non tidal wetlands dominated by woody vegetation less than 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent. The species present could be true shrubs, young trees and shrubs, or trees that are small or stunted due to environmental conditions (Cowardin et al. 1979).
Palustrine Aquatic Bed	Includes tidal and nontidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is below 0.5 percent and which are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, detached floating mats, and rooted vascular plant assemblages. Total vegetation cover is greater than 80 percent.
Unconsolidated Shore	Unconsolidated material such as silt, sand, or gravel that is subject to inundation and redistribution due to the action of water. Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms representing this class.
Developed, Open Space	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover.
Developed, Low Intensity	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 21 to 49 percent of total cover.
Developed, Medium Intensity	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover.
Developed, High Intensity	Includes highly developed areas where people reside or work in high numbers. Impervious surfaces account for 80 to 100 percent of the total cover.

Table 2-12: Descriptions of Land Use Types	
Land Use Type	**Description**
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
Cultivated Crops	Areas used for the production of annual crops. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
Barren Land (Rock/Sand/Clay)	Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earth material. Generally, vegetation accounts for less than 10 percent of total cover.
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
Grassland	Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Scrub/Shrub	Areas dominated by shrubs less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes tree shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
Source: Coastal NLCD Classification Scheme, NOAA Coastal Services Center	

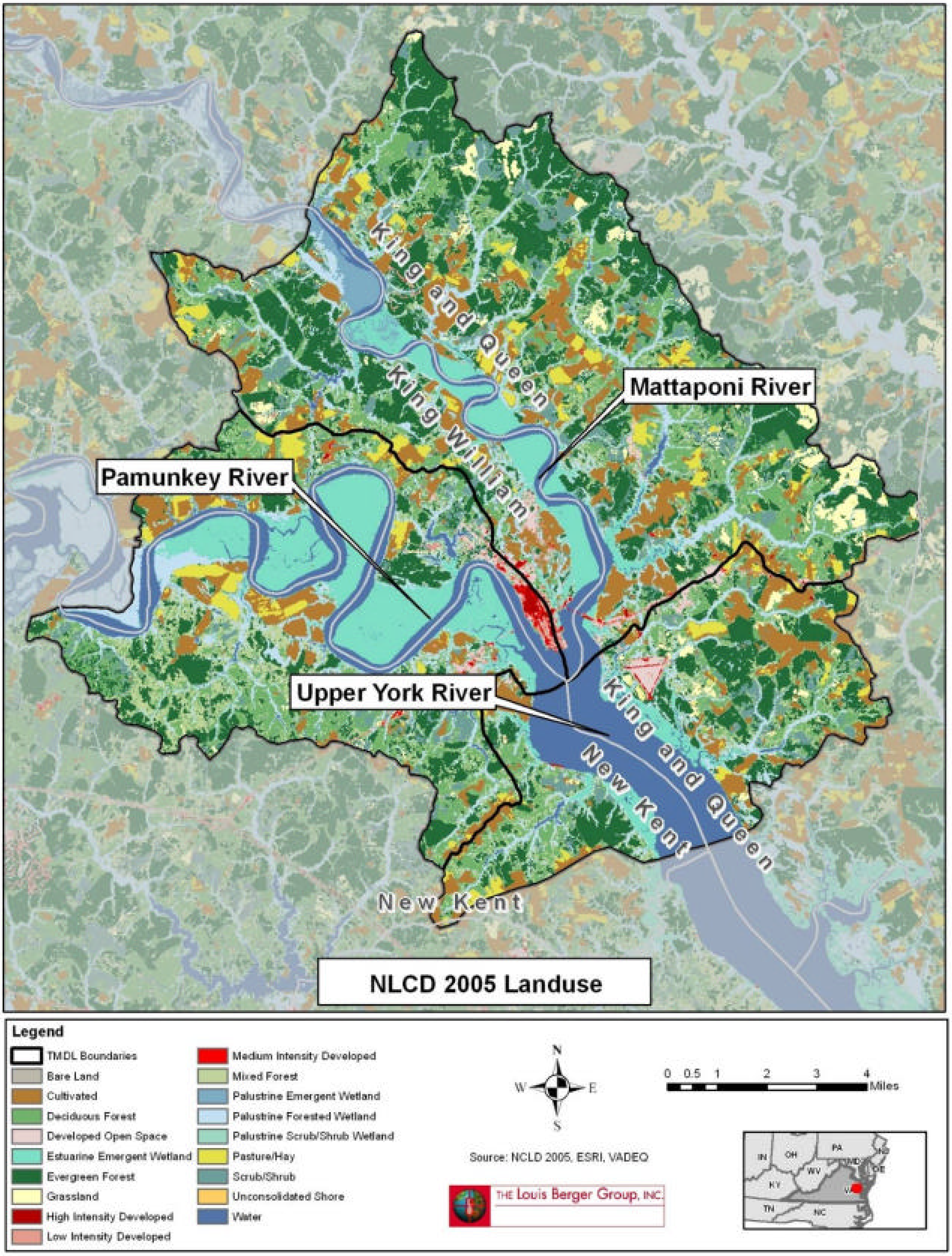

Figure 2-3: Land Use for the Upper Tidal York River watershed

2.3 Stream Flow and Estuary Volume Data

Stream Flow
There has been no stream flow monitored in the TMDL watersheds.

Estuary volume and tidal data
The estuary volume of the TMDL watersheds was provided by VA DEQ and is based on cross section measurements within the tidal portions of the TMDL watersheds. **Table 2-13** summarizes the results of provided volume data including average depth and surface area for the TMDL watershed. There is one station with available tide data located in the TMDL watershed. The tide data were retrieved from NOAA's Tides and Currents website and include mean tidal range, spring range, and mean tide level. **Table 2-14** shows the available tide data for this station.

Table 2-13: Volume Summary of the Upper Tidal York Watershed

Waterbody	Average Depth (m)	Surface Area (m^2)	Volume (m^3)
Upper York River (TMDL #1 & TMDL #2)	3.05	18,694,535	56,969,506
Lower Pamunkey River (TMDL #3)	3.45	11,313,069	39,068,362
Lower Mattaponi River (TMDL #4)	3.42	6,565,620	22,468,802

Table 2- 14: Existing NOAA Tide Station in the Upper York River TMDL Watershed

Name	Station ID	Location	Mean Tidal Range (feet)	Spring Range (feet)	Mean Tide Level (feet)
West Point, VA	8636769	Mattaponi River	2.8	3.4	1.5

2.4 Ambient Water Quality Data for Bacteria

Environmental monitoring efforts for collecting bacteria data in the TMDL watersheds have been conducted by the Virginia Department of Environmental Quality (VA DEQ) and the Virginia Department of Health-Department of Shellfish and Sanitation (VDH-DSS). VDH-DSS water quality data were provided from both VA DEQ and VDH-DSS. All available data for bacteria, located within the TMDL watersheds and at the boundary of the impaired watersheds, were analyzed and compared to VA DEQ bacteria standards for shellfish and recreation use. VDH-DSS only collected bacteria samples for the indicator fecal coliform whereas VA DEQ for the indicator fecal coliform, Escherichia coli (E.coli), and enterococci. Bacteria samples for E. coli are not analyzed in this TMDL, because the indicator is used for waterbodies with fresh water and outside of the saltwater and transition zone. **Table 2-15** summarizes VDH-DSS and VA DEQ monitoring efforts for all bacteria indicators according to station ID. The location of the bacteria monitoring stations is depicted in **Figure 2-1**. The following sections summarize and present the available bacteria monitoring data within and at the boundaries of the TMDL watershed.

Table 2-15: Summary of VDH-DSS and VA DEQ Monitoring Stations, Stream, Bacteria Indicator, and Sample Date

<table>
<tr><th rowspan="2">Station ID</th><th rowspan="2">Stream</th><th rowspan="2">Indicator</th><th colspan="2">Sample Date</th><th rowspan="2">Agency</th></tr>
<tr><th>First</th><th>Last</th></tr>
<tr><td>48-102</td><td rowspan="15">Upper York River</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td><td rowspan="15">VDH-DSS</td></tr>
<tr><td>49-103</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-104</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-104A</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-104B</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-105</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-106</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-107</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-204</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-205</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-206</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>49-207</td><td>Fecal Coliform</td><td>1/10/1985</td><td>4/29/2009</td></tr>
<tr><td>50-200</td><td>Fecal Coliform</td><td>-</td><td>-</td></tr>
<tr><td>50-202</td><td>Fecal Coliform</td><td>2/25/1985</td><td>4/29/2009</td></tr>
<tr><td>50-203</td><td>Fecal Coliform</td><td>2/25/1985</td><td>4/29/2009</td></tr>
<tr><td rowspan="2">8-MPN004.39</td><td rowspan="2">Mattaponi River</td><td>Fecal Coliform</td><td>2/14/1990</td><td>12/3/2007</td><td rowspan="12">VA DEQ</td></tr>
<tr><td>Enterococci</td><td>7/6/2004</td><td>10/20/2009</td></tr>
<tr><td rowspan="3">8-MPN017.46</td><td rowspan="3">Mattaponi River</td><td>Fecal Coliform</td><td>1/12/1994</td><td>11/13/2006</td></tr>
<tr><td>E. coli</td><td>1/12/1994</td><td>11/13/2006</td></tr>
<tr><td>Enterococci</td><td>10/23/2003</td><td>11/2/2009</td></tr>
<tr><td rowspan="2">8-PMK034.17</td><td rowspan="2">Pamunkey River</td><td>Fecal Coliform</td><td>1/12/1994</td><td>12/3/2007</td></tr>
<tr><td>E. coli</td><td>7/6/2004</td><td>10/20/2009</td></tr>
<tr><td rowspan="3">8-PMK006.36</td><td rowspan="3">Pamunkey River</td><td>Fecal Coliform</td><td>2/14/1990</td><td>10/29/2009</td></tr>
<tr><td>E. coli</td><td>7/9/2002</td><td>4/7/2004</td></tr>
<tr><td>Enterococci</td><td>7/9/2002</td><td>10/29/2009</td></tr>
<tr><td rowspan="2">8-YRK031.39</td><td rowspan="2">York River</td><td>Fecal Coliform</td><td>11/12/1991</td><td>1/20/2010</td></tr>
<tr><td>Enterococci</td><td>7/9/2002</td><td>1/20/2010</td></tr>
</table>

Table 2-15: Summary of VDH-DSS and VA DEQ Monitoring Stations, Stream, Bacteria Indicator, and Sample Date

Station ID	Stream	Indicator	Sample Date		Agency
			First	Last	
8-MCR001.64	Mill Creek	Fecal Coliform	9/25/1990	4/16/2001	
8-PHB001.40	Philbates Creek	Fecal Coliform	9/25/1990	4/16/2001	VA DEQ
8-TST003.16	Tastine Sw	E. coli	1/10/2008	12/22/2008	
8-TST001.81	Tastine Sw	Fecal Coliform	4/26/1995	3/13/2001	
		E. coli	1/10/2008	12/22/2008	
8-TST001.35	Tastine Sw	E. coli	1/10/2008	12/22/2008	
8-LTS001.65	Little Tastine Sw	E. coli	1/10/2008	12/22/2008	
8-XIN001.00	UT 1 Tastine Sw	E. coli	1/10/2008	12/22/2008	
8-XIO000.12	UT 2 Tastine Sw	E. coli	1/10/2008	12/22/2008	
8-CBN002.69	Corbin Pond	E. coli	1/10/2008	12/22/2008	
		Enterococci	1/10/2008	12/22/2008	
8-BMC003.65	Burnt Mill Creek	E. coli	6/6/2005	12/4/2006	
8-HTQ003.77	Heartquake Creek	E. coli	1/6/2009	11/2/2009	
		Fecal Coliform	4/26/1995	3/13/2001	

2.4.1 VA DEQ Bacteria Water Quality Data

VA DEQ collected samples for bacteria at sixteen water quality monitoring stations within and at the boundaries of the TMDL watershed. The location of the VA DEQ monitoring stations are shown in **Figure 2-2**. At VA DEQ stations where fecal coliform were collected, the geometric mean and 90th percentile for the bacteria indicator fecal coliform was computed based on the VDH-DSS approach, which calculates the geometric mean and 90th percentile values using the last 30 months of data (usually the last 30 collection events). The purpose of this analysis is to observe the impact of fecal coliform loads on shellfish impaired Upper York River. **Table 2-16** presents the maximum geometric mean and 90th percentile measurement for all observed samples and whether the shellfish water quality standard is exceeded. Bacteria data was also analyzed for enterococci and compared to the single sample maximum criterion. (Bacteria data could not be compared to the geometric mean criterion, since the required two samples per calendar month to calculate the geometric mean was not met.) **Table 2-17** presents a summary of VA DEQ enterococci exceedances and the maximum measurements for all observed samples and whether the recreational water quality standard is exceeded. Stations that did not have fecal coliform or enterococci data, or that did not have enough data to calculate the exceeded geometric mean and/or the exceeded 90th percentile are not included in the tables. The results of the analysis for the entire fecal coliform data set are also shown in several figures in Appendix B.

Table 2-16: VA DEQ Maximum Values of Geometric Mean and 90th Percentile Exceedances for Fecal Coliform

Station ID	Segment	Geometric Mean	Station Exceeded Geometric Mean Standard: 14 MPN	90th Percentile	Station Exceeded 90th Percentile Standard: 49 MPN
8-PHB001.40	Philbates Creek	67	**Yes**	491	**Yes**
8-YRK022.70	York River	29	**Yes**	157	**Yes**
8-YRK028.10	York River	130	**Yes**	460	**Yes**
8-YRK031.39	York River	47	**Yes**	293	**Yes**
8-YRK031.48	York River	117	**Yes**	350	**Yes**

Table 2-17: Summary of VA DEQ Enterococci Exceedances

Station ID	Stream	No. of Samples	Exceedances		Maximum Value	Station Exceeded single sample maximum criterion: 104 MPN*
			No.	%	No/100ML	
8-MPN004.39	Mattaponi River	63	21	33	1500	**Yes**
8-MPN017.46	Mattaponi River	16	5	31	380	**Yes**
8-PMK006.36	Pamunkey River	79	35	44	2000	**Yes**
8-YRK022.70	York River	82	4	5	1100	**No**
8-YRK031.39	York River	83	21	25	>2000	**Yes**
8-CBN002.69	Corbin Pond	9	0	0	100	**No**

*When violation rate of 10% is exceeded

2.4.2 VDH-DSS Bacteria Water Quality Data

VDH-DSS conducted sampling for fecal coliform at 14 of their 15 monitoring stations within the Upper Tidal York watershed. All 14 stations are located on the mainstem of the Upper York River. The analysis of the fecal coliform data is based on the VDH-DSS approach, which calculates the geometric mean and 90th percentile values using the last 30 months of data (usually the last 30 collection events). All available fecal coliform data were analyzed from 1985 through the present to calculate the geometric mean and 90th percentile values. The computed geometric mean and 90th percentile values were then compared to the VA DEQ water quality criteria for shellfish waters. The results of this analysis are shown in **Table 2-18**, which summarize the maximum geometric mean and 90th percentile measurements of the entire data set. The maximum value is shown in order to include the worst case condemnation. Stations that did not have enough data to calculate the exceeded geometric mean and/or the exceeded 90th percentile are not included in the table (Station 50-200). The results of the analysis for the entire fecal coliform data set are also shown in several figures in Appendix B.

Table 2-18: VDH-DSS Maximum Values of Geometric Mean and 90th Percentile Exceedances per Station

Segment	Station ID	Geometric Mean	Station Exceeds Geometric Mean Criterion: 14 MPN	90th Percentile	Station Exceeds 90th Percentile Criterion: 49 MPN
Upper York River	48-102	16	**Yes**	90	**Yes**
	49-103	22	**Yes**	115	**Yes**
	49-104	21	**Yes**	93	**Yes**
	49-104A	37	**Yes**	236	**Yes**
	49-104B	67	**Yes**	468	**Yes**
	49-105	22	**Yes**	115	**Yes**
	49-106	28	**Yes**	154	**Yes**
	49-107	35	**Yes**	205	**Yes**
	49-204	20	**Yes**	101	**Yes**
	49-205	24	**Yes**	169	**Yes**
	49-206	25	**Yes**	150	**Yes**
	49-207	30	**Yes**	175	**Yes**
	50-202	18	**Yes**	99	**Yes**
	50-203	16	**Yes**	96	**Yes**

2.4.3 VDH-DSS Bacteria Source Data

As part of the TMDL development, Bacteria Source Tracking (BST) sampling was conducted by VDH-DSS over a twelve-month period from October 2005 to September 2006 at one VDH-DSS monitoring station, 49-207 (**Figure 2-1**). The objective of the BST study was to identify the sources of bacteria contamination within the Upper Tidal York watershed. The BST analysis was performed by MapTech (Map Tech, Inc., Dec. 2006).

There are various methodologies used to perform BST, which fall into three major categories: molecular, biochemical and chemical. Molecular (genotype) methods are referred to as "DNA fingerprinting," and are based on the unique genetic makeup of different strains, or subspecies, of bacteria. Biochemical (phenotype) methods are based on detecting biochemical substances produced by bacteria. The type and quantity of these substances are measured to identify the bacteria source. Chemical methods are based on testing for chemical compounds that are associated with human wastewaters, and are restricted to determining if sources of pollution are human or non-human.

The Antibiotic Resistance Analysis (ARA) method, a biochemical method, was used for the Upper York River. ARA has been the most widely used and published BST method to date and has been employed in Virginia, Florida, Kansas, Oregon, South Carolina, Tennessee, and Texas. Advantages of ARA include low cost per sample and fast turnaround times for analyzing samples. The method can also be performed on large numbers of bacterial isolates. For the Upper Tidal York River watershed, the maximum number of bacterial isolates per sample is 24.

Overall, the results from BST indicate that bacteria from human, livestock, wildlife, and pet sources are present in the Upper York River. Results from all sampling events at the monitoring stations are presented in **Table 2-19** and **Appendix C**.

Table 2-19: BST Sampling Events within the Upper Tidal York River watershed

Station	Date	Fecal Coliform (counts/100mL)*	Isolates	Wildlife	Human	Livestock	Pets
Upper York River, Station 49-207	10/12/05	43	24	8%	**63%**	17%	**12%**
	11/28/05	43	8	25%	25%	50%	0%
	12/12/05	23	22	**63%**	5%	14%	**18%**
	1/9/06	9.1	4	75%	25%	0%	0%
	2/22/06	7.3	4	25%	0%	50%	25%
	3/8/06	3.6	NVI	NVI	NVI	NVI	NVI
	4/5/06	9.1	NVI	NVI	NVI	NVI	NVI
	5/23/06	3	6	67%	0%	0%	33%
	6/20/06	43	15	**20%**	13%	**47%**	**20%**
	7/5/06	1100	24	**71%**	8%	17%	4%
	8/2/06	93	24	8%	**29%**	12%	**51%**
	9/14/06	240	24	12%	**17%**	**46%**	**25%**

NVI: No viable isolates.

* Since no E. coli data was available (BST is cultured the indicator E. coli) the enumerations are based on VDH-DSS fecal coliform data collected on the same day as the BST data.

2.4.3.1 Weighted Average of BST Sources

In order to eliminate some of the high variability in BST results, a method was developed by VA DEQ, which computes a weighted average based on the fraction of each bacteria source (wildlife, human, livestock, and pets). The weighted average for each source is calculated by dividing the total number of biochemical responses to antibiotics of each source (wildlife, human, livestock, or pet) with the total number of responses to antibiotics from all sources (the sum of all the sources). The total number of biochemical responses to antibiotics for each source for each sample is obtained by multiplying the total number of isolates with the bacterial enumeration (Fecal coliform in MPN/100mL) and with the fraction of the source.

The weighted average of each source represents the fraction of bacterial source in the watershed and is applied in this bacterial TMDL in order to allocate nonpoint sources of bacteria. **Table 2-20** and **Figure 2-4** depict the computed weighted average for each station. **Figure 2-4** depicts the BST at monitoring station 49-207.

Table 2-20: Computed Weighted BST Fractions

Segment	Station	Wildlife	Human	Livestock	Pets
Upper York River (TMDL #1 & TMDL #2)	49-207	55%	12%	22%	11%

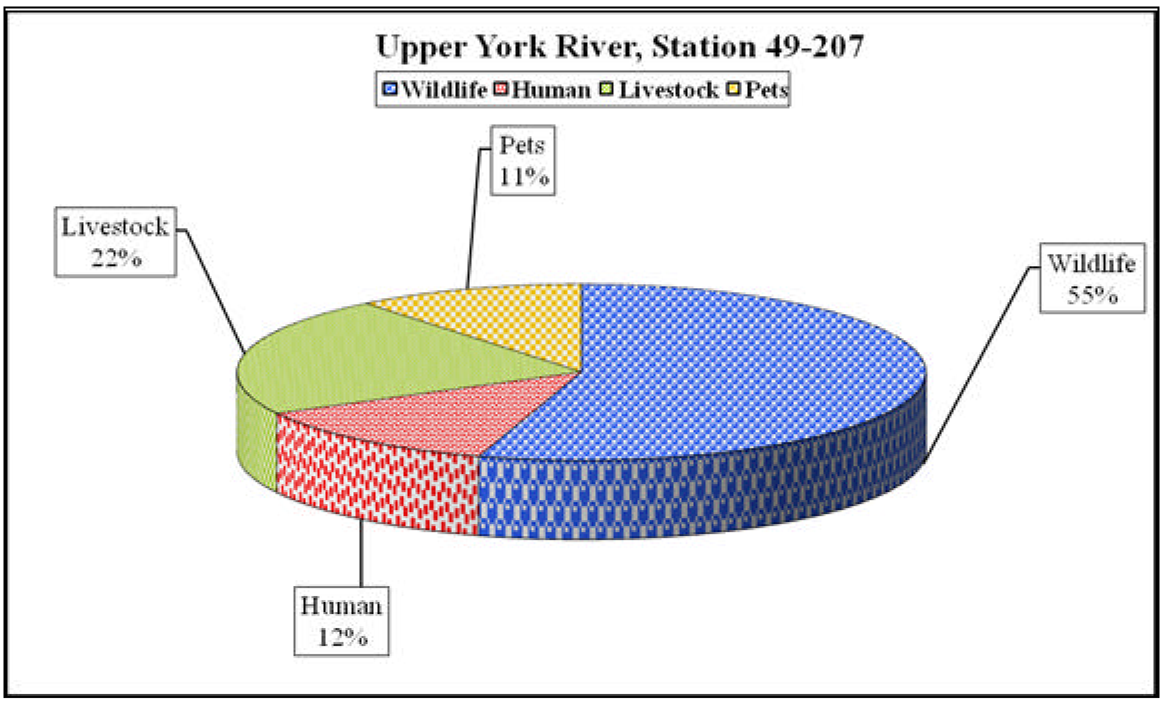

Figure 2- 4: Weighted BST Results at Station 49-207 (Upper York River)

2.4.4 VDH-DSS Shoreline Sanitary Survey Data

The shoreline survey is used as a tool to identify nonpoint source contribution to bacteria problems. VDH-DSS surveyed the Upper Tidal York River watershed in 2005. Included in this shoreline survey was the York River: West Point Vicinity, including the counties of King and Queen, King William, and New Kent. The results of the shoreline survey can be found in Appendix A.

2.5 Bacteria Source Assessment

This section focuses on characterizing the sources that potentially contribute to the bacteria loading in the TMDL watershed. These sources include permitted facilities, septic systems, livestock, biosolids, wildlife, and pets.

Based on data obtained from VA DEQ, there are four individually permitted facilities and as many as 37 general permits within the bacteria impaired watershed. There are no MS4 permits within the watershed. Bacteria source data has been obtained from published sources as well as citizen feedback and involvement.

2.5.1 Permitted Facilities

Based on data obtained from VA DEQ, there are as many as 24 total permitted facilities in the Upper Tidal York River watershed. The permit number, permit type, facility name and receiving stream for each permit are presented in **Table 2-21**. The available flow data and bacteria data for those permitted facilities with available fecal coliform (VA0075434, VA0088331) were analyzed and compared to their permit bacteria limit. The fecal coliform maximum concentration exceeded the bacteria limit 27 times at HRSD Town of West Point Sewage Treatment Plant (VA0075434). The immediate area surrounding both treatment plant outfalls (VA0075434, VA0088331) are identified by DSS as shellfish condemnation area 2C. The direct harvest of shellfish for human consumption is prohibited because of the location of a municipal wastewater treatment plant in this segment. Therefore this segment is evaluated for primary contact (recreation) use only.

The locations of the permitted facilities are presented in **Figure 2-5.** Latitudes and longitudes were not available for several permits (asterisked in Table 2-21). These permits are not shown in **Figure 2-5**. Note that multiple points often have the same label. This is because the points represent multiple outlets at one facility.

Table 2-21: Permitted Facilities in the Upper Tidal York River watershed

Permit Number	Type	Facility Name	Receiving Stream
VA0003115	VPDES	Smurfit Stone Container Corporation - West Point	Pamunkey River
VA0075434	VPDES	HRSD Town of West Point Sewage Treatment Plant	Mattaponi River
VA0088331	VPDES	Parham Landing WWTP	Pamunkey River
VA0090433	VPDES	Augusta Lumber LLC - West Point Division	UT Herrick Creek
VAG404212	Domestic	Mickens Walter Residence	UT Olsson's Pond
VAG840139	NMMM	Britts Inc Mine 1	Thorofare Creek
VAG110189	Ready Mix	Rappahannock Concrete - New Kent	UT Mill Creek
VAR051194*	Stormwater - Industrial	Bohannon Lumber Company Inc	Glebe Swamp
VAR051243	Stormwater - Industrial	Commercial Carrier Corporation	Mill Creek
VAR051263	Stormwater - Industrial	Direct Wood Products Plant 1	Eltham Creek
VAR051596	Stormwater - Industrial	Basic Construction Company -New Kent Asphalt Plant	UT Pamunkey
VAR051609	Stormwater - Industrial	Middle Peninsula Regional Airport	Goalders Creek
VAR051378	Stormwater - Industrial	Asb Greenworld Incorporated	Goalders Creek
VAR100200*	Stormwater - Construction	VDOT Richmond District 0634 063 P42 M501	Taylor Pond
VAR102161*	Stormwater - Construction	Stainback - Residence	Goose Creek
VAR103065*	Stormwater - Construction	West Point Station	Glass Island Creek
VAR103207*	Stormwater - Construction	Crouse James F and Reginia – Residence	Taylor Pond

Table 2-21: Permitted Facilities in the Upper Tidal York River watershed			
Permit Number	**Type**	**Facility Name**	**Receiving Stream**
VAR103856*	Stormwater - Construction	Independent Group - Bohannon Industrial Park	Glebe Swamp
VAR102402	Stormwater - Construction	Mann Hill Farm	Custis Mill Creek
VAR102640*	Stormwater - Construction	George Nice and Sons Inc	UTRIB to France Swamp
VAR102650*	Stormwater - Construction	Twin Island Farms	York River
VAR103062*	Stormwater - Construction	Lacy David V Residence	Hockley Creek/UT
VAR104561*	Stormwater - Construction	Shores of the York	York River
VAR104937*	Stormwater – Construction	Middle Peninsula Regional Airport	Goalders Creek
UTRIB: Unknown tributary			
* These permits do not have latitude and longitude data and do not appear in Figure 2-5.			

Figure 2-5: Permitted Facilities in the Upper Tidal York River watershed

2.5.2 Sanitary Sewer System, Septic Tanks, and Straight Pipes

Houses can be connected to a public sanitary sewer, a septic tank, or the sewage can be disposed by other means. Estimates of the total number of households using each type of waste disposal are presented in this section.

The 2000 U.S. Census Bureau census track data for King and Queen, King William, and New Kent counties were reviewed to establish the population growth rates and number of housing units in the watershed. 2008 estimates were used for the total population estimate, and for the number of houses. The 1990 census data documents the distribution of houses on sewage systems, septic systems, and other means (considered to be straight pipes). These 1990 estimated distributions were applied to the 2008 population and housing unit numbers by assuming the distributions in 1990 and 2008 are the same and multiplying the total number of houses in 2008 by the percent distributions in 1990 to estimate the number of houses on public sewers, septic tanks and other means in 2008. A summary of the census data and population estimates used for the TMDL watershed are presented in **Table 2-22**.

In order to determine the amount of bacteria contributed by human sources, it is necessary to estimate the failure rates of septic systems. The number of failing septic systems in each watershed was based on the US Census data. The number of households in each watershed were determined from US Census Bureau data and then multiplied by the septic failure rate of 12% (VA DEQ, 2005). The 12% septic failure rate is a default value when Virginia Department of Health (VDH) information regarding septic failure rates in the watershed is unavailable. **Table 2-22** also shows the estimated amount of failing septic systems per county. **Table 2-23** shows the estimated amount of population, number of houses, number of houses on public sewer, number of houses on septic systems, number of houses on other means, and number of failing septic systems per TMDL watershed.

Table 2-22: Population Estimates for King and Queen, King William and New Kent Counties						
County/Town	**Population[1]**	**Number of Houses[1]**	**Number of Houses Public Sewer [1, 2]**	**Number of Houses on Septic Systems [1, 2]**	**Number of Houses on "Other Means" [1, 2]**	**Number of Houses with a Failing Septic System[3]**
King and Queen	6,830	3,355	17	3,114	224	374
King William[4] (Including Town of West Point)	16,040	6,452	1,788	4,349	315	522
New Kent	17,825	7,111	73	6,875	163	825
TOTAL	**40,695**	**16,918**	**1,878**	**14,338**	**702**	**1,721**

[1] Census 2008 estimates

[2] Based upon 2008 census estimate and ratio of parameter: 1990 census estimate

[3] Based on a septic failure rate of 12% (VA DEQ 2005)

[4] Town of West Point numbers are as follows: Population: 2,866; Number of Houses: 1,490; Number of Houses Public Sewer: 1,388; Number of Houses on Septic Systems: 102; Number of Houses on "Other Means": 0; Number of Houses with a Failing Septic System: 12. Population is based on Census 2000 estimates, Number of Houses numbers were provided by the Town of West Point, and the Number of Failing Septic Systems was calculated using a septic failure rate of 12%.

Table 2-23: Population Estimates per TMDL Watershed						
TMDL Watershed	**Population [1]**	**Number of Houses[1]**	**Number of Houses Public Sewer[2]**	**Number of Houses on Septic Systems [2]**	**Number of Houses on "Other Means"[2]**	**Number of Houses with a Failing Septic System[3]**
TMDL #1 and #2 Upper York Shellfish and Recreational	7,281	3,064	277	2,657	130	319
TMDL #3 Lower Pamunkey	3,691	1,476	128	1,303	45	156
TMDL #4 Lower Mattaponi	2,523	1,127	145	916	66	110
TOTAL	**13,495**	**5,667**	**550**	**4,876**	**241**	**585**

[1] Census 2008 estimates

[2] Based upon 2008 census estimate and ratio of parameter: 1990 census estimate

3 Based on a septic failure rate of 12% (VA DEQ 2005)

2.5.3 Livestock

An inventory of the livestock of the Upper Tidal York River watershed was conducted using data and information provided by United States Department of Agriculture (USDA)

Census of Agriculture (2007)[2], and stakeholders input. Livestock information was available for all counties in the watershed. This database was used to determine the livestock inventories shown in **Table 2-24** per county. **Table 2-25** shows estimates of livestock inventories per TMDL watershed.

Table 2-24: Livestock Present in King and Queen, King William and New Kent Counties

County/Town	Cattle	Pigs	Poultry	Horses	Sheep
King and Queen	1,418	N/A	151	306	84
King William (Including Town of West Point[1])	1,781	440	467	254	68
New Kent	663	20	689	404	63
TOTAL	**3,862**	**460**	**1,307**	**964**	**215**

Differences in totals are due to rounding;
[1] Town of West Point numbers are as follows: Cattle: 0; Pigs: 0; Poultry: 0; Horses: 0; Sheep: 0
Numbers were provided by the Town of West Point.

Table 2- 25: Livestock Present Per TMDL Watershed

TMDL Watershed	Cattle	Pigs	Poultry	Horses	Sheep
TMDL #1 and #2 Upper York Shellfish and Recreational	721	67	232	185	42
TMDL #3 Lower Pamunkey	222	21	72	57	13
TMDL #4 Lower Mattaponi	353	33	114	91	20
TOTAL	**1,296**	**121**	**418**	**333**	**75**

2.5.4 Land Application of Biosolids

Biosolids applications can adversely impact bacteria levels if not tilled into the soil prior to the next significant rain. Biosolids are typically lime stabilized by the source or the applicator prior to application by mixing lime into the material to raise the pH to pH 12, which kills the bacteria. However Class B biosolids, the type typically applied in Virginia, are allowed to contain up to 1,995,262 cfu/g-dry fecal bacteria. VA DEQ makes a thorough search for biosolids permit applications for the location of potential

[2] Data available from the USDA 2007 Census of Agriculture Report for the state of Virginia at http://www.agcensus.usda.gov/Publications/2007/Full_Report/index.asp

application fields in a TMDL watershed, and then requests dates of applications and tonnage applied from applicators.

Based on data provided by Virginia Department of Health (VDH) and VA DEQ indicated that there have been biosolid applications in the counties of King and Queen, New Kent, and King William between 2000 and 2006; No biosolid applications were recorded for the area within the boundaries of the Town of West Point. Biosolid data were available in dry tons and total area of application except for the County of New Kent where only the area of application was available. **Table 2-26** gives a summary of the dry tons applied per county per year. Note that only application sites, where geographic coordinates were available, are presented in the table. **Table 2-27** presents the available biosolid information per TMDL watershed.

Table 2-26: Biosolid Application by County (dry ton/year)

County	2000	2001	2002	2003	2004	2005	2006
King & Queen	1,946	6,186	1,565	-	7,734	6,929	1,037
King William	5,829	10,744	-	-	-	-	-
New Kent*	-	-	-	-	-	-	-

*No Biosolids loads were available for New Kent
Note that only application sites, where geographic coordinates were available, are presented in the table.

Table 2- 27: Biosolid Application by Impaired Segment Watershed (dry ton/year)

Impaired Segment Watershed*	2000	2001	2002	2003	2004	2005	2006
TMDL #1 and #2 Upper York River	-	-	-	-	270	44	-
TMDL #3 Lower Pamunkey River	-	-	-	-	-	-	-
TMDL #4 Mattaponi River	-	274	-	-	421	234	121

* Note that only application sites, where geographic coordinates were available, are presented in the table.

2.5.5 Wildlife

Similar to livestock contributions, wildlife contributions of bacteria can be indirect or direct. Indirect sources are those that are carried to the stream from the surrounding land via rain and runoff events, whereas direct sources are those that are directly deposited into the stream.

The wildlife inventory for the TMDL watershed was developed based on numbers provided by the Department of Game and Inland Fisheries (DGIF). The number of wildlife in the watershed was estimated by combining typical wildlife densities with available stream wildlife habitat. Typical wildlife densities provided by DGIF are presented in **Table-2-28**. Information from these databases was used to determine the wildlife inventory for each county as shown in **Table 2-29**, and per TMDL watershed as shown in **Table 2-30.**

Table 2- 28: Wildlife Densities in the TMDL Watersheds [1]

Wildlife type	Population Density	Habitat Requirements
Deer	0.047 animals/acre	Entire watershed
Raccoon (low density)	10/square mile	Upland forest
Raccoon (high density)	50/square mile	Bottomland forest, marsh, swamp, along streams
Muskrat (low density)	2 animals/mile	16/mile of ditch or medium sized stream intersecting agriculture crop fields, 8/mi of medium sized stream intersecting pasture fields, 10/mi of pond or lake edge, 50/mi of slow-moving river
Muskrat (high density)	15 animals/mile	
Muskrat (average density)	10 animals/mile	
Beaver (low density)	1.0/mile	Permanent streams and rivers
Beaver (high density)	14.5/mile	
Beaver (average density)	4.8/mile	
Canada Goose	http://migbirdapps.fws.gov/	Based on particular strata for watershed area
Mallard		
Wood Duck		
Black Duck		

[1] Source: Department of Game and Inland Fisheries (DGIF)

Table 2-29: Wildlife Present in King and Queen, King William and New Kent Counties

County/Town	Acres	Canada Geese	Black Duck	Wood Duck	Mallard	Deer	Raccoon	Muskrat	Beaver
King and Queen	205,229	284	0	0	284	9,646	6,721	5,147	975
King William (Including Town of West Point[1])	182,562	415	0	0	415	8,580	6,809	5,019	951
New Kent	140,575	369	0	0	369	6,607	5,901	3,735	709
TOTAL	**528,366**	**1,068**	**0**	**0**	**1,068**	**24,833**	**19,431**	**13,901**	**2,635**

[1]Town of West Point Numbers are as follows: Acres: 4,259; Canadian Geese: 10; Black Duck: 0; Wood Duck: 0; Mallard: 10; Deer: 200; Raccoon: 159; Muskrat: 117; Beaver: 22

Table 2-30: Wildlife Present Per TMDL Watershed[1]									
TMDL Watershed	**Acres**	**Canada Geese**	**Wood Duck**	**Black Duck**	**Mallard**	**Deer**	**Raccoon**	**Muskrat**	**Beaver**
TMDL #1 and #2 Upper York Shellfish and Recreational	106,392	>2,206	0	0	206	4,781	4,152	3,021	572
TMDL #3 Lower Pamunkey	32,793	>1,000[2]	0	0	63	1,474	1,280	931	176
TMDL #4 Lower Mattaponi	52,138	>1,000[2]	0	0	101	2,343	2,035	1,480	280

[1] Based on the Department of Game and Inland Fisheries (DGIF)
2 Based on stakeholders' input

2.5.6 Pets

The two types of domestic pets that were considered potential bacteria sources in this watershed were cats and dogs. The Animal Control Office (ACO) of the three counties was contacted to request information on total dog numbers (individual and kennels) and the location of kennels. The information provided by the counties is summarized in **Table 2-31.** 20-kennel and 50-kennel licenses indicate that up to 20 or 50 dogs respectively can be accounted for by each tag. The numbers shown in Table 2-31 for these categories reflect the maximum number of dogs possible. In order to estimate the number of pets in the counties where no information was provided, pet numbers were estimated by determining the number of households in the county and multiplying this number by national average estimates of the number of pets per household, which are 0.543 dogs per household and 0.593 cats per household (American Veterinary Medical Association). **Table 2-32** shows the numbers of dogs and cats within each county based on estimates and the provided number of individual dog counts from the counties. **Table 2-33** shows the number of pets per TMDL watershed based on household numbers. Information from the ACO on dogs was not used in Table 2-33, since no information on the graphical location of ACO dog numbers was provided.

Table 2-31: Dogs Present for King and Queen, King William and New Kent Counties				
County	**Tag Type**	**2007**	**2008**	**2009**
King and Queen	Individual	NI	NI	NI
	20-kennel*	NI	NI	NI
	50-kennel*	NI	NI	NI
King William	Individual	NI	NI	4,300**
	20-kennel*	NI	NI	3,500
	50-kennel*	NI	NI	NI
New Kent	Individual	1,978	2,921	3,203
	20-kennel*	2,920	2,620	2,800
	50-kennel*	950	800	950
			New Kent Total:	6,953

*The numbers presented reflect the maximum amount of dogs possible
**Number has been doubled due to estimation by King William County Department of Treasury
NI = No information;

Table 2-32: Pet Inventory for King and Queen, King William and New Kent Counties			
County	**Households**	**Dogs** [2]	**Cats**
King and Queen	3,355	1,822	1,990
King William (Including Town of West Point[1])	6,452	4,300	3,826
New Kent	7,112	3,203	4,217
TOTAL	**16,919**	**9,325**	**10,033**

[1] Town of West Point numbers are as follows: Households: 1,490; Dogs: 809; Cats: 884. Number of Households provided by the Town of West Point.
[2] The total number of dogs in King William and New Kent County are based on individual counts in 2009 from ACO; no information was available for dog counts in King and Queen County. The dog numbers do not include dog numbers from kennels, since they represent maximum numbers of dogs possible. Dog numbers in King William and New Kent Counties including kennels from 2009:
King William: 4,300 (individual) + 3,500 (kennels) = 7,800
New Kent: 3,203 (individual) + 6,953 (kennels) = 10,156

Table 2-33: Pet Inventory per TMDL Watershed			
TMDL Watershed	**Households**	**Dogs**	**Cats**
TMDL #1 and #2 Upper York Shellfish and Recreational	3,064	1,664	1,817
TMDL #3 Lower Pamukney	1,476	802	875
TMDL #4 Lower Mattaponi	1,127	612	668
TOTAL	**5,667**	**3,078**	**3,360**

Number of households provided by King and Queen, King William and New Kent Counties
Source: American Veterinary Medical Association (AVMA); 0.593 cats/household, 0.543 dogs/household

3.0 Modeling Approach

This section describes the modeling approach used in the TMDL development. The primary focus is on the sources represented in the model, assumptions used, and model set-up. Separate models were setup to compute the fecal coliform loads in the impaired segment of Upper York River and the enterococci loads in the impaired segments of Upper York, Lower Pamunkey and Mattaponi Rivers. However, the same modeling approach, as discussed in the following sections, was used to develop these TMDLs.

3.1 Modeling Goals

The goals of the modeling approach were to develop a predictive tool for the waterbody that can:

- represent a bacteria water quality model for small coastal basins
- represent the watershed hydrologic characteristics and tidal volume in steady state
- represent the nonpoint sources of bacteria and their respective contribution
- use kinetic data (die-off rate of bacteria)
- estimate the in-stream pollutant loadings under steady state
- allow for direct comparisons between the in-stream conditions and the water quality standard

3.2 Modeling Area

Modeling is applied to the Upper York River and its tributaries in areas designated as impaired by VA DEQ (2008). The designated areas are brackish waters and tidally influenced by an unrestricted connection to the York River.

3.3 Modeling Strategy

3.3.1 Model Selection and Approach

A simplified model approach, jointly developed by EPA, VA DEQ, VA DCR, Maryland Department of the Environment (MDE), VDH-DSS, Virginia Institute of Marine Sciences (VIMS), United States Geological Survey, Virginia Polytechnic University, James Madison University, and Tetra Tech, was selected to estimate present bacteria loads for small coastal basins, to calculate allocation and needed reductions of each source (VA DEQ, 2005, 2006). A spreadsheet model, which is run in Microsoft EXCEL, calculates estuaries bacteria loads based on steady state mass balance in the estuary over a tidal period (the prevailing tide in the estuary of Upper York River is the lunar semi-diurnal (M2) tide with a tidal period of 12.42 hours). Tidal Exchange in case of tributaries is between the estuary (tributary) and a larger river (referred to as 'ocean' in the model), or the Upper York River segment. Tidal Exchange in case of the Upper York River segment is between this segment and the downstream segment of the York River. The steady state condition of the model mirrors average condition of the estuary system and incorporates the following assumptions:

1. Water is incompressible
2. Water is completely mixed:
    a. Density variations because of temperature and salinity changes by saline and freshwater inflow are negligible
    b. Variations of bacteria concentration are negligible
3. The saline volume flowing into the estuary is based on an average tidal range, the surface area of the estuary, and an average fraction of incoming new ocean water
4. The volume of water flowing out the estuary is the sum of assumption Nr. 1, 2 and 3
5. Average freshwater flow is estimated based on observed freshwater flow per unit area from USGS flow gauge station in vicinity
6. The source precipitation and sink evaporation are negligible
7. Bacteria is decayed through a combined daily first order kinetic rate

The water balance in the estuary under steady state is defined as follows (the change of the total volume of water in the estuary (V_b) from one tidal cycle to the next is zero; $\frac{dV_b}{dT} = 0$):

$$0 = Q_0 - Q_b + Q_f \qquad (1)$$

In which Q_0 = Volume of water entering the estuary through flood tide which was not released from the estuary on the previous ebb tide [m^3 per tidal cycle]

Q_b = Volume of water flowing out of the estuary through ebb tide which did not enter the estuary on the previous flood tide [m^3 per tidal cycle]

Q_f = Volume of net freshwater over a tidal period [m^3 per tidal cycle]

Q_0 is obtained when the volume of water which flows into the estuary from the ocean during flood (tidal prism) is corrected by the average fraction of incoming new ocean water (ocean tidal exchange ratio):

$$Q_0 = b * Q_T \qquad (2)$$

In which Q_T = tidal prism [m^3 per tidal cycle]

ß = Ocean tidal exchange ratio [-]

The ocean tidal exchange ratio is quantified through salinity levels in the estuary and ocean and defined by the following equation by Fischer et al. (1979) (Guo and Lordi, 2000):

$$b = \frac{S_f - S_e}{S_0 - S_e} \qquad (3)$$

In which S_f = Average salinity of ocean water entering the estuary during flood [ppt]

S_e = Average salinity of estuary water leaving the estuary during ebb [ppt]

S_0 = Salinity of the water at the ocean site [ppt]

Based on simulation runs with the Tidal Prism Water Quality Model (TPWQM) in Virginia coastal embayments by Kuo et al. (1998), the ocean tidal exchange ratio ranged between 0.3 and 0.7.

The tidal prism is the volume of water flowing into the estuary from the ocean through the inlet during flood tide and is computed through the surface area of the estuary and the mean tidal range. The mean tidal range is defined as the mean difference between high and low tidal levels.

$$Q_T = TD_{ave} * SA_B \qquad (4)$$

In which TD_{ave} = Mean tidal range [m per tidal cycle]

SA_B = Water surface area of the estuary [m^2]

When equation (1) is formulated as mass balance for bacteria and a total daily death rate for bacteria is enclosed, the following equation can be formulated ($\frac{dV_b C}{dT} = 0$):

$$0 = Q_0 C_0 - Q_b C_b + Q_f C_f - k_b V_b C_b \qquad (5)$$

In which C_0 = Bacteria concentration entering the estuary through flood tide which was not released from the estuary on the previous ebb tide [MPN/100mL]

C_b = Bacteria concentration leaving the estuary through ebb tide which did not enter from the estuary on the previous flood tide [MPN/100mL]

C_f = Bacteria concentration from the watershed and the local area in the estuary during tidal cycle [MPN/100mL]

k_b = Total death rate for bacteria in estuary [day^{-1}]

V_b = Mean total volume of water in the estuary [m^3]

Data on death rates for fecal coliform in salt water are of limited availability. In this TMDL, a total death rate for fecal coliform of 1.85 day^{-1}, the midpoint of the range (0.70 to 3.0 day^{-1}) given by Thomann and Mueller (1987), was applied. Kaya et al (2005) published similar decay rates for enterococci in estuarine and coastal waters. Therefore, an overall death rate of 1.85 day^{-1} was used in developing the Mattaponi River and Lower Pamunkey River entercocci TMDLs.

3.3.2 Estimation of the Current Daily Load Capacity of the Bay

When $Q_f C_f$ equals L_t (total load capacity of the estuary) and equation (5) is solved for L_t, the following equation yields:

$$L_t = (C_b (Q_b + k_b V_b) - Q_0 C_0) * f_{conv} \qquad (6)$$

In which L_t = Estimated daily load capacity of the estuary [MPN/day]

f_{conv} = Conversion factor: 24/12.42 * 10^4 (the factor 24/12.42 accounts for the remaining 11.38 hrs out of 24 hrs, the factor 10^4 converts bacteria unit MPN/100mL into MPN/m^3)

Equation (6) is used to calculate the current daily load capacity for bacteria in the estuary. The daily load capacity is calculated separately for the maximum geometric mean and single maximum value measured in the estuary (C_b) and at the boundary between the estuary and the York River (C_0). The current load capacity with the highest load is used for the load allocation to account for critical conditions.

3.3.3 Estimation of the Allowable Daily Load Capacity of the Bay

When C_b and C_0 in equation (6) are substituted with VA DEQ criterion for bacteria (C_c), the following equation yields:

$$L_t = (C_c(Q_b + k_b V_b) - Q_0 C_c) * f_{conv} \qquad (7)$$

In which C_c = Concentration of bacteria for VA criteria of geometric mean and singe maximum value

Equation (7) is used to calculate the allowable daily load for bacteria in the estuary based on VA DEQ criteria for bacteria in saltwater and transition zone. The allowable daily load capacity is computed for the criterion with the highest current load capacity.

The difference between the current and the allowable daily load capacity is the required reduction of bacteria load in the watershed.

3.4 Volume Estimations

Four volumes of water needed to be considered for developing the bacteria TMDLs for the Upper York River and its tributaries:

- Volume of water at sea level in the estuary
- Volume of water entering the estuary through flood tide
- Volume of water flowing out of the estuary through ebb tide
- Volume of net freshwater over a tidal cycle

3.4.1 Volume of Water at Sea Level

The volume of water, at sea level were estimated using bathymetry measurements collected by VA DEQ in the estuarine reaches of Mattaponi River, Pamunkey River, and Upper York River. The average bathymetric data are discussed in Section 2.3.

3.4.2 Volume of Water Entering the Estuary

The volume of water entering each estuary through flood tide was computed by applying equation (2) and (4). The surface area was estimated based on bathymetry data, and the mean tidal ranges for the Upper Tidal York River watershed were obtained from NOAA's website "Tide and Currents" (NOAA, 2006). The tidal station "West Point, VA" was used for the mean tidal ranges of the Upper York River and its tributaries. An ocean tidal exchange ratio of 0.5 was selected for the estuary based on the average reported range from model test runs with the Tidal Prism Water Quality Model (TPWQM) in Virginia coastal embayments by Kuo et al. (1998). **Table 3-1** shows the estimated estuary surface area and the calculated incoming volume of the estuaries of the Upper York River and its tributaries for a mean tidal range of 0.85 meters (a value based on NOAA station "West Point, VA").

Table 3-1: Estimated Estuary Surface Area and Calculated Incoming Volume for the Estuary of the Upper York River and its Tributaries

Waterbody	Surface Area	Calculated Volume (Q_0)
	m^2	m^3/tidal cycle
Upper York River (TMDL #1 & TMDL #2)	18,694,535	7,977,332
Lower Pamunkey River (TMDL #3)	11,313,069	4,827,513
Lower Mattaponi River (TMDL #4)	6,565,620	2,801,681

3.4.3 Volume of Water Flowing out of the Estuary

The volume of water flowing out of the estuary through flood tide was computed by applying equation (1). **Table 3-2** shows the volume of water leaving the estuary segments of the Upper Tidal York River watershed.

Table 3-2: Computed Volume of Water Leaving the Estuary of the Upper York River and its tributaries

Waterbody	Calculated Volume (Q_b)
	m^3/tidal cycle
Upper York River (TMDL #1 & TMDL #2)	8,173,104
Lower Pamunkey River (TMDL #3)	4,887,855
Lower Mattaponi River (TMDL #4)	2,897,621

3.4.4 Volume of Net Freshwater

Freshwater input to an estuary is defined by the net downstream flow from the tributaries and direct contribution from adjoining areas. The volumes of fresh water entering the estuaries of the Upper York River, Mattaponi River, and Pamunkey River were estimated based on average flow measurements over a 16-year period (1979-1995) at the USGS 01677000 Ware Creek near Toano, VA gage. Long term flows at two nearby USGS gages (USGS 01673638 Cohoke Mill Creek near Lester Manor, VA and USGS 02042500 Chickahominy River near Providence Forge, VA) were evaluated and no significant difference in average flow rate per unit area was found. Therefore, the net freshwater input to all the Upper York River and its tributary segments were estimated based on the average flow rate from the USGS 01677000 Ware Creek near Toano, VA gage. Based on the 16 year average flow from 1979 through 1995 at USGS 01677000, a unit flow rate per square meter was computed and applied to the Upper York River and its tributary watersheds to obtain the total volume of water entering the estuary. **Table 3-3** shows the computed unit freshwater flow rate per m^2 and the volume of freshwater per tidal cycle for the Upper York River and its tributary watersheds.

Table 3-3: Drainage Area and Freshwater Inflow Volume for the Estuaries of the Upper York River and its tributaries

Waterbody	Drainage Area	Inflow Volume*
	m^2	m^3/tidal cycle**
Upper York River (TMDL #1 & TMDL #2)	430,554,912	195,772
Lower Pamunkey River (TMDL #3)	132,709,106	60,342
Lower Mattaponi River (TMDL #4)	210,995,864	95,939

*Based on a unite flow rate at USGS 01677000 of 1.018×10^{-8} m^3/sec m^2
**Based on a lunar semi-diurnal (m^2) tide with a tidal period of 12.42 hours

3.5 Bacteria Sources Representation

This section demonstrates which bacteria sources were included or represented in the model. In a tidally influenced system, three potential main sources need to be accounted for:

1. Sources from the watershed include human sources (failed septic systems and permitted dischargers), livestock, wildlife, and pets.
2. Sources within the estuary include waterfowl and boat traffic.

3. Downstream boundary source from the boundary between estuary and the York River.

The first two sources were accounted for in an agglomerated number, combining all bacteria sources, represented by the maximum concentrations measured at a representative station inside each estuary of the Upper York, Pumankey and Mattaponi Rivers. However, the individual sources such as human sources, pets, livestock, and wildlife were accounted for through Bacteria Source Tracking (BST) data for the shellfish TMDL (based on fecal coliform concentrations) in the Upper York River and through detail calculations using EPA's Bacterial Indicator Tool for the entercocci TMDLs in the Upper York, Pamunkey and Mattaponi Rivers. The BST data were collected at one station in the Upper York River impaired segment. Stations inside the estuaries are considered to represent bacteria sources originating from point and nonpoint sources in the drainage areas of the impaired segments. The BST data was used to distribute fecal coliform loadings among the various sources. EPA's Bacterial Indicator Tool was used to determine the relative contributions of entercocci loads from human sources, pets, livestock, and wildlife.

The third source is represented by the maximum fecal coliform measurement taken at the boundary stations located in near the mouth of the Upper York River, Pamunkey River and Mattaponi River estuaries.

Table 3-4 and **Table 3-5** show the maximum fecal coliform at the station located in the estuary and at the boundary of the impaired segment, respectively. **Tables 3-6** and **3-7** show the maximum enterococci at the stations located in the estuaries of the Lower Pamunkey and Mattaponi Rivers, and at their downstream boundaries, respectively. The tables also show- whether VA DEQ standards for fecal coliform and enterococci concentrations are exceeded. Both values are used in the model for calculating the total daily load capacity.

Table 3-4: Maximum Concentration of Fecal Coliform in the Estuary of the Upper York River					
Location	Station	Geometric Mean (MPN/100mL)	Exceeds Geometric Standard: 14 MPN/100mL.	Value (MPN /100mL)	Exceeds SSM standard: 49 MPN /100mL
Upper York River	48-104B	67	Yes	468	Yes

Table 3-5: Maximum Concentration of Fecal Coliform at the Downstream Boundary of the Upper York River Estuary					
Location	Station	Geometric Mean (MPN/100mL)	Exceeds Geometric Standard: 14 MPN/100mL.	Value (MPN /100mL)	Exceeds SSM standard: 49 MPN /100mL
Upper York River	50-202	18	Yes	99	Yes

Table 3-6: Maximum Concentrations of Enterococci in the Estuaries of the Lower Pamunkey River and the Mattaponi River					
Location	Station	Geometric Mean [1] (MPN/100mL)	Exceeds Geometric Standard[1]: 14 MPN/100mL.	Value (MPN /100mL)	Exceeds SSM standard: 104 MPN /100mL
Lower Pamunkey River	8-PMK006.36	--	--	2,000	Yes
Lower Mattaponi River	8-MPN004.39	--	--	1,500	Yes
[1] Requirements of at least two measurements for calculating geometric mean 35 count /100mL for enterococci were not met					

Table 3-7: Maximum Concentration of Enterococci at the Downstream Boundaries of the Lower Pamunkey River and the Mattaponi River Estuaries					
Location	Station	Geometric Mean [1] (MPN/100mL)	Exceeds Geometric Standard[1]: 35MPN/100mL.	Value (MPN /100mL)	Exceeds SSM standard:104 MPN /100mL
Upper York River – immediately downstream of Pamunkey and Mattaponi Rivers	8-YRK031.39	--	--	2000	Yes
[1] Requirements of at least two measurements for calculating geometric mean 35 count /100mL for enterococci were not met					

The BST data provided the distribution of fecal coliform loads from various nonpoint sources in the Upper Tidal York River watershed. In absence of similar monitoring data that allow for determination of relative contributions of enterococci loads from different nonpoint sources, the distribution of enterococci loads in the Lower Pamunkey River watershed and the Mattaponi River watershed were determined using a spreadsheet based analysis tool or Fecal Tool, which is a modified version of EPA's Bacterial Indicator Tool. The Fecal Tool employs user supplied landuse acreage, animal population, septic systems and unit load data to estimate the fecal coliform loads from various sources in a watershed environment (The unit load data used in the Fecal Tool are based on published fecal coliform production rates and are presented in Appendix C.). It is assumed that the distribution of entercocci load is identical to the distribution of fecal coliform load from the same source categories. Thus, the Fecal Tools results were used to estimate the entercocci distribution in the Lower Pamunkey River and the Mattaponi River watersheds as shown in **Table 3-8**, **Figure 3-1** and **Figure 3-2**.

Table 3-8: Percentage of Entercocci Loads by Major Source Categories

Segment	Basis	Wildlife	Human	Livestock	Pets
Lower Pamunkey River	Fecal Tool Spreadsheet	7.5%	11.3%	75.1%	6.2%
Mattaponi River	Fecal Tool Spreadsheet	5.0%	11.1%	77.7%	6.3%

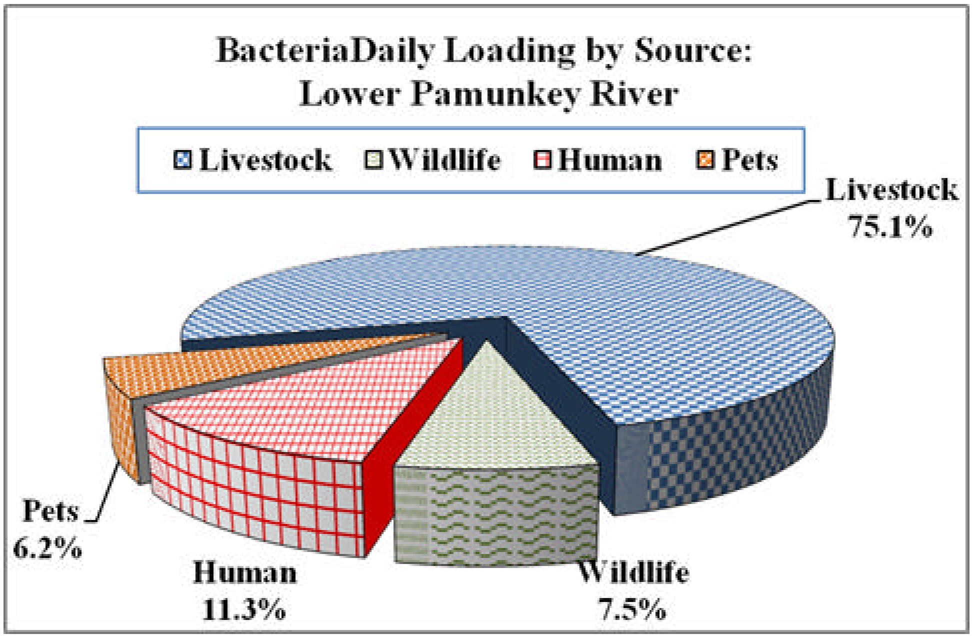

Figure 3- 1: Distribution of Bacteria Loads by Source in the Lower Pamunkey River Watershed.

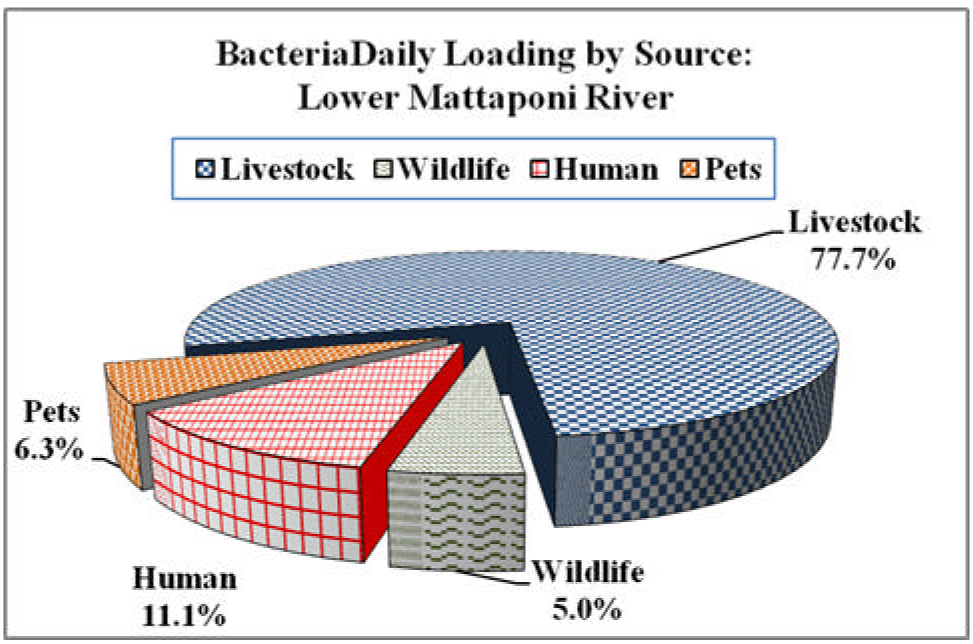

Figure 3- 2: Distribution of Bacteria Loads by Source in the Mattaponi River Watershed

4.0 TMDL Allocation

The allocation analysis for the bacteria impaired segment of the Upper York River, Lower Pamunkey River and Mattaponi River is the third stage in TMDL development. Its purpose is to develop a framework for reducing fecal coliform and enterococci loading under the existing watershed conditions so that water quality standards can be met. In this section, TMDL allocations will be presented for the shellfish impaired segment of the Upper York (cause group code: F26E-20-SF), recreational impaired segment within the Upper York (cause group code: F26E-05-BAC), recreational impairments for the Lower Pamunkey River (cause group code: F14E-03-BAC), and Lower Mattaponi River (cause group code: F25E-01-BAC).

The TMDL represents the maximum amount of pollutant that the stream can contain without exceeding the water quality standard. The load allocations for the selected scenarios were calculated using the following equation:

TMDL = ? WLA +? LA + MOS

Where,

WLA = waste load allocation (point source contributions);

LA = load allocation (nonpoint source allocation); and

MOS = margin of safety.

Typically, several potential allocation strategies would achieve the TMDL endpoint and water quality standards. Available control options depend on the number, location, and character of pollutant sources.

4.1 Incorporation of Margin of Safety

The margin of safety (MOS) is a required component of the TMDL, which accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. According to EPA guidance (EPA, 1991), the MOS can be incorporated into the TMDL using two methods:

- Implicitly incorporating the MOS using conservative model assumptions to develop allocations; or
- Explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

The MOS will be implicitly incorporated into this TMDL. Implicitly incorporating the MOS requires that allocations meet the fecal coliform standard geometric mean of 14 MPN/100mL and the 90th Percentile Standard of 49 MPN/100mL and the entercocci standard geometric mean of 35 MPN/100mL and the Single Sample Maximum Standard of 104 counts/100mL at any time. Conservative assumptions such as using the worst case geometric mean, 90th percentile and highest instantaneous enterococci exceedances in load calculations are further examples of an implicit MOS.

4.2 Waste Load Allocation

There are three permitted dischargers located in the Upper Tidal York watershed that discharge bacteria loads. Of the three, two are individual permitted dischargers (VA0088331 and VA0075434) and one is a domestic residential discharger (VAG404212). However, the two individual permitted dischargers (VA0088331 and VA0075434) were not considered in the WLA for shellfish impaired segment in the Upper York, because the immediate area surrounding both treatment plant outfalls are identified by DSS as shellfish condemnation area 2C. The direct harvest of shellfish for human consumption is prohibited because of the location of a municipal wastewater treatment plant in this segment. Therefore, both dischargers are evaluated for primary contact (recreation) use only and are considered (depending on the location) in the WLA for the recreational impaired segment for the Upper York, Lower Pamunkey River, and Lower Mattaponi River. Although two additional point sources dischargers (VA0003115 and VA0090433) are located in the Upper Tidal York River watershed, they were not permitted for bacteria discharge and, therefore, excluded from TMDL allocations. An expansion for future growth factor of 5 was applied to compute the WLA from the permitted dischargers in TMDL watersheds where STPs contributed to bacteria load. In TMDL watersheds, in which no STPs contributed to bacteria load, a 1 percent of the allowable bacteria load for future growth was applied to the WLA.

4.3 Load Allocation Development and Scenarios

The reduction of loadings from nonpoint sources, including livestock, pets, and wildlife direct deposition, was incorporated into the load allocation. Fecal coliform loadings (daily load capacity of the estuary) were calculated only in the estuaries of the Upper York in order to obtain the current load and allowable load. Enterococci loading were calculated in the estuaries of the Upper York, the Lower Pamunkey River, and the Lower Mattaponi River. The current load for fecal colicorm is the maximum value of the geometric mean and 90th percentile and for enterococci the maximum instantaneous concentration based on measurements at monitoring stations inside the estuary. The allowable load is the maximum values of the bacteria standard based on VA DEQ standards for fecal coliform and enterococci. The required percent load reduction for the Upper York River and its tributaries watershed was estimated by subtracting the allowable load from the current load, dividing the remainder by the current load, and multiplying by 100. **Table 4-1** shows the computed model results of the current load, allowable load, and reduction for the 90th percentile for the Upper York River and **Table 4-2** the computed model results of the current load, allowable, reduction for the SSM (Single Sample Maximum) for the Upper York, Lower Pamunkey River and Lower Mattaponi River. The maximum values of the 90th percentile for fecal coliform and the maximum value for enterococci were used to calculate the load allocation and the TMDL in the watershed, since they represented the maximum current loads.

Table 4-9: Current Load, Allowable Load, and Required Reduction for the Shellfish Impaired Segment of Upper York

Waterbody	Station	Volume (m^3)	Max 90th Percentile (MPN/100mL)	90th Percentile Standard (MPN/100mL)	Current Load (MPN/day)	Allowable Load (MPN/day)	Required Reduction (%)
Upper York River	48-104B	56,969,506	468	49 (Fecal Coliform)	1.15E+15	1.14E+14	90%

Table 4-10: Current Load, Allowable Load, and Required Reduction for the Recreational Impaired Segments for the Upper York, Lower Pamunkey River and Lower Mattaponi River							
Waterbody	**Station**	**Volume (m^3)**	**Max Concentration (Count/100mL)**	**SSM [1] Standard (Count /100mL)**	**Current Load (Count /day)**	**Allowable Load (Count /day)**	**Required Reduction (%)**
Upper York River	8-YRK031.39	56,969,506	2000	104 (Enterococci)	4.79E+15	2.42E+14	95.0%
Lower Pamunkey River	8-PMK006.36	39,068,362	2,000		3.14E+15	1.63E+14	94.8%
Mattaponi River	8-MPN004.39	22,468,802	1,500		1.33E+15	9.41E+13	92.9%

[1] Single Sample Maximum for Enterococci

4.4 Allocation Plan and TMDL Summary

4.4.1 Waste Load Allocation

Waste load allocations are applied to two wastewater/sewage treatment plants (WWTPs/STPs) and a domestic facility. The allocated load for each discharger is generally calculated using the design flow and the permitted bacteria concentration. Since no permitted limits for fecal coliform and enterococci were reported, the 90th Percentile standard for fecal coliform (49 MPN/100mL) and enterococci (104 count/100mL) were used to account for the effluent bacteria concentration from all dischargers. The allocated loads including the design flow and bacteria concentration are shown in **Tables 4-3**, **4-4, 4-5,** and **4-6**. To account for future growth and for streams with permitted STP facilities, an expansion factor of 5 was applied to calculate the WLA. In TMDL watersheds, in which no STPs contributed to bacteria load, a 1 percent of the allowable bacteria load for future growth was applied to the WLA. It should be noted that no reduction is applied to the dischargers.

Table 4-11: Waste Load Allocation for Fecal Coliform in the Upper Tidal York River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Fecal Coliform Concentration (MPN/100ml)** [1]	**Allocated Load**	**Percent Reduction**
VAG404212	Residence	60	49	1.11E+05	0
1% of the allowable load for future growth in absence of any WWTP				1.14E+12	
Total Allocated Waste Load				1.14E+12	
[1]The effluent fecal coliform concentration is based on the 90th percentile standard for fecal					

Table 4-12: Waste Load Allocation for Enterococci in the Upper Tidal York River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Enterococci Concentration (count /100ml)** [1]	**Allocated Load**	**Percent Reduction**
VAG404212	Residence	60	104	2.36E+05	0
VA0075434	HRSD Town of West Point Sewage Treatment Plant	600,000	104	2.36E+09	0
VA0088331	Parham Landing WWTP	568,000	104	2.24E+09	0
Current Allocated Waste Load				4.60E+09	
Expansion for Future Growth (5X WLA)				2.30E+10	
Total Allocated Waste Load				2.76E+10	
[1]The effluent enterococci concentration is based on the Single Sample Maximum standard for enterococci					

Table 4-13: Waste Load Allocation for Enterococci in the Lower Pamunkey River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Enterococci Concentration (count /100ml)** [1]	**Allocated Load**	**Percent Reduction**
VA0088331	Parham Landing WWTP	568,000	104	2.24E+09	0
Current Allocated Waste Load				2.24E+09	
Expansion for Future Growth (5X WLA)				1.12E+10	
Total Allocated Waste Load				1.34E+10	
[1]The effluent entercocci concentration is based on the Single Sample Maximum standard for enterococci					

Table 4-14: Waste Load Allocation for Entercocci in the Mattaponi River watershed					
Point Source	**Facility Name**	**Design Flow (gallons/day)**	**Enterococci Concentration (count /100ml)** [1]	**Allocated Load**	**Percent Reduction**
VAG404212	Residence	60	104	2.36E+05	0
VA0075434	HRSD Town of West Point Sewage Treatment Plant	600,000	104	2.36E+09	0
Current Allocated Waste Load				2.36E+09	
Expansion for Future Growth (5X WLA)				1.18E+10	
Total Allocated Waste Load				1.42E+10	

[1] The effluent entercocci concentration is based on the Single Sample Maximum standard for enterococci

4.4.2 Load Allocation and TMDL

The load allocation for the Upper York impairments (shellfish and recreation, respectively) is based on Bacteria Source Tracking (BST) results for livestock, wildlife, human, and pets. The load allocation for Lower Pamunkey and Mattaponi River (Recreation) are based on Fecal Tool analyses for livestock, wildlife, human, and pets in the Lower Pamunkey River watershed and the Mattaponi River watershed. The BST results are based on a weighted average of samples collected by VDH-DSS over a twelve-month period from 2005-2006 at the VDH-DSS monitoring station 49-207. The enterococci results are based on the computed fecal coliform loads using the Fecal Tool spreadsheet analyses and the assumption that the distribution of enterococci loads will the same as the distribution of fecal coliform loads by source categories. A complete reduction of all human sources is required, since fecal coliform and enterococci from human sources are considered a serious concern in estuaries (VA DEQ, 2005). Reductions for wildlife are applied when the reduction of controllable loads (humans, livestock, and pets) does not achieve the water quality standard for the estuary (VA DEQ, 2005). However, the TMDL does not recommend reductions in wildlife populations. Allocations are developed using the proportion of these sources in the BST data. The fecal coliform TMDL allocations by BST source categories that would meet the 90th percentile fecal coliform standard of 49 MPN/100mL for the Upper Tidal York River watersheds are provided in **Table 4-7**. The enterococci TMDL allocations by different source categories that would meet the Single Sample Maximum percentile enterococci standard of 104 count/100mL for the Upper York, Lower Pamunkey River and the Mattaponi River watersheds are provided in **Tables 4-8, 4-9** and **4-10**.

Summaries of the TMDL allocation plans for Upper York River (for shellfish and recreation, respectively), Lower Pamunkey River and Mattaponi River watersheds are presented in **Tables 4-11**, **4-12**, **4-13,** and **4-14,** respectively. Minor differences in current loads are due to rounding.

Table 4-15: Distribution of Fecal Coliform Under Existing Conditions, TMDL Allocation, and Reduction in the Upper Tidal York River watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (MPN/day)	Allocated Load (MPN/day)	Required Reduction (%)
Livestock	22%	2.52E+14	0.00E+00	100%
Wildlife	55%	6.30E+14	1.13E+14	82%
Human	12%	1.37E+14	0.00E+00	100%
Pets	11%	1.26E+14	0.00E+00	100%
Total		1.15E+15	1.13E+14	90%

* Weighted average of samples taken between 2005 and 2006

Table 4-16: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Upper Tidal York River watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	22%	1.05E+15	0.00E+00	100%
Wildlife	55%	2.63E+15	2.41E+14	91%
Human	12%	5.75E+14	0.00E+00	100%
Pets	11%	5.27E+14	0.00E+00	100%
Total		4.79E+15	2.42E+14	95%

* Weighted average of samples taken between 2005 and 2006

Table 4-17: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Lower Pamunkey Watershed for Nonpoint Sources

Source	Distribution of Allocation by Source* (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	75%	2.36E+15	0.00E+00	100%
Wildlife	8%	2.34E+14	1.63E+14	30%
Human	11%	3.54E+14	0.00E+00	100%
Pets	6%	1.94E+14	0.00E+00	100%
Total		3.14E+15	1.63E+14	95%

* Based on Fecal Tool analysis of bacteria loads

Table 4-18: Distribution of Enterococci Under Existing Conditions, TMDL Allocation, and Reduction in the Mattaponi River Watershed for Nonpoint Sources

Source	BST * Allocation (% of total load)	Current Load (count/day)	Allocated Load (count/day)	Required Reduction (%)
Livestock	78%	1.03E+15	2.58E+13	98%
Wildlife	5%	6.62E+13	6.62E+13	0%
Human	11%	1.47E+14	0.00E+00	100%
Pets	6%	8.36E+13	2.09E+12	98%
Total		1.33E+15	9.41E+13	93%

* Based on Fecal Tool analysis of bacteria loads

Table 4-19: The Upper York River TMDL Allocation Plan for Fecal Coliform Loads (MPN/day)

WLA (Point Sources)	LA (Nonpoint sources)	MOS (Margin of safety)	TMDL
1.14E+12	**1.13E+14**	**IMPLICIT**	**1.14E+14**

Table 4-20: The Upper York River TMDL Allocation Plan for Enterococci Loads (count/day)

WLA (Point Sources)	LA (Nonpoint sources)	MOS (Margin of safety)	TMDL
2.76E+10	**2.42E+14**	**IMPLICIT**	**2.42E+14**

Table 4-21: The Lower Pamunkey River TMDL Allocation Plan for Enterococci Loads (count/day)			
WLA (Point Sources)	LA (Nonpoint sources)	MOS (Margin of safety)	TMDL
1.34E+10	1.63E+14	IMPLICIT	1.63E+14

Table 4-22: The Mattaponi River TMDL Allocation Plan for Enterococci Loads (count/day)			
WLA (Point Sources)	LA (Nonpoint sources)	MOS (Margin of safety)	TMDL
1.42E+10	9.41E+13	IMPLICIT	9.41E+13

4.5 Consideration of Seasonal Variability

The Clean Water Act requires that a TMDL be established with consideration of seasonable variations. This includes variations of the hydrologic flow regime and the water quality. The seasonable variation was accounted for by the incorporation of monthly sampling and long-term data record in estimating existing conditions.

4.6 Consideration of Critical Conditions

The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. The Upper York bacteria TMDL reduction was developed using the maximum measured bacteria concentration within the impaired waterbody and stringent bacteria criteria (90^{th} percentile for shellfish impaired waterbodies and the single sample maxium for recreational impaired waterbodies). These two elements; the use of the maximum measured bacteria concentration along with stringent bacteria criteria insure that the critical conditions are accounted for the Upper York Bacteria TMDL.

5.0 TMDL Implementation

The goal of the TMDL program is to establish a three-step path that will lead to attainment of water quality standards. The first step in the process is to develop TMDLs that will result in meeting water quality standards. This report represents the culmination of that effort for the bacteria impairments in the watershed. The second step is to develop a TMDL implementation plan. The final step is to implement the TMDL implementation plan, and to monitor water quality to determine if water quality standards are being attained.

Once a TMDL has been approved by EPA, measures must be taken to reduce pollution levels in the waterbody. These measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), are implemented in an iterative process that is described along with specific BMPs in the implementation plan. The process for developing an implementation plan has been described in the recent "TMDL Implementation Plan Guidance Manual", published in July 2003 and available upon request from the DEQ and DCR TMDL project staff or at http://www.deq.state.va.us/tmdl/implans/ipguide.pdf. With successful completion of implementation plans, Virginia will be well on the way to restoring impaired waters and enhancing the value of this important resource. Additionally, development of an approved implementation plan will improve a locality's chances for obtaining financial and technical assistance during implementation.

5.1 Staged Implementation

In general, Virginia intends for the required reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality. For example, in agricultural areas of the watershed, the most promising management practice is livestock exclusion from waterbodies. This has been shown to be very effective in lowering fecal coliform concentrations in waterbodies, both by reducing the cattle deposits themselves and by providing additional riparian buffers.

Additionally, in both urban and rural areas, reducing the human fecal loading from failing septic systems should be a primary implementation focus because of its health implications. This component could be implemented through education on septic tank pump-outs, as well as a septic system repair/replacement program and the use of alternative waste treatment systems. Per the Chesapeake Bay act, 5 year pump outs of septic tanks are mandatory and regulated by the counties. In sewered areas, reducing the loading from leaking sewer lines could be accomplished through a sanitary sewer inspection and management program.

To reduce fecal loading from pets, pet education on managing pet waste may be effective. Pet poop-scooping education, placement of dog waste baggie stations in popular dog walking locations, pet waste composters for homeowners (depending on their proximity to the water table), and septic systems for large kennels or hunt clubs could be beneficial.

Education could be made available to homeowners, farmers, and businesses concerning the importance of maintaining the Chesapeake Bay Act's requirement of observing a 100 foot riparian buffer along all creeks and tributaries of the Bay. Protecting existing buffers in addition to restoring buffers which have been destroyed are relatively inexpensive but exceptionally effective methods of reducing runoff which carry with it bacteria, nutrients, and even chemicals to surface waters in both agricultural and urban settings. Riparian buffers serve as "strainers" which prevent the entry of such components to the waterway.

The iterative implementation of BMPs in the watershed has several benefits:

1. It enables tracking of water quality improvements following BMP implementation through follow-up monitoring;
2. It provides a measure of quality control, given the uncertainties inherent in computer simulation modeling;
3. It provides a mechanism for developing public support through periodic updates on BMP implementation and water quality improvements;
4. It helps ensure that the most cost effective practices are implemented first; and

5. It allows for the evaluation of the adequacy of the TMDL in achieving water quality standards.

Watershed stakeholders will have opportunity to participate in the development of the TMDL implementation plan. Specific goals for BMP implementation will be established as part of the implementation plan development.

5.2 Link to ongoing Restoration Efforts

Implementation of this TMDL will contribute to on-going water quality improvement efforts aimed at restoring water quality.

The measures discussed in the previous section support ongoing efforts to improve water quality, such as the placement of educational signage along the walking trail at the Mattaponi Bridge in West Point that addresses both pet waste and buffer protection (York River and Small Coastal Basin Roundtable), and the educational and stewardship activities initiated by the Mattaponi and Pamunkey Rivers Association.

5.3 Reasonable Assurance for Implementation

5.3.1 Follow-Up Monitoring

VDH-DSS will continue sampling at the established bacteriological monitoring stations in accordance with its shellfish monitoring program. VADEQ will continue to use data from these monitoring stations and related ambient monitoring stations to evaluate improvements in the bacterial community and the effectiveness of TMDL implementation in attainment of the general water quality standard.

5.3.2 Regulatory Framework

While section 303(d) of the Clean Water Act and current EPA regulations do not require the development of TMDL implementation plans as part of the TMDL process, they do require reasonable assurance that the load and wasteload allocations can and will be implemented. Additionally, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (the "Act") directs the State Water Control Board to "develop and implement a plan to achieve fully supporting status for impaired waters" (Section 62.1-44.19:7). The Act also establishes that the implementation plan shall include the date of expected achievement of water quality objectives, measurable goals, corrective actions necessary and the associated costs, benefits and environmental impacts of addressing the impairments. EPA outlines the minimum elements of an approvable implementation plan in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process." The listed elements include implementation actions/management measures, timelines, legal or regulatory controls, time required to attain water quality standards, monitoring plans and milestones for attaining water quality standards.

Once developed, DEQ intends to incorporate the TMDL implementation plan into the appropriate Water Quality Management Plan (WQMP), in accordance with the Clean Water Act's Section 303(e). In response to a Memorandum of Understanding (MOU) between EPA and DEQ, DEQ also submitted a draft Continuous Planning Process to EPA in which DEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

5.3.3 Implementation Funding Sources

One potential source of funding for TMDL implementation is Section 319 of the Clean Water Act. Other funding sources for implementation include the U.S. Department of Agriculture's Conservation Reserve Enhancement and Environmental Quality Incentive Programs, the Virginia State Revolving Loan Program, the Virginia Agricultural Cost Share Program, and grants from the Virginia Water Quality Improvement Fund, National Fish & Wildlife Foundation, VA Environmental Endowment, and the Chesapeake Bay Restoration Fund. The TMDL Implementation Plan Guidance Manual contains additional information on funding sources, as well as government agencies that might support implementation efforts and suggestions for integrating TMDL implementation with other watershed planning efforts.

5.3.4 Addressing Wildlife Contributions

In some waters for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of bacteria (other than wildlife), the stream will not attain standards under all flow regimes at all times. **However, neither the Commonwealth of Virginia, nor EPA are proposing the elimination of wildlife to allow for the attainment of water quality standards.** This is obviously an impractical and wholly undesirable action. While managing over-populations of wildlife remains as an option to local stakeholders, the reduction of wildlife or changing a natural background condition is not the intended goal of a TMDL.

Based on the above, EPA and Virginia have developed a TMDL strategy to address the wildlife issue. The first step in this strategy is to develop a reduction goal. The pollutant reductions for the interim goal are applied only to controllable, anthropogenic sources identified in the TMDL, setting aside any control strategies for wildlife. During the first implementation phase, all controllable sources would be reduced to the maximum extent practicable using the staged approach outlined above. Following completion of the first phase, DEQ would re-assess water quality in the stream to determine if the water quality standard is attained. This effort will also evaluate if the technical assumptions were correct.

In some cases, the effort may never have to go to the second phase because the water quality standard exceedances attributed to wildlife may be very small and fall within the margin of error. If water quality standards are not being met after best management practice implementation, a special study called a Use Attainability Analysis (UAA) may be initiated to reflect the presence of naturally high bacteria levels due to uncontrollable sources. The outcomes of the UAA may lead to the determination that the designated use(s) of the waters may need to be changed to reflect the attainable use(s). To remove a designated use, the state must demonstrate 1) that the use is not an existing use, 2) that downstream uses are protected, and 3) that the source of bacterial contamination is natural and uncontrollable by effluent limitations and by implementing cost-effective and reasonable best management practices for Nonpoint source control (9 VAC 25-260-10).

All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process. Additional information can be obtained at http://www.deq.state.va.us/wqs/WQS03AUG.pdf.

6.0 Public Participation

The development of the Upper York River, Lower Pamunkey River, and Lower Mattaponi River TMDLs would not have been possible without public participation, which included two sets of public meetings held within the watershed. A public notice was published in a local paper for each set of public meetings and email invitations publicized the public meeting. The public meetings were also posted in the Virginia Register and on posters displayed on public streets throughout the watershed. Stakeholders attended the public meetings. The following is a summary of the meetings.

Public Meeting #1. This meeting was held on January 20, 2010 at the West Point Library at 712 Main Street West Point, VA 23181. A total of 24 people attended the first set of public meetings. Copies of the presentation were available for public distribution.

Public Meeting #2. This meeting was held on March 2, 2010 at the West Point Downtown Business Center 621 Main Street, West Point VA 23181. A total of 20 people attended the second set of public meetings. Copies of the presentation were available for public distribution.

7.0 References

American Veterinary Medical Association Website (2005). Available at http://www.avma.org/membshp/marketstats/formulas.asp

Brann, Craig (2009). *Mill Creek TMDL in Northumberland County.* National Association of Conservation Districts. October 19, 2009.

EPA (1999). *Review of Potentila Modeling Tools and Approaches to Support the BEACH Program.* United States of Environmental Protection Agency, Office of Science and Technology, 823-R-99-002.

EPA, U.S. Environmental Protection Agency (2001). *Overview of Current Total Maximum Daily Load (TMDL) Program and Regulation*. Available at <http://www.epa.gov/owow/tmdl/overviewfs.html>.

Guo, Q. and G. P. Lordi (2000). *Method for Quantifying Freshwater Input and Flushing Time in Estuaries.* Journal of Environmental Engineering, 126, 7, 675-683.

Kaya, D., et al. (2005). *Decay of intestinal enterococci concentrations in high-energy estuarine and coastal waters: towards real-time T90 values for modelling faecal indicators in recreational waters. Water Research*, Vol 39, Issue 4, February 2005, Pages 655-667

Kuo, A., Butt, A. J., Kim, S. C., and J. Lin (1998*). Application of a tidal prism water quality model to Virginia small coastal basins : Poquoson River, Piankatank River, Cherrystone Inlet, and Hungars Creek.* Special report in Applied Marine Science and Ocean engineering; no. 348

Lucas, Bill (2009). *Virginia Department of Environmental Quality 1st Public Comment Period for the Rappahannock River Main-stem at Tappahannock, Little Carter Creek, Jugs Creek, Piscataway Creek, Mark Haven Beach and Garrett's Marina Shellfish TMDL Development*. October 29, 2009.

NOAA (2006). *Tides and Current*. National Oceanic and Atmospheric Administration. Available at: http://tidesandcurrents.noaa.gov/tides06/

Thomann, Robert V. and John A. Mueller (1987). *Principles of Surface Water Quality Modeling and Control.* Harper Collins Publisher Inc.

US Census Bureau (2000). *Census 2000 population, demographic and housing information.* Available at http://quickfacts.census.gov/qfd/states/51000lk.html

USDA (2007). *2007 Census of Agriculture Report*. Available at http://www.agcensus.usda.gov/Publications/2007/Full_Report/index.asp

USDA National Resources Conservation Service (2008, 2009). *Soil Data Mart*. Available at <http://soildatamart.nrcs.usda.gov/Default.aspx>

USGS (2006). *National Elevation Dataset*. Available at <http://ned.usgs.gov/>

VA DEQ (2001). *Total Maximum Daily Load Program, A Ten Year Implementation Plan-Report to the Governor, House Committees, and Senate Committees, November 1, 2000.* Available at <http://www.deq.state.va.us/tmdl/reports/hb30.pdf>

VA DEQ (2005). *Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination. Rappahannock River: Mud and Parrots Creeks.* Final Report. Virginia Department of Environmental Quality.

VA DEQ (2006). *Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacterial Contamination. Poquoson River and Back River*. Final Report. Virginia Department of Environmental Quality.

VA DEQ (2008). *State Water Control Board. Virginia Water Quality Standards.* Final Report. Virginia Department of Environmental Quality.

VDH (2004, 2006). *Shoreline Surveys.* Available at http://www.vdh.virginia.gov/EnvironmentalHealth/Shellfish/closureSurvey/index.htm

8.0 Glossary

303(d). A section of the Clean Water Act of 1972 requiring states to identify and list water bodies that do not meet the states' water quality standards.

Allocations. That portion of receiving water's loading capacity attributed to one of its existing or future pollution sources (nonpoint or point) or to natural background sources. (A wasteload allocation [WLA] is that portion of the loading capacity allocated to an existing or future point source, and a load allocation [LA] is that portion allocated to an existing or future nonpoint source or to natural background levels. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)

Ambient water quality. Natural concentration of water quality constituents prior to mixing of either point or nonpoint source load of contaminants. Reference ambient concentration is used to indicate the concentration of a chemical that will not cause adverse impact on human health.

Anthropogenic. Pertains to the [environmental] influence of human activities.

Bacteria. Single-celled microorganisms. Bacteria of the coliform group are considered the primary indicators of fecal contamination and are often used to assess water quality.

Bacterial source tracking (BST). A collection of scientific methods used to track sources of fecal contamination.

Biosolids. Also known as Sewage sludge, is the name for the solid, semisolid, or liquid materials removed during the treatment of domestic sewage in a treatment facility. Biosolids include, but are not limited to, solids removed during primary, secondary, or advanced wastewater treatment, scum, domestic septage, portable toilet pumpings, Type III marine sanitation device pumpings, and sewage sludge products. When properly treated and processed, sewage sludge becomes "biosolids" which can be safely recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth.

Best management practices (BMPs). Methods, measures, or practices determined to be reasonable and cost-effective means for a landowner to meet certain, generally nonpoint source, pollution control needs. BMPs include structural and nonstructural controls and operation and maintenance procedures.

Clean Water Act (CWA). The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The Clean Water Act (CWA) contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is section 303(d), which establishes the TMDL program.

Concentration. Amount of a substance or material in a given unit volume of solution; usually measured in milligrams per liter (mg/L) or parts per million (ppm).

Contamination. The act of polluting or making impure; any indication of chemical, sediment, or biological impurities.

Cost-share program. A program that allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The remainder of the costs is paid by the producer(s).

Critical condition. The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. 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.

Designated uses. Those uses specified in water quality standards for each waterbody or segment whether or not they are being attained.

Domestic wastewater. Also called sanitary wastewater, consists of wastewater discharged from residences and from commercial, institutional, and similar facilities.

Drainage basin. A part of a land area enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into a receiving water. Also referred to as a watershed, river basin, or hydrologic unit.

Existing use. Use actually attained in the waterbody on or after November 28, 1975, whether or not it is included in the water quality standards (40 CFR 131.3).

Fecal Coliform. Indicator organisms (organisms indicating presence of pathogens) associated with the digestive tract.

Geometric mean. A measure of the central tendency of a data set that minimizes the effects of extreme values.

GIS. Geographic Information System. A system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. (Dueker and Kjerne, 1989)

Infiltration capacity. The capacity of a soil to allow water to infiltrate into or through it during a storm.

Interflow. Runoff that travels just below the surface of the soil.

Loading, Load, Loading rate. The total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in weight per unit time.

Load allocation (LA). The portion of a receiving waters loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can 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 (40 CFR 130.2(g)).

Loading capacity (LC). The greatest amount of loading a water body can receive without violating water quality standards.

Margin of safety (MOS). A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (CWA section 303(d)(1)©). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).

Mean. The sum of the values in a data set divided by the number of values in the data set.

Monitoring. Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

Narrative criteria. Non-quantitative guidelines that describe the desired water quality goals.

Nonpoint source. Pollution that originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff.

Numeric targets. A measurable value determined for the pollutant of concern, which, if achieved, is expected to result in the attainment of water quality standards in the listed waterbody.

Point source. Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving water waterbody or river.

Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. (CWA section 502(6)).

Pollution. Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Poultry Litter. A material used as bedding in poultry operations. Common litter materials are woodshavings, sawdust, peanut hulls, shredded sugar cane, straw, and other dry, absorbent, low-cost organicmaterials. After use, the litter consists primarily of poultry manure, but also contains the original littermaterial, feathers, and spilled feed.

Privately owned treatment works. Any device or system that is (a) used to treat wastes from any facility whose operator is not the operator of the treatment works and (b) not a publicly owned treatment works.

Public comment period. The time allowed for the public to express its views and concerns regarding action by EPA or states (e.g., a Federal Register notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly owned treatment works (POTW). Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.
Raw sewage. Untreated municipal sewage.

Receiving waters. Creeks, streams, rivers, lakes, estuaries, ground-water formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged, either naturally or in man-made systems.

Riparian areas. Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones.

Riparian zone. The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Runoff. That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

Septic system. An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Sewer. A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.

Slope. The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25 or 1 on 25, indicating one unit vertical rise in 25 units of horizontal distance, or in a decimal fraction (0.04), degrees (2 degrees 18 minutes), or percent (4 percent).

Stakeholder. Any person with a vested interest in the TMDL development.

Surface area. The area of the surface of a waterbody; best measured by planimetry or the use of a geographic information system.

Surface runoff. Precipitation, snowmelt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants.

Surface water. All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

Topography. The physical features of a geographic surface area including relative elevations and the positions of natural and man-made features.

Total Maximum Daily Load (TMDL). The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural background, plus a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

VADEQ. Virginia Department of Environmental Quality.

VDH. Virginia Department of Health.

Virginia Pollutant Discharge Elimination System (NPDES). The national program for issuing, modifying, revoking and re-issuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Clean Water Act.

Wasteload allocation (WLA). The portion of a receiving waters' loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).

Wastewater. Usually refers to effluent from a sewage treatment plant. See also **Domestic wastewater**.

Wastewater treatment. Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralize contaminants.

Water quality. The biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.

Water quality criteria. Levels of water quality expected to render a body of water suitable for its designated use, composed of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or states for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water quality standard. Law or regulation that consists of the beneficial designated use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.

Watershed. A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

WQIA. Water Quality Improvement Act.

APPENDIX A:

Shoreline Sanitation Survey

COMMONWEALTH of VIRGINIA
Department of Health
DIVISION OF SHELLFISH SANITATION
109 Govenor Street, Room 614-B
Richmond, VA 23219

Ph: 804-864-7487
Fax: 804-864-7481

YORK RIVER: WEST POINT VICINITY
King and Queen, King William, and New Kent Counties
Shoreline Sanitary Survey

Date: May 25, 2005
Survey Period: February 17, 2005 – April 27, 2005
Total Number of Properties Surveyed: 695
Surveyed By: S. E. Naylor

SECTION A: GENERAL

This survey area extends from Reference Point 49 at Belleview on the York River to the mouth of Burnt Mill Creek on the Mattaponi River, across the Mattaponi River to a point opposite the mouth of Burnt Mill Creek, across King William County to the mouth of Herrick Creek on the Pamunkey River, across the Pamunkey River to a point opposite the mouth of Herrick Creek and south to Reference Point 50 at Terrapin Point on the York River; including the shoreline of the York River, Mattaponi River and the Pamunkey River between these two reference points, Hockley Creek, Bakers Creek, Robinson Creek, Goalders Creek, West Point Creek, Herrick Creek (Olssons Pond), Eltham Marsh, Thorofare, Mill Creek, Ferry Creek, Baker Creek, Philbates Creek and all of their tributaries. The survey boundary has been revised. See map for current survey boundary.

The topography of the area varies in elevation from 5′ around the shoreline to a maximum of 50′ at the outer edge of the survey boundary. The population varies from sparse in the countryside with moderate concentrations along U.S. Route 33 in King and Queen County and the communities of Eltham, Plum Point, and Barhamsville in New Kent County to somewhat heavy in and around the Town of West Point. The economy is dependent primarily upon industry, commerce and agriculture. The largest employer in the area is the Smurfit-Stone pulp and paper mill.

Meteorological data indicated that 9.51" of rain fell during the survey period. A monthly breakdown follows:

February 17-28	0.98"
March	4.89"
April 1-27	3.64"

The current restrictions on shellfish harvesting is Condemned Shellfish Area #4, Upper York River, revised 5 November 2004. A copy of the current condemnation notice and map is attached to the back of this report. This report lists only those properties which have a sanitary deficiency or have other environmental significance. ***"DIRECT"*** indicates that the significant activity or deficiency has a direct impact on shellfish waters. Individual field

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forms with full information on properties listed in this report are on file in the Richmond Office of the Division of Shellfish Sanitation and are available for reference until superseded by a subsequent resurvey of the area. Data in the report is also made available to local health departments and other agencies to address items that may be out of compliance with their regulatory programs.

SECTION B: SEWAGE POLLUTION SOURCES

SEWAGE TREATMENT FACITILITES

19. ***DIRECT*** – Town of West Point, Trenton Funkhouser, Town Manager, P.O. Box 152, West Point 23181. Municipal sewage treatment plant. VPDES Permit #VA0075434. Design flow 0.6 MGD. Treatment facility consists of pretreatment, an off-line flow equalization basin, two primary clarifiers, two trickling filters, two secondary clarifiers, and one chlorine contact tank. The wasted sludge is stabilized by two aerobic digesters and dewatered on six sand drying beds. Final effluent discharges into the Mattaponi River. The most recent Department of Environmental Quality inspection report is attached.

ON-SITE SEWAGE DEFICIENCES

3. CONTRIBUTES POLLUTION – 958 York River Road, Shacklsford 23156. Dwelling- white asbestos siding 2 story with red shutters. 3 persons. Cracked lid on septic tank, effluent erupting onto groundsurface. Sanitary Notice issued 2-18-05 to field #43.

4. CONTRIBUTES POLLUTION – 470 York River Road, Shacklsford 23156. Dwelling- blue asbestos siding 2 story with white trim. 2 persons. Make-shift wooden lid covering tank, effluent erupting onto groundsurface. Sanitary Notice issued 2-18-05 to field #50.

7. CONTRIBUTES POLLUTION – 6473 Lewis B. Puller Memorial Highway, Mattaponi 23110. Dwelling- white vinyl siding 1 story with detached garage. 2 persons. Effluent erupting from septic tank onto groundsurface 30' from drainage ditch at 1' elevation. Sanitary Notice issued 3-2-05 to field #108.

8. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 167 Simpson Creek Road, Mattaponi 23110. Dwelling- gray vinyl siding 1 story with black shutters. 2 persons. Laundry wastes erupting from septic tank onto ground surface. Sanitary Notice issued 3-3-05 to field #146.

9. CONTRIBUTES POLLUTION – 6816 Lewis B. Puller Memorial Highway, Mattaponi 23110. Dwelling- whites asbestos siding 1 story with detached yellow vinyl siding garage. 1 person. Effluent erupting from septic tank and drainfield onto ground surface. Sanitary Notice issued 3-7-05 to field #175.

10. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 6792 Lewis B. Puller Memorial Highway, Mattaponi 23110. Dwelling- white aluminum siding 1 story. 3 persons. Laundry wastes discharge to groundsurface via underground pipe from house. Sanitary Notice issued 3-7-05 to field #177.

12. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 6478 Lewis B. Puller Memorial Highway, Mattaponi 23110. Dwelling- grey vinyl siding 2 story with red shutters. No contact. Unapproved, make-shift lid over grease trap. Sanitary Notice issued 3-7-05 to field #193.

14. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 144 Gregory Lane, Mattaponi 23110. Dwelling- brick ranch style 1 story with white shutters. 1 person. Laundry wastes erupting from grease trap to ground surface 50' from marsh at 6' elevation. Sanitary Notice issued 3-15-05 to field #251.

15. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 110 Virginia Avenue, Mattaponi 23110. Dwelling- white vinyl siding 2 story with red shutters. 2 persons. Laundry wastes erupting from drainfield onto ground surface. Sanitary Notice issued 3-15-05 to field #254.

20. CONTRIBUTES POLLUTION – 3210 ODI Street, West Point 23181. Dwelling- blue vinyl siding 1 story with white trim. No contact. Unapproved, make-shift lid over septic tank 15' from drainage ditch. Sanitary Notice issued 3-24-05 to field #284.

21. CONTRIBUTES POLLUTION – 430 East Magnolia Avenue, West Point 23181. Dwelling- brick ranch style 1 story. 3 persons. Effluent erupting from drainfield onto ground surface. Sanitary Notice issued 3-25-05 to field #287.

22. CONTRIBUTES POLLUTION – 540 East Magnolia Avenue, West Point 23181. Dwelling- brick ranch style 1 story with green shutters and yellow trim. 2 persons. Effluent erupting from drainfield onto ground surface 40' from ditch. Sanitary Notice issued 3-29-05 to field #297.

23. CONTRIBUTES POLLUTION – 3410 Bond Street, West Point 23181. Dwelling- yellow wood siding 1 story with blue trim. 1 person. Effluent erupting from end of drainfield onto ground surface 25' from ditch. Sanitary Notice issued 3-29-05 to field #302.

24. CONTRIBUTES POLLUTION – 4020 King William Avenue, West Point 23181. Dwelling- white asbestos siding 1 ½ story. No contact. Effluent erupting from septic tank onto ground surface approximately 500' from Olsson's Pond. Sanitary Notice issued 3-30-05 to field #317.

25. CONTRIBUTES POLLUTION – 34067 King William Avenue, West Point 23181. Dwelling- white asbestos siding 1 ½ story. No contact. Effluent erupting from drainfield onto ground surface approximately 200' from Olsson's Pond. Sanitary Notice issued 3-30-05 to field #320.

28. CONTRIBUTES POLLUTION – 19130 Eltham Road, West Point 23181. Dwelling- white vinyl siding 2 story with green shutters. No contact. Unapproved wooden, make-shift lid over septic tank. Sanitary Notice issued 3-31-05 to field #331.

30. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 19110 Eltham Road, West Point 23181. Dwelling- white aluminum siding 2 story with white awnings. 2 persons. Laundry wastes drain onto ground surface via 2" black hose from shed. Sanitary Notice issued 3-31-05 to field #333.

31. CONTRIBUTES POLLUTION – 19030 Eltham Road, West Point 23181. Dwelling- grey vinyl siding 2 story with red shutters. 2 persons. Effluent erupting from septic tank onto ground surface. Sanitary Notice issued 3-31-05 to field #336.

32. CONTRIBUTES POLLUTION – 19010 Eltham Road, West Point 23181. Dwellings- Three travel trailers. 8+ persons. Lid of septic tank removed, contents exposed. Sanitary Notice issued 3-31-05 to field #345.

33. CONTRIBUTES POLLUTION – 19010 Eltham Road, West Point 23181. Dwellings- Three travel trailers (Lot #s 26, 29, 27). 8+ persons. Effluent erupting from septic tank onto ground surface. Sanitary Notice issued 3-31-05 to field #350.

36. CONTRIBUTES POLLUTION – 18825 Eltham Road, West Point 23181. Dwelling- white asbestos siding 1 story with black shutters. No contact. Broken lid to septic tank, contents exposed. Sanitary Notice issued 4-7-05 to field #442.

39. CONTRIBUTES POLLUTION, ***DIRECT*** – 8111 Farmers Drive, West Point 23181. Dwelling- brick 1 ½ story with green shutters. No contact. Effluent erupting from drainfield onto ground surface into Mill Creek marsh. Sanitary Notice issued 4-7-05 to field #454.

40. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 8330 Mill Creek Road, West Point 23181. Dwelling- white vinyl siding 1 story with detached garage. No contact. Laundry wastes erupting from grease trap onto ground surface 25' from drainage ditch at 2' elevation. Sanitary Notice issued 4-12-05 to field #460.

41. CONTRIBUTES POLLUTION – 8315 Mill Creek Road, West Point 23181. Dwelling- brick ranch style 1 story with white shutters and detached garage. 2 persons. Effluent erupting from septic tank onto ground surface 40' from ditch at 3' elevation. Sanitary Notice issued 4-12-05 to field #476.

42. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 19141 Eltham Road, West Point 23181. Dwelling- white aluminum siding 2 story with green shutters. No contact. Laundry wastes discharge from house to ground surface via 4" white PVC pipe. Sanitary Notice issued 4-14-05 to field #488.

44. CONTRIBUTES POLLUTION – 7885 Maryland Avenue, West Point 23181. Dwelling- gray vinyl siding 1 story with blue shutters. 1 person. Broken cap to septic tank clean-out. Sanitary Notice issued 4-18-05 to field #560.

45. CONTRIBUTES POLLUTION (Kitchen or Laundry Wastes) – 19541 Mattaponi Road, West Point 23181. Dwelling- white vinyl siding 1 story with brown shutters. 4 persons. Laundry wastes draining onto ground surface via 2" clear plastic hose. Sanitary Notice issued 4-19-05 to field #574.

46. CONTRIBUTES POLLUTION – 839 Plum Point Road, West Point 23181. Dwelling- tan vinyl siding and stucco 1 story with red shutters. 2 persons. Lid to septic tank is broken and covered with a piece of sheet metal. Pipe from house to septic tank is broken, effluent erupting onto ground surface. Sanitary Notice issued 4-19-05 to field #576.

47. CONTRIBUTES POLLUTION – 7909 Vermont Avenue, West Point 23181. Dwelling- white vinyl siding 1 ½ story with blue shutters. 2 persons. Cracked lid to grease trap, contents exposed. Sanitary Notice issued 4-20-05 to field #592.

POTENTIAL POLLUTION

1. 1792 York River Road, Shackleford 23156. Dwelling- yellow vinyl siding 1 ½ story with brown shutters. 2 persons. Occupant stated that toilet has problems flushing, no evidence of discharge at time of survey.

2. 1768 York River Road, Shackleford 23156. Dwelling- white asbestos siding 1 ½ story with green shutters and carport. No contact. 2" buried black hose observed exiting from house. End of hose could not be located.

5. 227 Airport Road, Mattaponi 23110. Dwelling- white particle board siding 1 story with green shutters and shed. 1 person. Owner states that septic system has problems in extremely wet weather. No evidence of discharge at time of survey.

28. 19250 Eltham Road, West Point 23181. Business- 7-11 Store and Citgo gas station. 3 employees. Manager states tank must be pumped weekly to prevent drainfield from erupting on to ground surface. No evidence of discharge at time of survey.

34. 8117 Parks Road, West Point 23181. Dwelling- brick 1 story with white trim. 2 persons. Owner states septic system works slow during wet weather. No evidence of discharge at time of survey.

35. 8125 Parks Road, West Point 23181. Dwelling- white construction block 1 story with green shutters. 2 persons. Owner's state septic system works poorly in wet weather. No evidence of discharge at time of survey.

38. 8003 Farmers Drive, West Point 23181. Dwelling- white aluminum siding 1 story with brown shutters. 3 persons. Distribution box has been dug up; occupant states septic system was working poorly. No evidence of discharge at time of survey. Observed on-site were junked cars, lawnmowers, scrap metal, and a house trailer scattered about the property 10' from Mill Creek.

48. 19438 Mattaponi Road, West Point 23181. Dwelling- tan asbestos siding 1 story with light brown shutters. 1 person. Occupant states septic system is working poorly. No evidence of discharge at time of survey.

SECTION C: NON-SEWAGE WASTE SITES

INDUSTRIAL WASTES

6. ASB Greenworld, 496 Airport Road, Mattaponi 23110. Plant Manager: Ray Hogge, PO Box 207, Mattaponi 23110. Business: Manufacturing of potting soil and bark products. 10-25 employees. Located on property was one 500 gallon above ground diesel fuel tank. Bags of potting soil and mulch are stored on pallets outside of factory and all runoff is collected into a retention pond on property. Currently operating under permit #VAR051378 for stormwater and industrial wastes discharges from the Department of Environmental Quality.

11. Walter C. Via Enterprises, 6574 Lewis B. Puller Memorial Highway, Mattaponi 23110. Business: shopping center and general contracting office. 10 employees. Located on property was one 500 gallon above ground used oil tank without a physical berm.

16. ***DIRECT*** – Occupant: Massey Oil Company, 7th Street, West Point 23181. Owner: Massey family, PO Box 470, West Point 23181. Business: fuel oil and oil distributor. 8 employees. Located on property were seven 15,000 gallon above ground tanks of fuel oil, gasoline, and kerosene inside a concrete berm and one 500 gallon truck tank of varsol. Property is located approximately 5' from the Mattaponi River.

17. ***DIRECT*** – Occupant: Papco Oil Company, 270 Glass Island Road, West Point 23181. Owner: Papco Oil Company, PO Box 471, West Point 23181. Business: fuel oil distributor. 6-9 employees. Located on property were two 20,000 gallon gas and fuel oil tanks, one 40,000 gallon fuel oil tank, three 15,000 gallon kerosene and gas tanks and thirteen 55 gallon oil drums. All tanks are located above ground inside an earthen berm approximately 15' from the marsh.

26. ***DIRECT*** – Smurfit-Stone Container Enterprises, Inc. d/b/a Smurfit-Stone Container Corporation, PO Box 100, West Point 23181. Business: wood pulp mill, paper mill and bleach plant. Approximately 615 employees. Process waste water treatment plant utilizing an activated sludge process. VPDES permit #VA0003115. Has no designed flow limitations. Treatment facility consists of 5 pump stations, flow equalization, 6 mechanical bar screens, 2 primary clarifiers, a 30" magnetic flow meter, nutrient addition, defoamer, a cooling tower, 3 UNOX aeration basins, 3 secondary clarifiers, 2 sludge screws, 2 coil (vacuum) filters, 1 belt press for dewatering sludge. Sludge is burned in a wood waste boiler. Final effluent is piped into the Pamunkey River.

27. ***DIRECT*** – Smurfit-Stone Container Enterprises, Inc., PO Box 100, West Point 23181. Business: wood pulp mill, paper mill and bleach plant. Approximately 615 employees. Industrial waste lagoon. VPDES permit #VA0003115. The lined black liquor storage pond contains black liquor generated as a byproduct of the pulping process. The storage pond is a manufacturing process unit which recycles the black liquor to be used as a fuel and a feedstock in a chemical recovery furnace. There is no discharge to surface or groundsurface.

37. Britt's Septic Tank Service, 8001 Farmers Drive, West Point 23181. Business: Septic tank service. Tan concrete block 1 story office building. 3 employees. Located on property was one 500 gallon above ground diesel fuel tank without a berm approximately 100' from Mill Creek at 8' elevation.

SOLID WASTE DUMPSITES

37. Britt's Septic Tank Service, 8001 Farmers Drive, West Point 23181. Business: [illegible]

46. ***DIRECT*** – [illegible] Trucking, [illegible] Road, West Point 23181. Business: [illegible]

SECTION D: BOATING ACTIVITY

MARINAS

26. Smurfit-Stone Container Enterprises, Inc., P.O. Box 100, West Point 23181. Business: wood pulp mill, paper mill and bleach plant with docking facilities for receiving chips, caustic and fuel oil by barge. Approximately 615 employees. Present at time of survey were 2 tugboats and an emergency boat on lift. Boating services provided are fuel, water and electricity. There are containers available for solid waste collection and bilge water collection. Sanitary facilities provided are 2 commodes, 1 urinal, 2 lavatories, and 2 showers for men. Sewage disposal is by connection to the West Point STP. Britt's Septic Tank Service provides pump out as needed for holding tanks.

UNDER SURVEILLANCE

13. Burnt Mill Landing, end of Rt. 605, Mattaponi 23110. Owner: Virginia Department of Transportation, Richmond 23219. Public boat ramp. No contact. There were no boats present at time of survey. The only boating service provided is an in-out ramp and a trash receptacle. There are no sanitary facilities, boat holding tank pump-out facilities or dump station facilities provided at this location.

18. Glass Island Boat Landing, end of Rt. 1130, West Point 23181. Owner: Department of Game and Inland Fisheries, 4010 West Broad Street, Richmond 23230. Public boat ramp and fishing pier. No contact. 2 slips/moorings. There were no boats present at time of survey. The only boating services available are an in-out ramp and trash receptacles. Sanitary facilities provided is one unisex porta-john which is also used as a dump station for portable marine toilets. There are no boat holding tank pump-out facilities provided at this location.

SECTION E: CONTRIBUTES ANIMAL POLLUTION

49. 6601 Holly Fork Road, West Point 23181. Dwelling- white vinyl siding 2 story with red shutters and matching horse stable. 2 persons. Present at time of survey were 2 horses, 6 goats, and 5 chickens. All animals are in fenced areas greater than 500' from a tributary of the York River. Waste disposal is unknown.

SUMMARY

Area #049
York River: West Point Vicinity
May 25, 2005

SECTION B: SEWAGE POLLUTION SOURCES

1. SEWAGE TREATMENT FACILITIES

1 – DIRECT – #19
0 – INDIRECT – None
1 – B.1. TOTAL

2. ON-SITE SEWAGE DEFICIENCIES – Correction of deficiencies in this section is the responsibility of the local health department.

1 – CONTRIBUTES POLLUTION, DIRECT – #39
18 – CONTRIBUTES POLLUTION, INDIRECT – #3, 4, 7, 9, 20, 21, 22, 23, 24, 25, 29, 31, 32, 33, 36, 41, 44, 46
0 – CP (Kitchen or Laundry Wastes), DIRECT – None
10 – CP (Kitchen or Laundry Wastes), INDIRECT – #8, 10, 12, 14, 15, 30, 40, 42, 45, 47
0 – NO FACILITIES, DIRECT – None
0 – NO FACILITIES, INDIRECT – None
29 – B.2. TOTAL

3. POTENTIAL POLLUTION – Periodic surveillance of these properties will be maintained to determine any status change.

8 – POTENTIAL POLLUTION – #1, 2, 5, 28, 34, 35, 38, 48

SECTION C: NON-SEWAGE WASTE SITES

1. INDUSTRIAL WASTE SITES

[illegible] – DIRECT – #[illegible], 17, [illegible]
[illegible] – INDIRECT – #[illegible] 11, [illegible], [illegible]
[illegible] – C.1. TOTAL

2. SOLID WASTE DUMPSITES

[illegible] – DIRECT – #[illegible], [illegible]
0 – INDIRECT – None
[illegible] – C.2. TOTAL

SECTION D: BOATING ACTIVITY

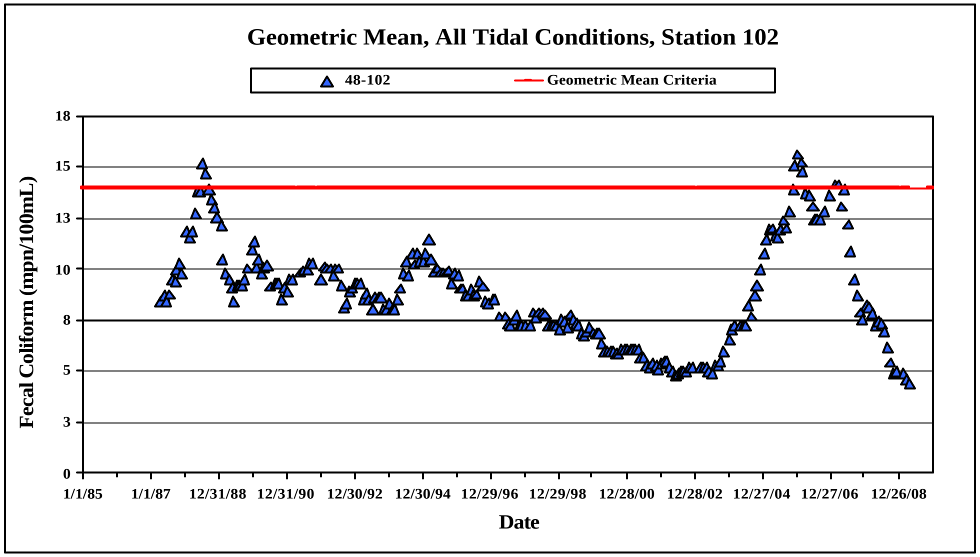
1 – MARINAS – #[illegible]
0 – OTHER PLACES WHERE BOATS ARE MOORED – None
[illegible] – UNDER SURVEILLANCE – #[illegible], 1[illegible]
[illegible] – D. TOTAL

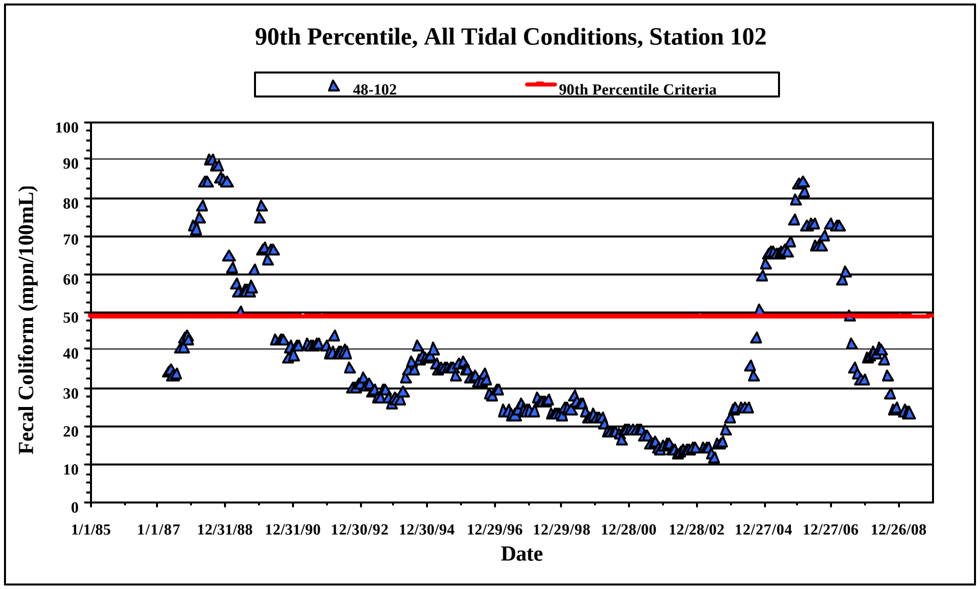
SECTION E: CONTRIBUTING ANIMAL POLLUTION

0 – DIRECT – None
1 – INDIRECT – #[illegible]
1 – E. TOTAL

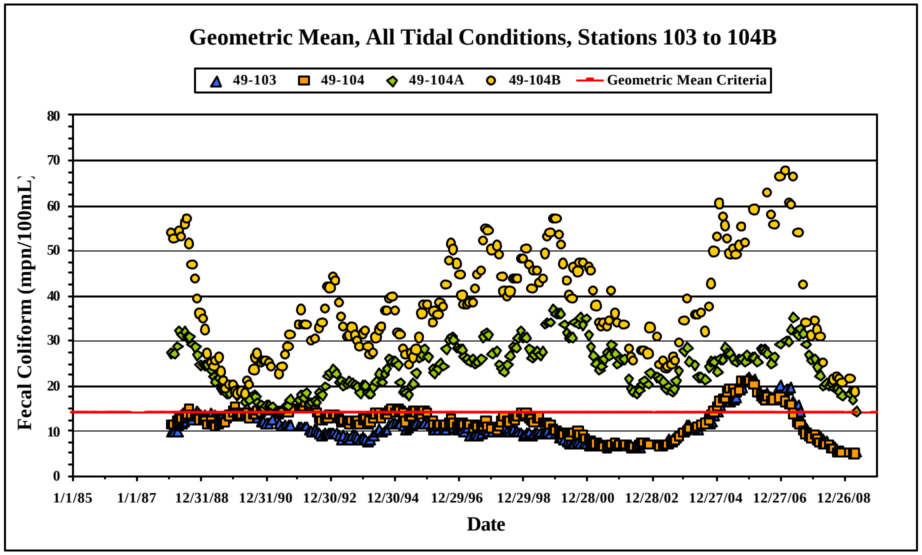
APPENDIX B:
Water Quality Graphs

VDH-DSS Area 48: Geometric Mean and 90th Percentile, All Tidal Conditions, Upper York River





VDH-DSS Area 49: Geometric Mean, All Tidal Conditions, Upper York River


Geometric Mean, All Tidal Conditions, Stations 103 to 104B
49-103
49-104
49-104A
49-104B
Geometric Mean Criteria
Fecal Coliform (mpn/100mL)
0
10
20
30
40
50
60
70
80
1/1/85
1/1/87
12/31/88
12/31/90
12/30/92
12/30/94
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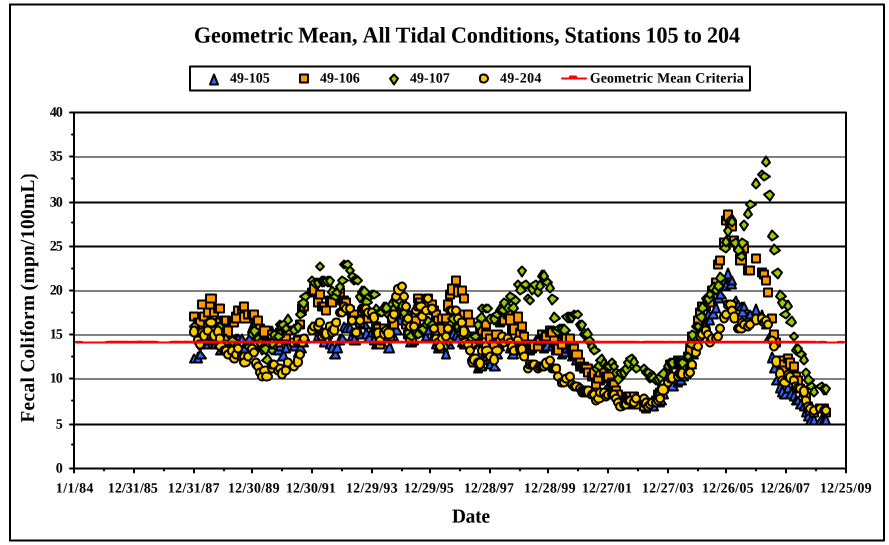
12/27/04
12/27/06
12/26/08
Date


Geometric Mean, All Tidal Conditions, Stations 105 to 204
49-105
49-106
49-107
49-204
Geometric Mean Criteria
Fecal Coliform (mpn/100mL)
0
5
10
15
20
25
30
35
40
1/1/84
12/31/85
12/31/87
12/30/89
12/30/91
12/29/93
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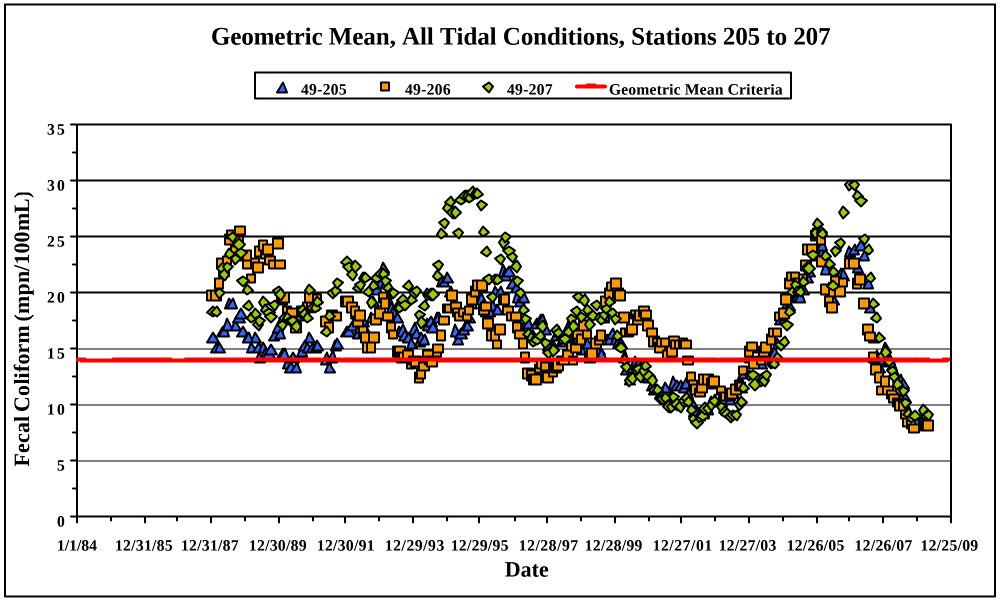
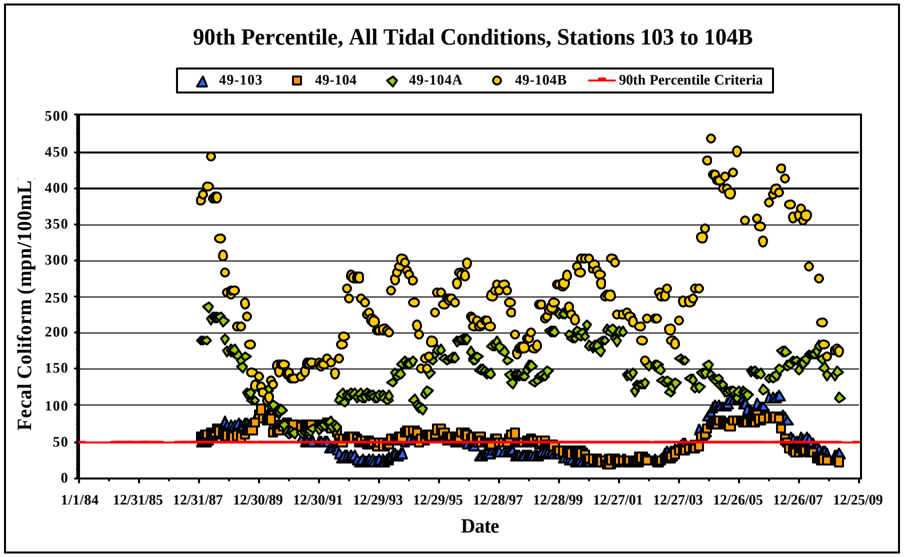
12/26/05
12/26/07
12/25/09
Date



VDH-DSS Area 49: 90th Percentile, All Tidal Conditions, Upper York River


90th Percentile, All Tidal Conditions, Stations 103 to 104B
49-103
49-104
49-104A
49-104B
90th Percentile Criteria
Fecal Coliform (mpn/100mL)
500
450
400
350
300
250
200
150
100
50
0
1/1/84
12/31/85
12/31/87
12/30/89
12/30/91
12/29/93
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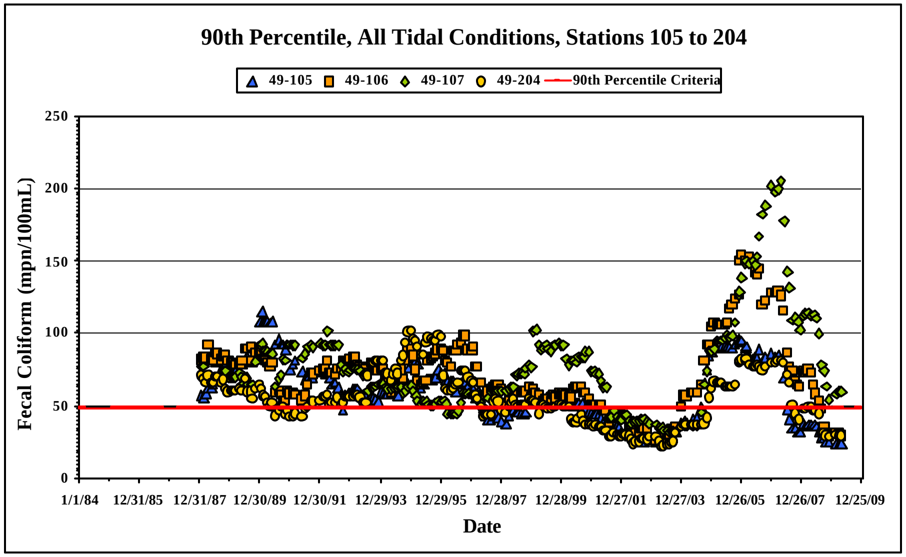
12/26/07
12/25/09
Date


90th Percentile, All Tidal Conditions, Stations 105 to 204
49-105
49-106
49-107
49-204
90th Percentile Criteria
Fecal Coliform (mpn/100mL)
250
200
150
100
50
0
1/1/84
12/31/85
12/31/87
12/30/89
12/30/91
12/29/93
12/29/95
12/28/97
12/28/99
12/27/01
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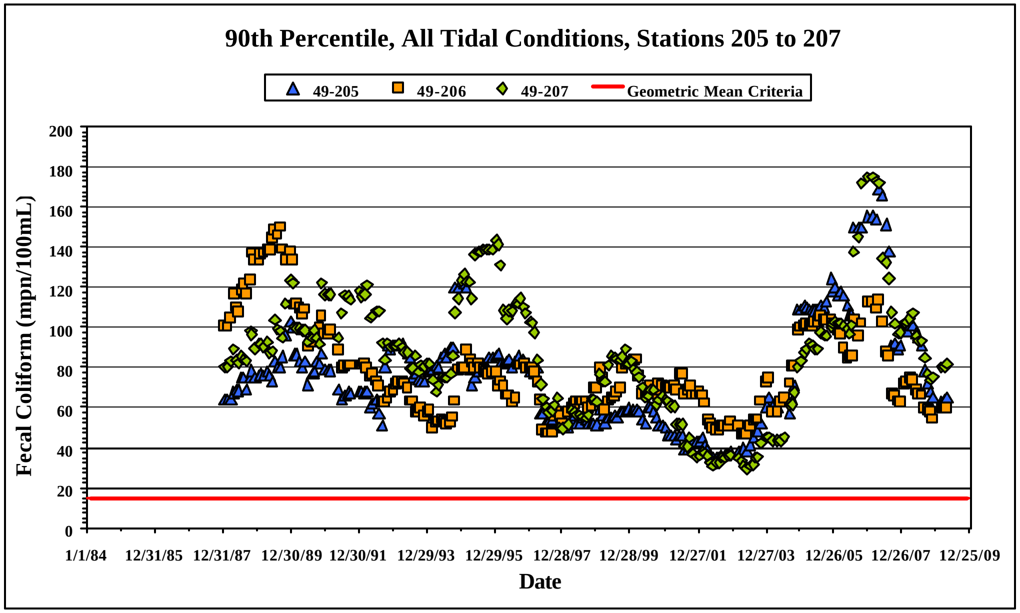
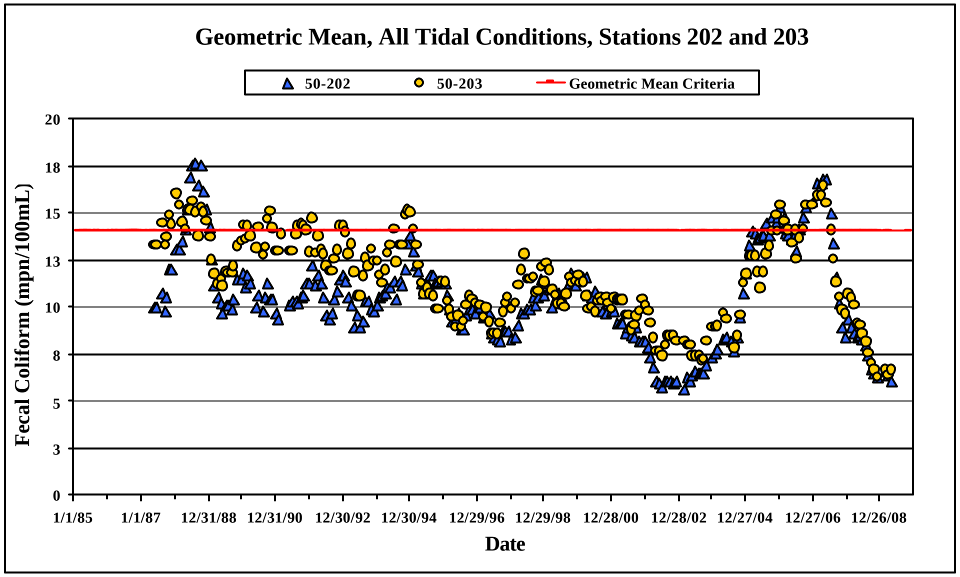
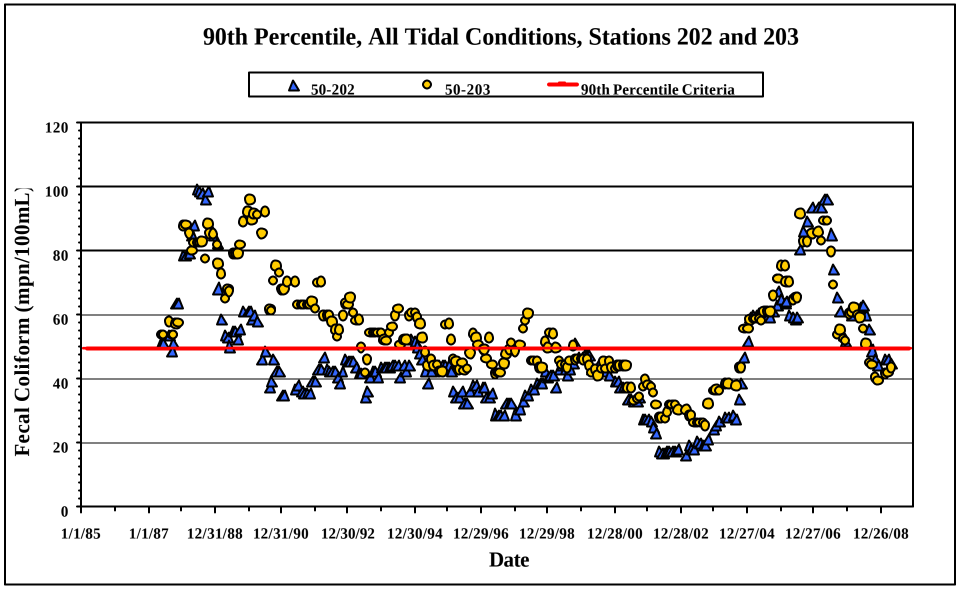
12/26/07
12/25/09
Date

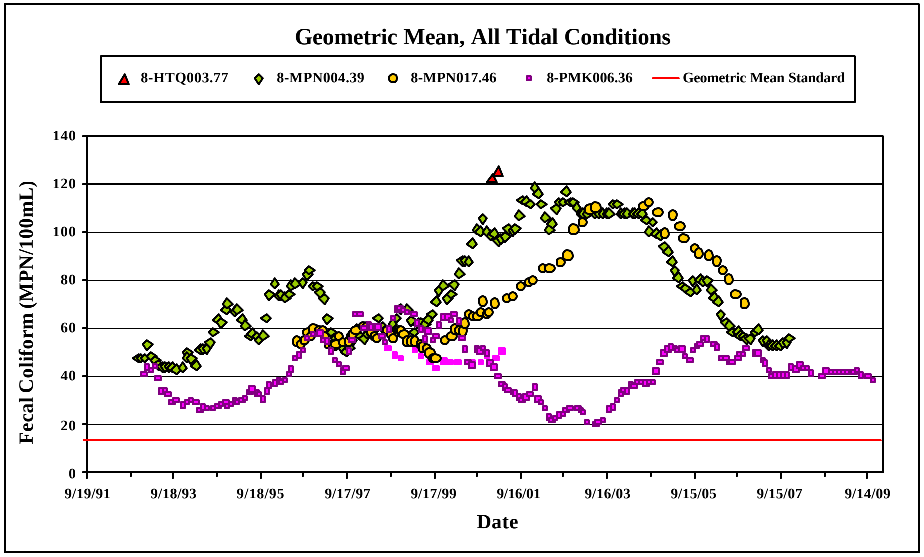


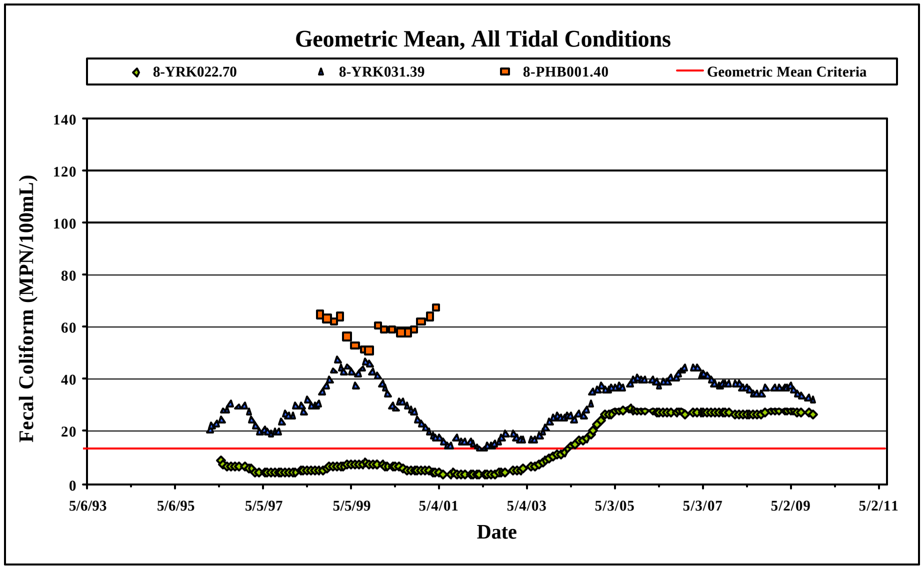
VDH-DSS Area 50: Geometric Mean and 90th Percentile, All Tidal Conditions, Upper York River


Geometric Mean, All Tidal Conditions, Stations 202 and 203
50-202
50-203
Geometric Mean Criteria
Fecal Coliform (mpn/100mL)
20
18
15
13
10
8
5
3
0
1/1/85
1/1/87
12/31/88
12/31/90
12/30/92
12/30/94
12/29/96
12/29/98
12/28/00
12/28/02
12/27/04
12/27/06
12/26/08
Date

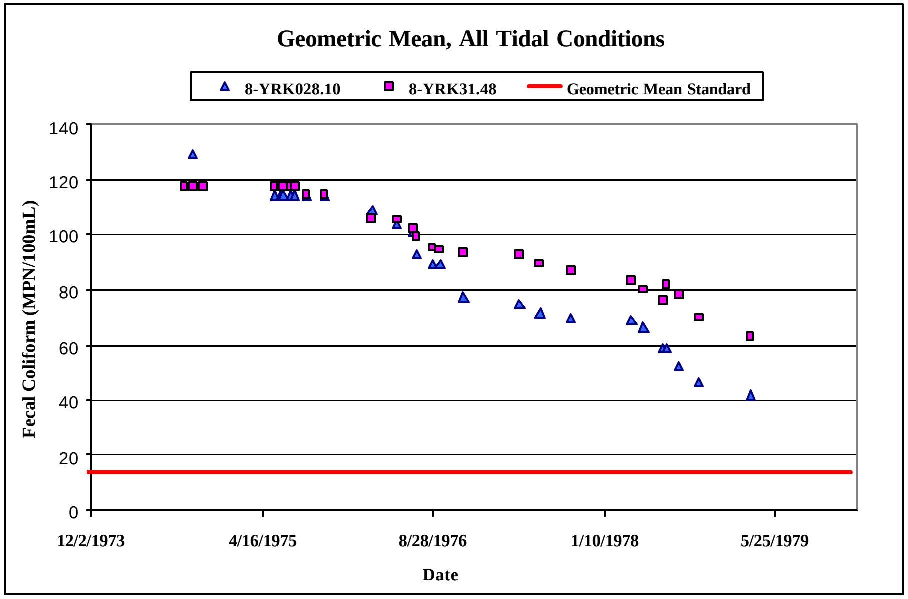

90th Percentile, All Tidal Conditions, Stations 202 and 203
50-202
50-203
90th Percentile Criteria
Fecal Coliform (mpn/100mL)
0
20
40
60
80
100
120
1/1/85
1/1/87
12/31/88
12/31/90
12/30/92
12/30/94
12/29/96
12/29/98
12/28/00
12/28/02
12/27/04
12/27/06
12/26/08
Date

VA DEQ Water Quality Data: Geometric Mean, All Tidal Conditions

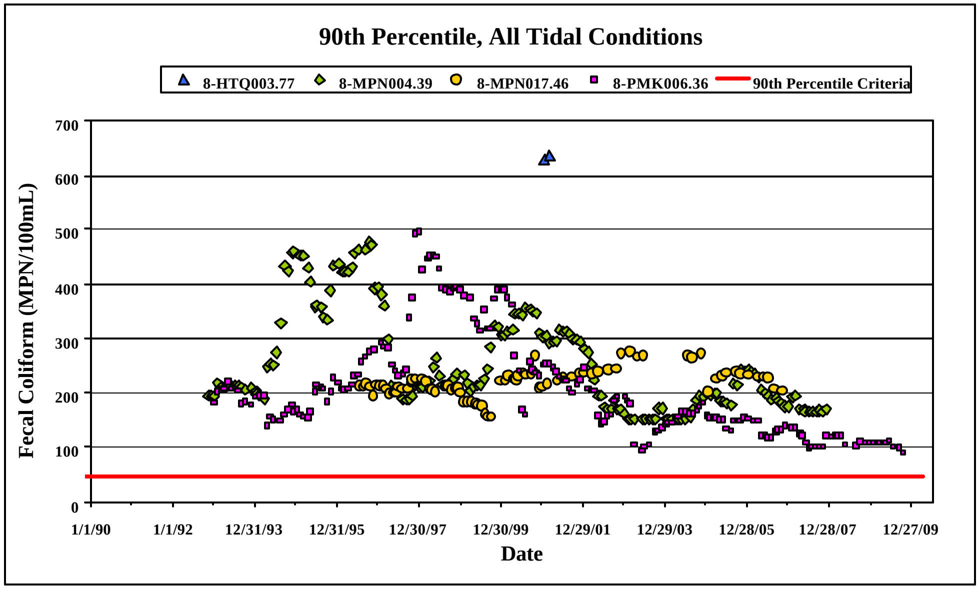


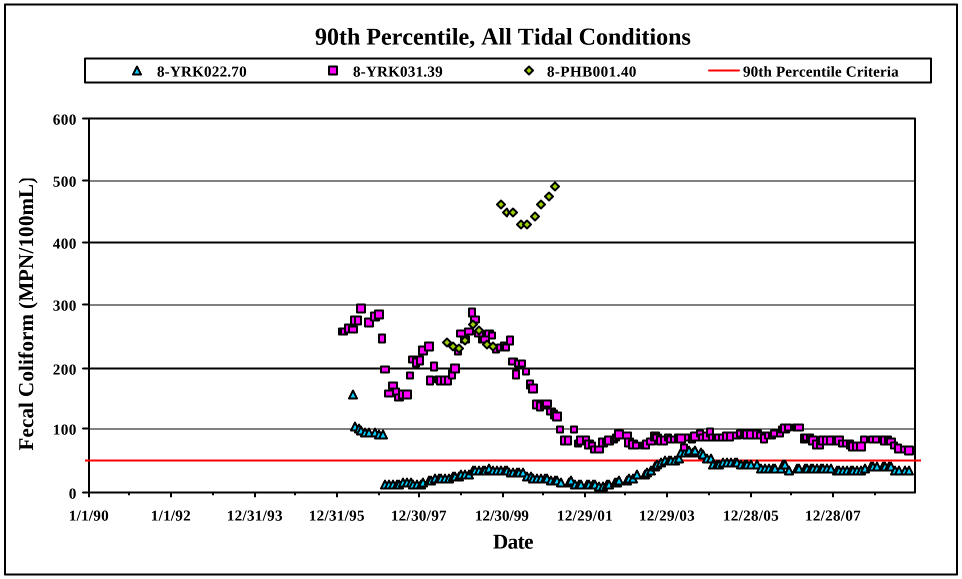


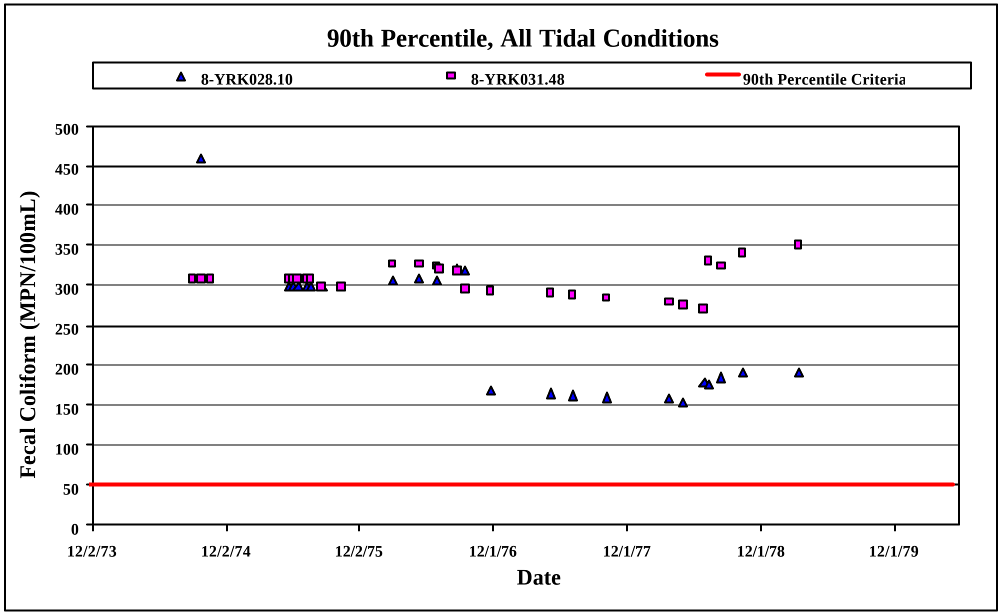
Geometric Mean, All Tidal Conditions
8-YRK022.70
8-YRK031.39
8-PHB001.40
Geometric Mean Criteria
Fecal Coliform (MPN/100mL)
140
120
100
80
60
40
20
0
5/6/93
5/6/95
5/5/97
5/5/99
5/4/01
5/4/03
5/3/05
5/3/07
5/2/09
5/2/11
Date


Geometric Mean, All Tidal Conditions
8-YRK028.10
8-YRK31.48
Geometric Mean Standard
Fecal Coliform (MPN/100mL)
140
120
100
80
60
40
20
0
12/2/1973
4/16/1975
8/28/1976
1/10/1978
5/25/1979
Date

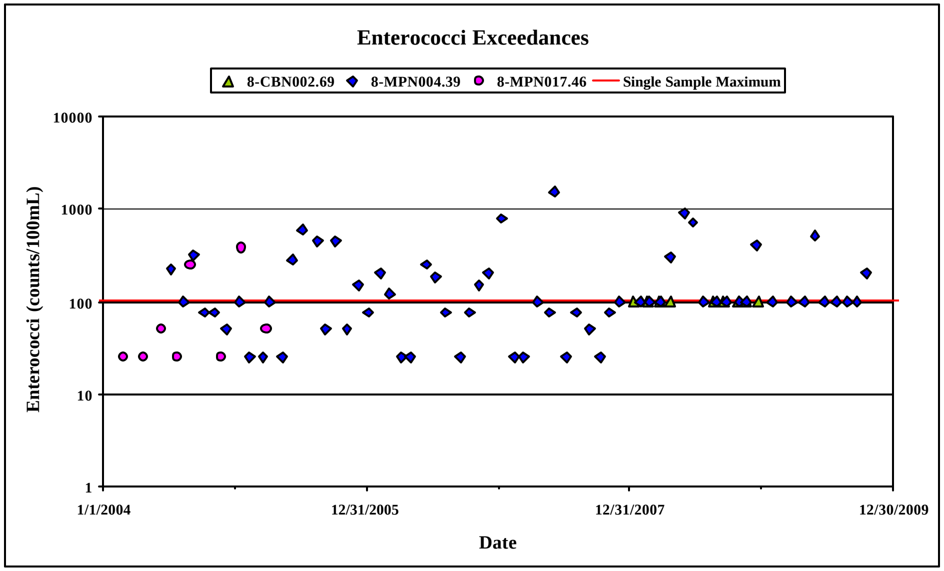
VA DEQ Water Quality Data: 90th Percentile, All Tidal Conditions

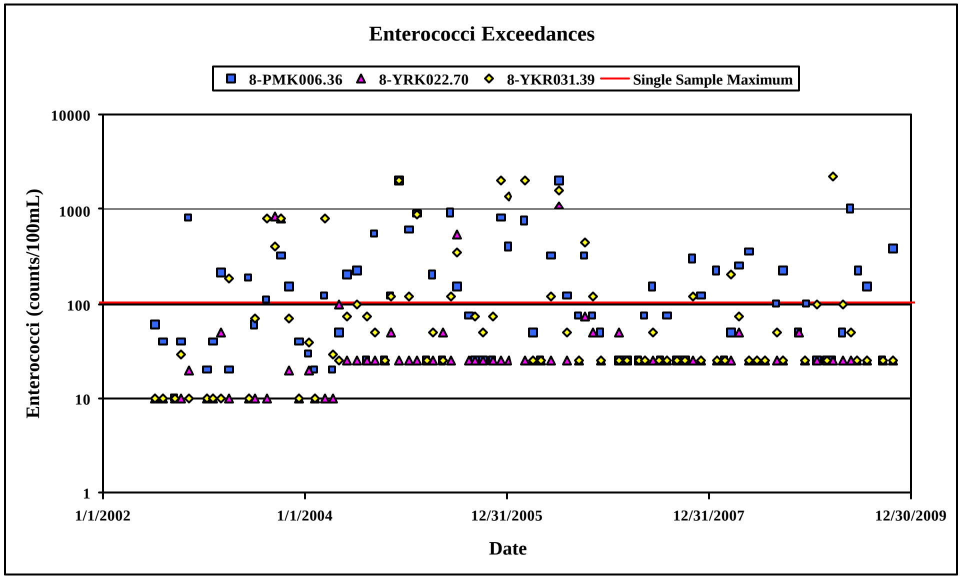



90th Percentile, All Tidal Conditions
8-YRK022.70
8-YRK031.39
8-PHB001.40
90th Percentile Criteria
Fecal Coliform (MPN/100mL)
600
500
400
300
200
100
0
1/1/90
1/1/92
12/31/93
12/31/95
12/30/97
12/30/99
12/29/01
12/29/03
12/28/05
12/28/07
Date


90th Percentile, All Tidal Conditions
8-YRK028.10
8-YRK031.48
90th Percentile Criteria
Fecal Coliform (MPN/100mL)
500
450
400
350
300
250
200
150
100
50
0
12/2/73
12/2/74
12/2/75
12/1/76
12/1/77
12/1/78
12/1/79
Date

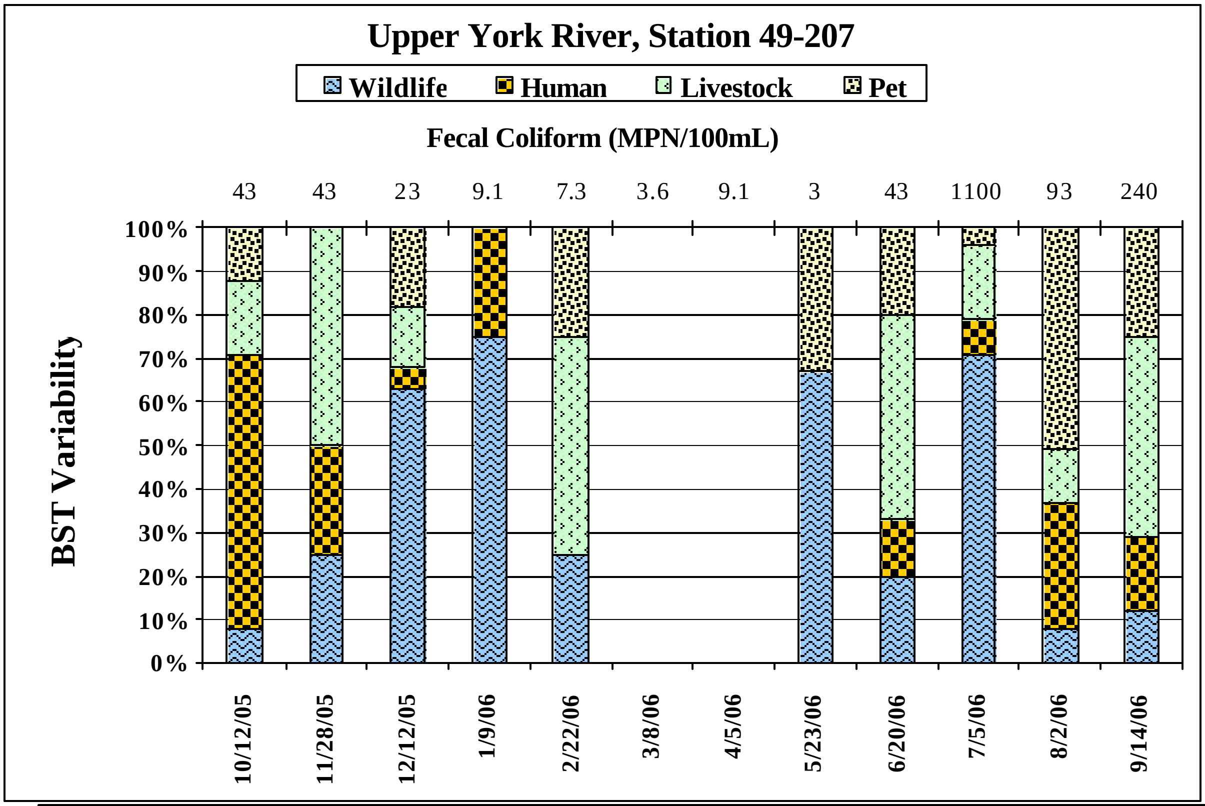
VA DEQ Water Quality Data: Enterococci Exceedances, All Tidal Conditions




Enterococci Exceedances
8-PMK006.36
8-YRK022.70
8-YKR031.39
Single Sample Maximum
10000
1000
100
10
1
Enterococci (counts/100mL)
1/1/2002
1/1/2004
12/31/2005
12/31/2007
12/30/2009
Date

APPENDIX C:

BST Variability
Fecal Coliform Production Rates Used in the TMDL



Numbers are based on data from VDH-DSS at Station 49-207

Fecal Coliform Production Rates for the Mattaponi and Pamunkey River Bacteria TMDLs

The distribution of enterococci loads in the Lower Pamunkey River watershed and the Mattaponi River watershed were determined using a spreadsheet based analysis tool or Fecal Tool, which is a modified version of EPA's Bacterial Indicator Tool. The Fecal Tool employs user supplied landuse acreage, animal population, septic systems and unit load data to estimate the fecal coliform loads from various sources in a watershed environment. The unit load data used in the Fecal Tool are based on published fecal coliform production rates. The Table below presents the fecal coliform production rates and their sources used for the Mattaponi and Pamunkty River Bacteria.

Fecal Coliform Production Rates that were used for the Mattaponi and Pamunky River Bacteria TMDLs		
Fecal Coliform Production Rates	**FC (#/animal/day)**	**Source**
Other Dairy Cow (heifer)	1.16E+10	VA Tech (2000)
Dairy cow	2.52E+10	VA Tech (2000)
Beef cow	3.30E+10	VA Tech (2000), VA Tech (2005)
Hog	1.08E+10	EPA Bacterial Indicator Tool (March 2002)
Sheep	2.70E+10	VA Tech (2000)
Horse	4.20E+08	VA Tech (2000)
Chicken	1.36E+08	EPA Bacterial Indicator Tool (March 2002), VA Tech (2005)
Turkey	9.30E+07	VA Tech (2000)
Duck	2.43E+09	EPA Bacterial Indicator Tool (March 2002), VA Tech (2000)
Goose	7.99E+08	VA Tech (2000)
Deer	3.47E+08	VA Tech (2000), VA Tech (2005)
Beaver	2.00E+05	VA Tech (2000), VA Tech (2005)
Raccoon	1.13E+08	VA Tech (2000)
Muskrat	2.50E+07	VA Tech (2000), VA Tech (2005)
Wild Turkey	9.30E+07	VA Tech (2000)
Mallard	2.43E+09	VA Tech (2000)
Wood Duck	2.43E+09	VA Tech (2000)
Human	1.95E+09	VA Tech (2000), VA Tech (2005)

Sources:
EPA Bacterial Indicator Tool (March 2002). Excel Spreadsheet Model to Estimate the Fecal Coliform Bacteria Contribution from Multiiple Sources;
Virginia Tech (Dec, 2000). Fecal Coliform TMDL for Sheep Creek, Elk Creek, Machine Creek, Little Otter River, and Lower Big Otter River in Bedford and Campbell Counties, Virginia, Submitted by Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Prepared by Virginia Tech, Department of Biological Systems Engineering;
VA Tech (2005). Total Maximum Daily Load Development for Mill Creek Bacteria (E. coli) Impairment, Submitted by: Virginia Department of Environmental Quality, Prepared by: Department of Biological Systems Engineering Virginia Tech.

APPENDIX D:

Comments

4_6_10_DEQ_sent_AnnJennings_final_yorkresponses
From: Smigo, Margaret (DEQ)
Sent: Tuesday, April 06, 2010 1:23 PM
To: 'afjennings11@cox.net'
Cc: 'Michaelis, Bjoern'; EL-Farhan, Raed
Subject: DEQ response to comments submitted for Bacteria TMDL Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds

Attachments: 4_6_10_DEQ_re_Ann_Jennings_finalyorkcomments.pdf

Good Afternoon Ms. Jennings,

Thank you for your comments on the draft Lower Pamunkey, Lower Mattaponi, and Upper York (Tidal) Bacteria TMDL report. DEQ has responded to your comments in the attached document. Your comments are underlined and DEQ's responses are in blue italics. If you have any questions regarding the responses, please don't hesitate to contact me directly.

Again, DEQ greatly appreciates your time and thanks you for your involvement in this report development. We look forward to working with you as well as other concerned citizens and stakeholders during the implementation planning stage.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now Margaret.Smigo@deq.virginia.gov

Visit our website at:
www.deq.virginia.gov

-----Original Message-----
From: afjennings11@cox.net [mailto:afjennings11@cox.net]
Sent: Thursday, April 01, 2010 7:14 PM
To: Smigo, Margaret (DEQ)
Cc: afjennings11@cox.net
Subject: Bacteria TMDL Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds

April 1, 2010

Margaret Smigo - TMDL Coordinator
VDEQ, Piedmont Regional Office
4949A Cox Road
Glen Allen, VA 23060

Re: Bacteria TMDL Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds

Dear Ms. Smigo:

Thank you for this opportunity to provide comment on the Bacteria TMDL

Page 1

Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds. My family and I reside in West Point, Virginia and frequently utilize these rivers for swimming, fishing, kayaking, and canoeing.

I request that the Department of Environmental Quality consider the following revisions to the TMDL:

1. The Waste Load Allocation (WLA) for Wastewater Treatment Plants (WWTP) should be lowered. The WLA should be based on the monthly average limit set for the WWTP discharge permits.
2. A WLA should also be assigned to VPDES stormwater permittees. This TMDL only assigns WLAs to WWTPs. An aggregate WLA must be assigned to development projects covered by the stormwater construction general permit.
3. The TMDL should clearly indicate the source of data used to estimate animal agriculture in the watersheds. Expertise in the local farming community should be consulted to verify the accuracy of the data, such as the local Soil and Water Conservation Districts, local Cooperative Extension, or local Farm Bureau offices.

Thank you again for this opportunity to provide comment.

Sincerely,

Ann F. Jennings
P.O. Box 257
Mattaponi, VA 23110
(804) 241-5951

RE: Ann Jennings comments
Lower Pamunkey, Lower Mattaponi,
and Upper York (Tidal)
Bacteria TMDL draft
4/6/10 VADEQ

April 1, 2010

Margaret Smigo – TMDL Coordinator
VDEQ, Piedmont Regional Office
4949A Cox Road
Glen Allen, VA 23060

Re: Bacteria TMDL Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds

Dear Ms. Smigo:

Thank you for this opportunity to provide comment on the Bacteria TMDL Development for the Lower Pamunkey, Lower Mattaponi, and Upper York River Watersheds. My family and I reside in West Point, Virginia and frequently utilize these rivers for swimming, fishing, kayaking, and canoeing.

I request that the Department of Environmental Quality consider the following revisions to the TMDL:

1. The Waste Load Allocation (WLA) for Wastewater Treatment Plants (WWTP) should be lowered. The WLA should be based on the monthly average limit set for the WWTP discharge permits.

Facilities which lie within a "prohibited zone" as designated by the Virginia Department of Health - Division of Shellfish Sanitation (VDH-DSS) are not assigned Waste Load Allocations (WLAs) in shellfish TMDL reports. These facilities do have a 200 cfu/100ml fecal coliform limit which is included in their permit for discharge. The prohibited zone assigned by VDH-DSS around the facility's discharge serves in lieu of a WLA and thus no shellfish within the area of the prohibited zone boundary may be taken. The prohibited zone area which VDH-DSS designates, is modeled using the fecal coliform limit of the permit and the extent to which downstream effects are anticipated based on the facilities' permitted flow, tides, etc. If you would like more information on how VDH-DSS derives prohibited zone boundaries, I would be happy to put you in touch with the appropriate people at that agency.

2. A WLA should also be assigned to VPDES stormwater permittees. This TMDL only assigns WLAs to WWTPs. An aggregate WLA must be assigned to development projects covered by the stormwater construction general permit.

Stormwater construction permits are not normally assigned limits for bacteria in their permit, therefore, they are not required to monitor for bacteria, they receive no WLA in the TMDL, and are not assigned prohibited zones from VDH. Unless a stormwater construction permit has been assigned a limit for bacteria (and

RE: Ann Jennings comments
Lower Pamunkey, Lower Mattaponi,
and Upper York (Tidal)
Bacteria TMDL draft
4/6/10 VADEQ

must monitor for bacteria or a surrogate such as Total Residual Chlorine) DEQ has no basis for assigning this type of permittee a WLA in a TMDL study. Should evidence indicating that such a permittee is in need of a bacteria limit, the permit would be modified to include a bacteria limit and a WLA would then be assigned in the TMDL.

3. The TMDL should clearly indicate the source of data used to estimate animal agriculture in the watersheds. Expertise in the local farming community should be consulted to verify the accuracy of the data, such as the local Soil and Water Conservation Districts, local Cooperative Extension, or local Farm Bureau offices.

DEQ agrees. DEQ and its contractor Louis Berger Group submitted watershed information and population estimates on livestock to the local Soil and Water Conservation Districts for verification. Unfortunately, even with repeated emails, we don't always receive a response as to whether or not our estimates (given their first-hand knowledge of the watershed) are reasonable. When a response is not submitted, the estimates are assumed to be reasonable. The source of data used to estimate the number of livestock is referenced in section 2.5.3 of the report.

Thank you again for this opportunity to provide comment.

Sincerely,

Ann F. Jennings
P.O. Box 257
Mattaponi, VA 23110
(804) 241-5951

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

April 6, 2010

Ms. May Sligh
VADCR TMDL/Watershed Field Coordinator
Tappahannock Regional Office
PO Box 1425
Tappahannock, CA 22560

RE: Comments on the draft report for the Lower Pamunkey, Lower Mattaponi, and Upper York Rivers Bacteria TMDL

Dear Ms. Sligh,

DEQ has received DCR's comments for the above named study and appreciates the thorough review. DEQ has responded to your comments (see attachment). DCR comments are underlined and DEQ responses are in italics.

We hope we have responded to your comments and answered your questions to your satisfaction. If you have any further questions, please don't hesitate to contact me at (804)527-5124.

DEQ looks forward to working with DCR during the implantation planning for these rivers.

Sincerely,

Margaret Smigo
VADEQ Regional TMDL Coordinator
Piedmont Regional Office

DEQ's Response to DCR Comments on the
Total Maximum Daily Load Development for the Upper York River,
Lower Pamunkey River and the Lower Mattaponi River *(Tidal)* Watersheds
April 6, 2010

General comment on Maps: A stream in King and Queen County, which appears to be Tastine (creek or swamp) is not drawn all the way down to the confluence with the Mattaponi.

Title page and other locations:

Include "Tidal" in title (see suggestion above).
Title was changed to Bacteria Total Maximum Daily Load (TMDL) Development for the Upper York River, the Lower Pamunkey River, and the Lower Mattaponi River (Tidal) Watersheds
Anywhere that Upper York Watershed is referenced should include "Tidal" after Upper to properly distinguish area in the context of the entire York basin. Upper York River is fine since just referring to the stream segment named "York" where the Mattaponi and Pamunkey converge.
"Upper York Watershed" changed to "Upper Tidal York Watershed" and "Upper Tidal York River watershed" throughout document
Replace February with April.
February changed to April

pp#E-6 — The word "be" is needed in the next to last sentence (will *be* the same).
"Will the same" changed to "will be the same"

pp#2-3: — 4th line – Route 360 may be deleted as there is no such route in Fig. 2-1. Instead include I-64 and Route 273.
Route 360 deleted, Route 273 and I-64 added (descriptions of Rt 273 and I-64 also added)

pp#2-27, 28 — Table 2-21 – There are three different spellings of the same creek: Goalders, Goulders and Golders. The correct one is Goalders Creek. Also, where the Crouse stormwater permit is referenced, it should be "residence", not "redidence".
Goalders Creek spelling corrected; "redidence" changed to "Residence" for Crouse stormwater permit reference.

pp#2-30: — Could VDH be used in place of estimated number of septic or to verify estimated numbers?
Please verify the estimated septic numbers based on your information. Attempts to get verification on estimates were made however neither DEQ nor its contractor Louis Berger Group received responses from local VDH officials. We will make changes to the septic numbers in the document if verification shows a significant difference.

pp#2-31: — Livestock data – Text indicates USDA/Census as data sources. In public meeting#2, data source was indicated as Center for Coastal Resource Management (CCRM). Revise text for correct data source and include that in Reference (pp#7-1).
Text is correct (livestock numbers are from the USDA/Census). Appropriate reference has been added to Chapter 7

1

pp#3-1: Model used is for small watersheds. The area of study watershed is 106,392 acres. Is there any cut-off area for small or big watershed?
The model does not provide any information on a numerical limit for the watershed size. However, the model provides specific information under which hydrologic conditions and boundaries it can be applied. Some of these specific conditions are: pre-dominantly well-mixed vertically and laterally, relatively shallow estuary, small change of the tidal range within the impaired segment, insignificant freshwater inflow. All these conditions are met for the bacteria impaired for the Upper York.

pp#3-9: Fecal Tool (Bacteria indicator Tool) is used to estimate enterococci in upper York, Pamunkey and Mattaponi tidal watersheds. Please include a brief description of this Tool, assumptions and a few results obtained in the narrative of the study. Any sources not included in the Tool, such as septic system failures and biosolids applications should be explained as to how they were accounted for in the evaluation. The fecal data worksheet should also be included in the Appendix.
The fecal tool used to develop loads is a very large Excel worksheet. Instead of including a detailed accounting of this tool, our contractor, Louis Berger Group, will give a brief explanation of the tool and in the Appendix, will attach a table indicating the fecal values per source type used in the calculations (along with references).

pp#3-11: Distribution of enterococci is assumed to be that of fecal coliform loads from same source category. Include a reference to substantiate this assumption.
Louis Berger Group has included a table in Appendix C showing the fecal coliform production rates that were used for the Pamunkey and Mattaponi River bacteria TMDLs, source reference, and explanation of the bacteria tool.

pp#5-2: 2nd paragraph under "Staged Implementation," please add that the septic pump outs are required by the CB Act.
Added

Also, please include efforts to address the pet waste issue since the source contribution is 6%-11% in these watersheds. Consider pet waste education programs, placement of dog waste baggie stations in popular dog walking locations, pet waste composters for homeowners (depending on proximity to water table), and septic systems for kennels.
Added

In another paragraph, add few sentences about the benefits of buffers along the streams, as many owners/stakeholders desire to clear and have lawn to the stream's edge despite the 100 foot buffer RPA. Protecting the existing buffer is probably the cheapest way to address runoff-bacteria contributions, in both the agricultural and urban setting.
Added

pp#5-2: Any ongoing water quality improvement efforts, if any, may be listed here. Consider the educational signage in West Point along the walking trail at the Mattaponi bridge that addresses both pet waste and buffer protection (York River and Small Coastal Basin Roundtable), and the many educational and stewardship activities initiated by the Mattaponi Pamunkey Rivers Association.

2

Additional information regarding ongoing efforts included.

pp# 5-3: Implementation section 5.3.2 – 6th line - Section 62.1-44.19.7 – Is it correct or might be 62.1-44.197.7?
Corrected, Section 62.1-44.19:7

pp#5-4: Under the "Implementation Funding Sources" section, first sentence - it is fine to describe the 319 funds as a potential source of funds, but the second sentence restates this and can be deleted. Also, consider this phrase to capture other funding sources: 'Other funding sources for implementation include the U.S. Department of Agriculture's Conservation Reserve Enhancement and Environmental Quality Incentive Programs, the Virginia State Revolving Loan Program, the Virginia Agricultural Cost Share Program, and grants from the Virginia Water Quality Improvement Fund, National Fish & Wildlife Foundation, VA Environmental Endowment, and the Chesapeake Bay Restoration Fund."
Second sentence deleted; Suggestion phrase used to describe other funding sources.

pp#6-1: Section 6.0 – update and include details of public meeting #2.
Section 6.0 updated to include second public meeting info.

"

3

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
(804) 786-6124

March 31, 2010

Ms. Margaret Smigo
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060

Dear Ms. Smigo,

I am writing to submit comments on the Total Maximum Daily Load Development for the Upper York River, Lower Pamunkey River and the Lower Mattaponi River Tidal Watersheds in New Kent, King William and King and Queen counties and the town of West Point. Overall, the document seems very thorough and is easy to follow. As well, the maps, tables and graphs aid the reader in understanding the narrative. The quality of this document is noted by DCR staff and we will greatly appreciate the level of detail and thoroughness once we begin implementation plan development. Our comments are both editorial and technical as we do request clarifications on the estimations made in the development of the allocations.

The fecal coliform and enterococci bacteria reductions required to meet water quality standards in the York, Mattaponi and Pamunkey Rivers and their tidal tributaries seem reasonable to attain during the implementation phase. We also note the excellent work of your contractor, Louis Berger, in working with the public at meetings and through other communications.

We appreciate the incorporation of standard comments made in previous TMDL studies and look forward to working with you further on addressing these impaired waters in our regions (Richmond Regional and Tappahannock Regional Offices of DCR).

Sincerely,

May Sligh
TMDL/Watershed Field Coordinator
VADCR-Tappahannock Regional Office
Cc: Ram Gupta, TMDL Project Manager, VADCR-Richmond Regional Office

State Parks • Soil and Water Conservation • Natural Heritage • Outdoor Recreation Planning
Chesapeake Bay Local Assistance • Dam Safety and Floodplain Management • Land Conservation

DCR's Review Comments on the
Total Maximum Daily Load Development for the Upper York River,
Lower Pamunkey River and the Lower Mattaponi River *(Tidal)* Watersheds
March 31, 2010

Some comments and suggestions are made to improve the readability and understanding of the report.

General comment on Maps: A stream in King and Queen County, which appears to be Tastine (creek or swamp) is not drawn all the way down to the confluence with the Mattaponi.

Title page and other locations:
Include "Tidal" in title (see suggestion above).
Anywhere that Upper York Watershed is referenced should include "Tidal" after Upper to properly distinguish area in the context of the entire York basin. Upper York River is fine since just referring to the stream segment named "York" where the Mattaponi and Pamunkey converge.
Replace February with April.

pp#E-6 The word "be" is needed in the next to last sentence (will *be* the same).

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pp#2-27, 28 Table 2-21 – There are three different spellings of the same creek: Goalders, Goulders and Golders. The correct one is Goalders Creek. Also, where the Crouse stormwater permit is referenced, it should be "residence", not "redidence".

pp#2-30: Could VDH be used in place of estimated number of septic or to verify estimated numbers?

pp#2-31: Livestock data – Text indicates USDA/Census as data sources. In public meeting#2, data source was indicated as Center for Coastal Resource Management (CCRM). Revise text for correct data source and include that in Reference (pp#7-1).

pp#3-1: Model used is for small watersheds. The area of study watershed is 106,392 acres. Is there any cut-off area for small or big watershed?

pp#3-9: Fecal Tool (Bacteria indicator Tool) is used to estimate enterococci in upper York, Pamunkey and Mattaponi tidal watersheds. Please include a brief description of this Tool, assumptions and a few results obtained in the narrative of the study. Any sources not included in the Tool, such as septic system failures and biosolids applications should be explained as to how they were accounted for in the evaluation. The fecal data worksheet should also be included in the Appendix.

1

pp#3-11: Distribution of enterococci is assumed to be that of fecal coliform loads from same source category. Include a reference to substantiate this assumption.

pp#5-2: 2nd paragraph under "Staged Implementation," please add that the septic pump outs are required by the CB Act.

Also, please include efforts to address the pet waste issue since the source contribution is 6%-11% in these watersheds. Consider pet waste education programs, placement of dog waste baggie stations in popular dog walking locations, pet waste composters for homeowners (depending on proximity to water table), and septic systems for kennels.

In another paragraph, add few sentences about the benefits of buffers along the streams, as many owners/stakeholders desire to clear and have lawn to the stream's edge despite the 100 foot buffer RPA. Protecting the existing buffer is probably the cheapest way to address runoff-bacteria contributions, in both the agricultural and urban setting.

pp#5-2: Any ongoing water quality improvement efforts, if any, may be listed here. Consider the educational signage in West Point along the walking trail at the Mattaponi bridge that addresses both pet waste and buffer protection (York River and Small Coastal Basin Roundtable), and the many educational and stewardship activities initiated by the Mattaponi Pamunkey Rivers Association.

pp# 5-3: Implementation section 5.3.2 – 6^{th} line - Section 62.1-44.19.7 – Is it correct or might be 62.1-44.197.7?

pp#5-4: Under the "Implementation Funding Sources" section, first sentence - it is fine to describe the 319 funds as a potential source of funds, but the second sentence restates this and can be deleted. Also, consider this phrase to capture other funding sources: "Other funding sources for implementation include the U.S. Department of Agriculture's Conservation Reserve Enhancement and Environmental Quality Incentive Programs, the Virginia State Revolving Loan Program, the Virginia Agricultural Cost Share Program, and grants from the Virginia Water Quality Improvement Fund, National Fish & Wildlife Foundation, VA Environmental Endowment, and the Chesapeake Bay Restoration Fund."

pp#6-1: Section 6.0 – update and include details of public meeting #2.

2

From: Smigo, Margaret (DEQ)
Sent: Tuesday, April 06, 2010 12:36 PM
To: Sligh, May (DCR)
Cc: Lunsford, Charlie (DCR); Gupta, Ram (DCR); Bennett, Robert (DCR); 'Michaelis, Bjoern'; EL-Farhan, Raed
Subject: DEQ response to Comments for York,Pamunkey, Mattaponi TMDL

Attachments: 4_6_10_DEQ_re_coverletter_DCR_final_york_comments.pdf; 4_6_10_DEQ_re_DCR_York_final_comments.pdf
Good Afternoon May!

Attached are DEQ's cover letter and response to comments for the draft of Lower Pamunkey, Lower Mattaponi, and Upper York River (Tidal) Bacteria TMDL.

Please let me know if you have any questions!

Best Regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Sligh, May (DCR)
Sent: Thursday, April 01, 2010 3:39 PM
To: Smigo, Margaret (DEQ)
Cc: Lunsford, Charlie (DCR); Gupta, Ram (DCR); Bennett, Robert (DCR)
Subject: Comments for York,Pamunkey, Mattaponi TMDL

Margaret,
Please see the attached letter and comments.
Thank you also for the information already sent to clarify some of our questions.
~May

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

March 23, 2010

Ms. Marion Jones
1783 Walkerton Rd
Walkerton, VA 23177

RE: Comment letter on DEQ water quality study for Lower Pamunkey, Lower Mattaponi, and Upper York Rivers

Dear Ms. Jones,

DEQ appreciates your support of the water quality study for the above Rivers. Your participation in the development of this study is valued and your concern for the waterways – along with that of other stakeholders and citizens in the watershed will be documented in the final report which is sent to EPA and the Virginia State Water Control Board for approval.

DEQ looks forward to working with you during the Implementation Planning phase to clean up these Rivers. If you would like to be added to our notification list (email is preferred) please let me know. If you have any questions about the TMDL study or the next steps in cleaning up these waters, please do not hesitate to contact me at (804)527-5124.

Best Regards,

Margaret Smigo
Piedmont – DEQ TMDL Coordinator
VA Dept. of Environmental Quality

RECEIVED
MAR 17 2010
PRO

1783 Walkerton Road
Walkerton, VA 23177

March 15, 2010

Margaret Smigo
TMDL Regional Coordinator
Piedmont Regional Office
4949 – A Cox Road
Glen Allen, VA 23060

Dear Ms. Smigo:

Regarding the Tidal Maximum Daily Load Study of the Mattaponi and Pamunkey Rivers: I am concerned about the amount of contamination in the Mattaponi River which was identified recently by a study by the DEQ. I understand some river clean up has improved the situation. I encourage the DEQ to continue their efforts. I am aware that funding for any project is critical and often not available. However, we need to continue to "clean up the Bay" and this will play a vital role.

Sincerely,

Mrs. Marion Jones

Marion Jones

Reminder Upper York, Lower Pamunkey, Lower Mattaponi, Rivers Bacteria TMDL Final Comment p... Page 1 of 3

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 23, 2010 8:14 AM
To: 'Paul Davis'
Subject: RE: *Reminder* Upper York, Lower Pamunkey, Lower Mattaponi, Rivers Bacteria TMDL Final Comment period ends next Thursday April 1st....

Good Morning Mr. Davis,

DEQ appreciates your comments and your participation in this water quality study. As a part of the Implementation Planning phase (next phase following the report approval), wildlife management can be incorporated with the help of the Dept. of Game & Inland Fisheries (DGIF). Should the water quality not improve following implementation of best management practices, a Use Attainability Analysis (UAA) can be conducted to determine if the background conditions (wildlife or natural conditions of the waterways) are such that the recreational use of this portion of the Pamunkey River are not attainable, and approval of such a report by EPA would effectively remove the use (and the impairment).

Again, we greatly value your time and hope you will join us when we meet again in the future to develop the implementation plan.

Best Regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

<u>*Note*</u> My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Paul Davis [mailto:padavis@vt.edu]
Sent: Monday, March 22, 2010 7:44 PM
To: Smigo, Margaret (DEQ)
Subject: Re: *Reminder* Upper York, Lower Pamunkey, Lower Mattaponi, Rivers Bacteria TMDL Final Comment period ends next Thursday April 1st....

We, the Davis Family own and operate a 1200 ac farm in the Lower Pamunkey watershed across from Sweet Hall Marsh. We have not had livestock on the farm since 1972, we grow grain crops including corn, soybeans, wheat and barley all planted no-till. We have not tilled the land since 1999, so we have no runoff of soil, fertilizers or pesticides in the Pamunkey River, which nearly surrounds our farm. We follow nutrient management and pesticide management plans on all our cropping acreage.

Our issues are wildlife, we have around 200 white tail deer that call our farm home year round, 1200

3/23/2010

Canada geese that spend 6 months on the River in front of my house and feed on our grain fields every day, 1,000,000 blackbirds that roost in Hill Marsh (1200 ac) that ajoins our farm every night. We also have normal populations of raccons, rabbits, turkeys, crows, mallard ducks, swans, and coyotes.

The Pamunkey River is full of blue catfish (not native species), rock fish, gar, carp and mud shad. We still have American Shad, herring, and rockfish migrating each spring.

Today's Never-Till farming pratices are helping provide great strides in water and soil quality. I have lived on the Pamunkey River for 53 years and the water quality and water clarity are better than when I was a teenager. I have shad,herring and rockfished my whole life and the water is so clear that we can only catch these fish, now days, after dark because the water is so clear the fish see the nets.

Thank you for giving us and opportunity to share what is happening on our farm, but all the grain farms on the Pamunkey and Mattaponi are practicing the same production system.

Paul Davis
Retired Agriculture Extension Agent, New Kent/Charles City
Farmer and Ag. Research Consultant
9194 Hill Farm Rd.
New Kent, Va 23124
804-840-1751

----- Original Message -----
From: Smigo, Margaret (DEQ)
Cc: Alling, Mark (DEQ) ; Michaelis, Bjoern ; EL-Farhan, Raed ; Sligh, May (DCR) ; rgupta@dcr.virginia.gov
Sent: Monday, March 22, 2010 2:34 PM
Subject: *Reminder* Upper York, Lower Pamunkey, Lower Mattaponi, Rivers Bacteria TMDL Final Comment period ends next Thursday April 1st....

Good Afternoon,

This is a friendly email to remind you that the 30-day public comment period for the Lower Pamunkey, Lower Mattaponi, and Upper York Rivers and Tributaries TMDL draft report will expire next **Thursday April 1st, 2010.**

The draft TMDL is available on the DEQ website at:

https://www.deq.virginia.gov/TMDLDataSearch/DraftReports.jspx

The presentations given at the public meetings are available for review at:

http://www.deq.virginia.gov/tmdl/mtgppt.html

Please remember that we are developing this report and that your input is quite valuable! Also, this TMDL requires the support and backing of local agencies, community groups, and citizens within the watershed in order to show that you would like to quickly move forward towards the Implementation Planning process. ***Please indicate what waterbody you are commenting on and include your name, address, and telephone number with your questions or comments.*** You may email your comments to:

margaret.smigo@deq.virginia.gov

or mail correspondence to:

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Friday, March 19, 2010 3:00 PM
To: 'Chris Justice'
Subject: RE: TMDL for the Mattaponi, Pamunkeyt and York Rivers

Good Afternoon Mr. Justice,

DEQ appreciates your support of the draft water quality study for the York, Mattaponi, and Pamunkey Rivers. Your comment will be incorporated into the report which will be sent to EPA and the State Water Control Board for approval.

DEQ looks forward to working with you and other concerned citizens and stakeholders during the implementation planning phase.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106
Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Chris Justice [mailto:justice@hermes.geog.umd.edu]
Sent: Thursday, March 18, 2010 9:24 PM
To: Smigo, Margaret (DEQ)
Subject: TMDL for the Mattaponi, Pamunkeyt and York Rivers

Dear Ms. Smigo

I am writing to you to voice my concern about the levels of pollution in stretches of the Mattaponi, Pamunkey and York Rivers, which exceed the Total Maximum Daily Load for certain pollutants. My family and I use the rivers regularly for swimming and fishing and are concerned about excessive levels of pollution and treasure our time on the river. I would encourage the DEQ to give priority to cleaning up the sections of these rivers where the pollution exceeds recommended limits and implementing long-term sustainable solutions to these problem areas in terms of land management and point and non-point source of pollution. I appreciate the efforts of the DEQ to safeguard Virginia's environment. We need these rivers to be clean and safe for the current and future generations.

Yours Sincerely

Chris Justice
160 Forestvue Dr.
Earlysville
Va.

3/19/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 16, 2010 4:49 PM
To: 'Robert Norris - PPG'
Subject: RE: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS

Good Afternoon Mr. Norris,

DEQ appreciates your support of the water quality study which was developed for the York, Mattaponi, and Pamunkey Rivers. Thank you for your participation in our meetings and the report development process. DEQ will incorporate your comments into the final report which will be sent to EPA and the State Water Control Board. We look forward to working with you and other concerned citizens and stakeholders during the implementation planning phase.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

<u>*Note*</u> My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Robert Norris - PPG [mailto:rnorris@premierplanninggroup.com]
Sent: Monday, March 15, 2010 6:57 PM
To: Smigo, Margaret (DEQ)
Subject: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS

Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS which jeopardize the harvesting of shellfish as well as jeopardize safe swimming for humans.

Thank you,
Robert M. Norris III

Premier Planning Group

Robert M. Norris, III, CLU, CRPC
7501 Boulders View Dr, Ste 440

3/16/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 16, 2010 4:45 PM
To: 'betsy mountcastle'
Subject: RE: RIVER CLEAN-UP

Good Afternoon Ms. Mountcastle,

DEQ appreciates your support of the water quality study for the York, Mattaponi, and Pamunkey Rivers. Your comment will be incorporated into the final report that is submitted to EPA and the State Water Control Board for approval. We look forward to working with you and other concerned citizens during the implementation planning phase.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

<u>***Note***</u> My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: betsy mountcastle [mailto:betsy_mountcastle@yahoo.com]
Sent: Tuesday, March 16, 2010 11:27 AM
To: Smigo, Margaret (DEQ)
Subject: RIVER CLEAN-UP

Please continue to minister to our rivers--the Pamunkey, the Mattaponi, and the Upper York by actively involving your agency in the clean-up project. It is so vital for their health and the health of our environment, natural world, and its peoples .There is evidenced need for help to purify these waters.

Thank you in advance for your clean- up efforts as I believe in you and know that you surely will do the right thing by our rivers.

Sincerely,

Betsy Mountcastle

3/16/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 16, 2010 4:42 PM
To: 'Stephen Kopelove'
Subject: RE: We support the DEQ Cleanup of the Mattaponi, Pamunkey and Upper York Rivers

Good Afternoon Mr. and Mrs. Kopelove,

DEQ greatly appreciates your comment of support for the water quality study of the York, Mattaponi, and Pamunkey Rivers. We thank you for your participation in the public meetings and the report development. Your comment will be incorporated into the final report that will be submitted to EPA and the State Water Control Board for approval.

We look forward to working with you and other concerned citizens and stakeholders during the implementation planning process.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now Margaret.Smigo@deq.virginia.gov

Visit our website at:
www.deq.virginia.gov

-----Original Message-----
From: Stephen Kopelove [mailto:kopelove2@verizon.net]
Sent: Tuesday, March 16, 2010 11:19 AM
To: Smigo, Margaret (DEQ)
Subject: We support the DEQ Cleanup of the Mattaponi, Pamunkey and Upper York Rivers

We would like to voice our support of the DEQ to please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

Stephen and Patricia Kopelove
2008 Cambridge Drive
Henrico, VA 23238

1

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 16, 2010 4:25 PM
To: 'onekeg'
Subject: Regarding your comment on York, Pamunkey, and Mattaponi Rivers

Good Afternoon Mr. Gran,

DEQ appreciates your support of the York, Mattaponi, and Pamunkey Rivers. Your comment will be incorporated into the report which will be sent to EPA and the State Water Control Board for approval.

DEQ looks forward to working with you and other concerned citizens and stakeholders during the implementation planning phase.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now Margaret.Smigo@deq.virginia.gov

Visit our website at:
www.deq.virginia.gov

-----Original Message-----
From: onekeg [mailto:onekeg@crosslink.net]
Sent: Tuesday, March 16, 2010 10:35 AM
To: Smigo, Margaret (DEQ)
Subject: Re:

Sorry I thought my comment was going to the subject rivers.
I am talking about thr bacterial load study on the York,
Mattaponi and Pamunky. Thank you.

Sincerely
Ed Gran

On Mon, 15 Mar 2010 11:50:37 -0400
"Smigo, Margaret (DEQ)" <Margaret.Smigo@deq.virginia.gov>

1

wrote:
> Hello Mr. Gran,
>
>
>
> Please advise me regarding which rivers you are referring
> to.
> Currently, I have about 8 different water quality studies
> on different
> waterways I am developing. I would be happy to apply
> your comment of
> support to whichever project you like.
>
>
>
> Sincerely,
>
>
>
>
>
> Margaret Smigo
> Regional TMDL Coordinator
> Dept. of Environmental Quality
> Piedmont Regional Office
> 4949-A Cox Road
> Glen Allen, Virginia 23060
> Office (804) 527-5124
> Fax (804)527-5106
>
> *Note* My email address is now
> Margaret.Smigo@deq.virginia.gov
>
> Visit our website at:
> www.deq.virginia.gov <http://www.deq.virginia.gov>
>
>
>
> ________________________________
>
> From: Ed Gran [mailto:onekeg@crosslink.net]
> Sent: Monday, March 15, 2010 10:31 AM
> To: Smigo, Margaret (DEQ)
> Subject:
>
>
>
> Please clean up these rivers. I think you cold get help
> from some of
> the volinter citizen groups.
>
>

2

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 16, 2010 4:29 PM
To: 'ginny morrow'
Subject: RE: Clean Rivers

Good Afternoon Ms. Morrow,

DEQ appreciates your support of the water quality study which was developed for the York, Mattaponi, and Pamunkey Rivers. Thank you for your participation in our meetings and the report development process. DEQ will incorporate your comments into the final report which will be sent to EPA and the State Water Control Board. We look forward to working with you and other concerned citizens and stakeholders during the implementation planning phase.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: ginny morrow [mailto:ginnymorrow@verizon.net]
Sent: Monday, March 15, 2010 9:25 PM
To: Smigo, Margaret (DEQ)
Subject: Clean Rivers

Ms. Smigo:

Please act on behalf of sustaining our natural resources. I urge you to promote continuted clean up of our rivers: the Mattaponi, Pamunkey, and Upper York, all of which offered sustenance and joy to me as a child.

Thank you.

Virginia Moore Morrow
Edandale Farm, New Kent County

3/16/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 15, 2010 8:08 AM
To: 'elizabeth tootelian'
Subject: RE:

Good Morning Ms. Tootelian,

Thank you very much for your email of support of DEQ's water quality study in the Mattaponi, Pamunkey and York Rivers. Your comment will be incorporated into the final report sent to EPA and the VA State Water Control Board for Approval. We look forward to working with you and other concerned citizens and stakeholders during the implementation planning phase.

Best Regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: elizabeth tootelian [mailto:elizabethtootelian@comcast.net]
Sent: Sunday, March 14, 2010 5:43 PM
To: Smigo, Margaret (DEQ)
Subject:

Please clean up the Mattaponi, Pamunkey and upper York rivers.

Mrs. Elizabeth D. Tootelian
402 Berwickshire Drive
Richmond, Virginia 23229

phone (804)740-8670

3/15/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 15, 2010 8:00 AM
To: 'Karen Westermann'
Subject: RE: Yes, please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

Good Morning Ms. Westermann,

DEQ greatly appreciates your concern for the Mattaponi, Pamunkey and York Rivers and thanks you for your support for the water quality study that has been developed. Your comment will be incorporated into the final draft report which will be sent to the EPA and VA State Water Control Board for approval.

We sincerely look forward to working with you and other concerned citizens and stakeholders during implementation planning.

With best regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Karen Westermann [mailto:kwestermann@earthlink.net]
Sent: Sunday, March 14, 2010 1:44 PM
To: Smigo, Margaret (DEQ)
Subject: Yes, please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

Dear Ms. Smigo,

Thank you so much for the work being done to keep our rivers clean. I want to express my strong support for the three phases of cleanup for the Mattaponi, Pamunkey, and Upper York Rivers.

With my deep appreciation,

Karen Tootelian- Westermann

www.chiefandi.com

3/15/2010

York Final Comments

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Tuesday, March 09, 2010 8:44 AM
To: 'Don Phillips'
Subject: RE: Clean Up of bacterial contamination in the Mattaponi, Pamunkey, and upper York Rivers

Good Morning Mr. Phillips,

Thank you very much for your email and your support of the water quality study which was conducted on the Lower Mattaponi, Lower Pamunkey, and Upper York Rivers. We greatly appreciate your participation in the TMDL development and hope you will join us for future implementation planning meetings (I've added you to our contact list so we will be in touch).

Your comments will be incorporated with the final draft TMDL that is sent to EPA and the Virginia State Water Control (SWCB) for approval.

Thank you again and we look forward to working with you to reduce bacteria pollution in these waterways!

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Don Phillips [mailto:dhp3@cox.net]
Sent: Monday, March 08, 2010 3:36 PM
To: Smigo, Margaret (DEQ)
Subject: Clean Up of bacterial contamination in the Mattaponi, Pamunkey, and upper York Rivers

Dear Ms. Smigo:

I was pleased to learn that the DEQ is proposing to identify the sources of bacterial contamination in the lower portions of the Mattaponi and Pamunkey Rivers and the upper portion of the York River and eliminate those contamination sources.

3/9/2010

The Mattaponi and Pamunkey have been called the two most pristine rivers on the East Coast and together, they provide 81% of the fresh water feeding the estuarine flow of the York River. It behooves Virginia to take care of those valuable resources. If we can't clean up those rivers, then we will be unlikely to clean up more impaired rivers.

Again, I want to congratulate the DEQ on its TMDL program and fully support the efforts to clean up this tributary system of the lower Chesapeake Bay.

Sincerely,

Donald H. Phillips, Ph. D.

YORK FINAL

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 08, 2010 8:43 AM
To: 'Dotty Rilee'
Subject: RE: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

Good Morning Ms. Rilee,

Thank you for your email and your concern regarding the bacteria pollution in the Lower Pamunkey, Lower Mattaponi, and Upper York Rivers. DEQ appreciates your comments of support for the clean-up of these waterways and hopes you will join us for future implementation planning meetings. While the TMDL report is nearly finished, the report is what will guide us in our "on the ground" efforts which will ultimately improve water quality. In order to restore the impaired water uses, we will need your help and the help of many others in the watershed.

We look forward to working along side you in order to reduce the bacteria in these rivers and improving the water quality. As a student of the Master Gardneners, you may already have connections to a few watershed groups out there and I encourage you to work with them or initiate a watershed organization in your own neighborhood (assuming you live in the watershed of these rivers). It is ultimately the work of citizens and stakeholders in and around the impaired waterways which will lead to a successful clean-up, and there certainly is no time like the present!

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Dotty Rilee [mailto:dottyrilee@verizon.net]
Sent: Sunday, March 07, 2010 8:02 PM
To: Smigo, Margaret (DEQ)
Subject: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

Dear Mrs. Smigo,

I met you recently at the Virginia Master Naturalist Class on the night we learned about Ichtyology.

3/8/2010

I remember the speakers teaching us about TMDL and the necessary steps needed to comply with TMDL studies.

Now I'm writing you to ask your help with the MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS.

This week, the DEQ conducted a presentation regarding an ongoing bacterial loading study in the Mattaponi and Pamunkey Rivers and the Upper York. This TMDL study has identified sections of these rivers which exceed the recommended healthy limits for bacterial loading. Parts of the rivers have been designated �Impaired� for shellfish harvesting and for swimming. Two specific bacteria were studied. Both bacterias originate in humans and animals and are transmitted into the water. There are two levels of contamination that are identified in the TMDL study. One for shellfish harvesting, the other for swimming. The TMDL is a 3 step program. The present phase, step one, establishes water quality. The second phase identifies solutions. The third phase implements restoration of the waterway. This well established program has several dozen TMDL river clean-ups in operation today. About 1/3 or the waterways have been restored to acceptable levels already, and many others are on the path to recovery.

The TMDL program establishes education and guidance to the stakeholders along the rivershed. Farming methods, municipal pollution, lawn management, septic system maintainence are among the key issues.

Please advise me of further steps I can take to make sure these rivers are on the path to recovery.

Thank you!

Dotty Rilee

3/8/2010

YORK Final

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 08, 2010 8:24 AM
To: 'Elli Morris'
Subject: RE: Clean up Mattponi, Pamunkey, and Upper York Rivers

Thank you for you email. We appreciate your interest and involvement regarding the Lower Pamunkey, Lower Mattaponi, and Upper York Rivers. We hope you will join us for future implementation meetings and we look forward to working with you to reduce the bacteria pollution in these rivers.

Sincerely,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now Margaret.Smigo@deq.virginia.gov

Visit our website at:
www.deq.virginia.gov

-----Original Message-----
From: Elli Morris [mailto:elli@wackophoto.com]
Sent: Sunday, March 07, 2010 10:01 AM
To: Smigo, Margaret (DEQ)
Subject: Clean up Mattponi, Pamunkey, and Upper York Rivers

Please clean up the Mattponi, Pamunkey, and Upper York Rivers.
These rivers are loved by their neighbors who need educational tools to improve the quality of these great treasures of Virginia.

Thanks for your commitment and help with our natural resources.

Ciao,
Elli Morris

Me, My Lens & Eye
804.204.1364
www.Wackophoto.com
AND www.coolingthesouth.com

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Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 15, 2010 1:41 PM
To: 'Anne Norris'
Subject: RE: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS

Hello Ms. Norris,

Thank you very much for your comment of support for DEQ's water quality study of the Lower Mattaponi, Lower Pamunkey, and Upper York Rivers. Your comment will be incorporated into the final document which will be sent to EPA and the VA State Water Control Board for approval. DEQ looks forward to working with you and other concerned citizens and stakeholders during the implementation planning process.

With best regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now **Margaret.Smigo@deq.virginia.gov**

Visit our website at:
www.deq.virginia.gov

From: Anne Norris [mailto:norris.anne@gmail.com]
Sent: Monday, March 15, 2010 10:56 AM
To: Smigo, Margaret (DEQ)
Subject: Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS

Please CLEAN UP THE MATTAPONI, PAMUNKEY, AND UPPER YORK RIVERS which jeopardize the harvesting of shellfish as well as jeopardize safe swimming for humans.

Thank you,
Anne Norris

3/15/2010

Smigo, Margaret (DEQ)

From: Smigo, Margaret (DEQ)
Sent: Monday, March 15, 2010 9:08 AM
To: 'Jennifer Tichacek'
Subject: RE: Clean-up of Mattaponi River

Good Morning Ms. Tichacek,

DEQ greatly appreciates your support of the water quality study developed for the Mattaponi, Pamunkey, and York Rivers. Your comments will be incorporated into the final report which is sent to EPA and the VA State Water Control Board for approval. DEQ looks forward to working with you and other concerned citizens and stakeholders during the implementation planning process.

With best regards,

Margaret Smigo
Regional TMDL Coordinator
Dept. of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Office (804) 527-5124
Fax (804)527-5106

Note My email address is now Margaret.Smigo@deq.virginia.gov

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www.deq.virginia.gov

-----Original Message-----
From: Jennifer Tichacek [mailto:jtichacek@gmail.com]
Sent: Monday, March 15, 2010 8:48 AM
To: Smigo, Margaret (DEQ)
Subject: Re: Clean-up of Mattaponi River

Please clean-up the Mattaponi, Pamunkey & Upper York Rivers. I know the Mattaponi used to be one of the cleanest rivers in the
country! I own a home on the Mattaponi and after the long-fought
battle with Newport News over the reservoir, I hate to think that I wouldn't want to swim in the river because these rivers are suffering from bacterial overload. As Roseanne Roseanna Danna used to say, "It's always something." Please help --

Jennifer Tichacek
jtichacek@gmail.com
(804) 559-3461