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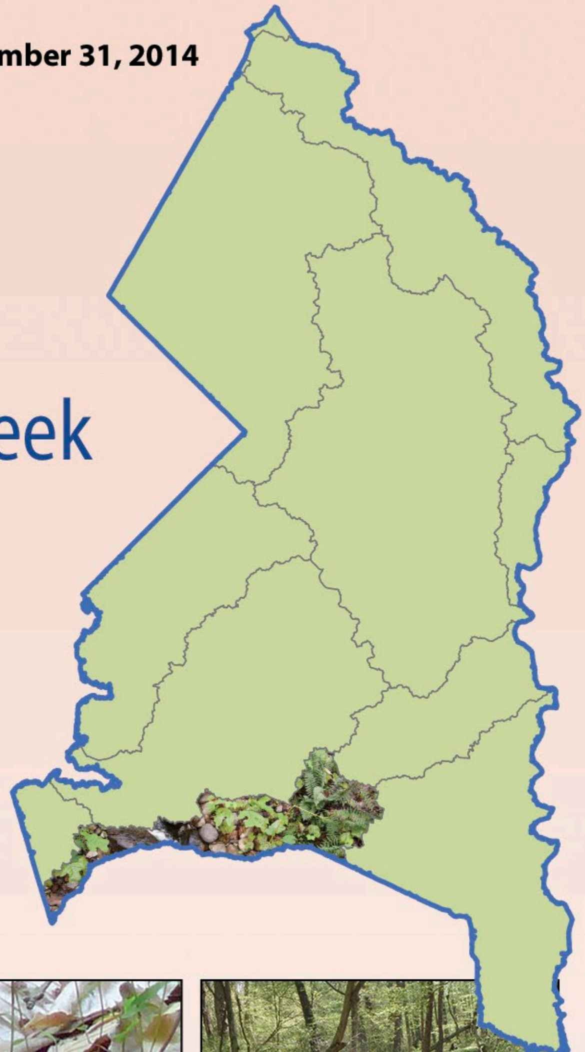
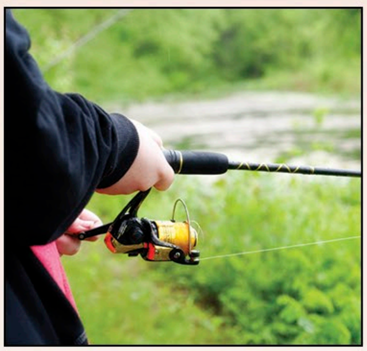
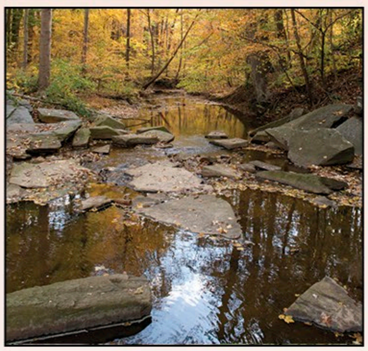
DEPARTMENT OF THE
ENVIRONMENT

December 31, 2014

Watershed Existing Condition Report for the Mattawoman Creek Watershed







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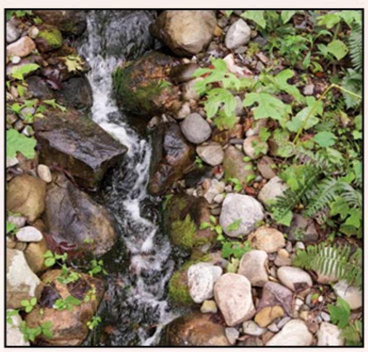

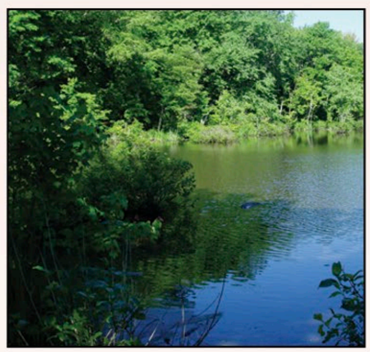

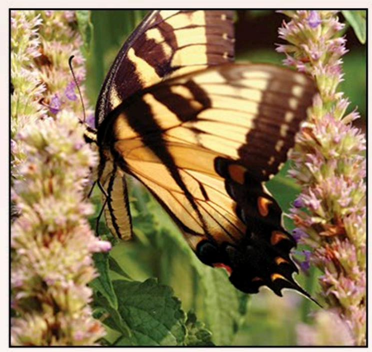

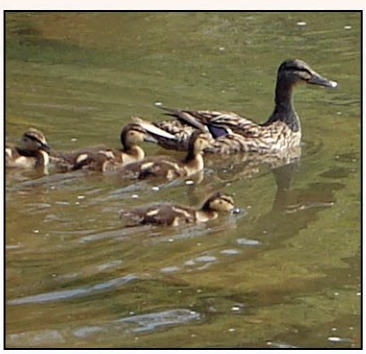

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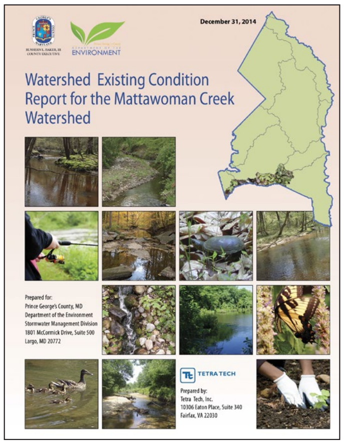

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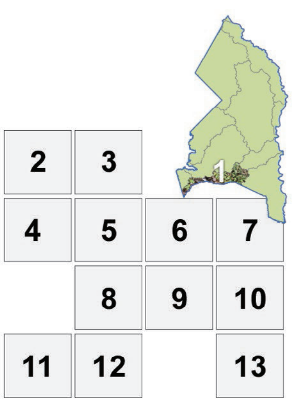

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ACRONYMS AND ABBREVIATIONS

ANC	acid neutralizing capacity
B-IBI	Benthic Index of Biotic Integrity
BMP	best management practice
BOD	biochemical oxygen demand
BSID	Biological Stress Identification
cfs	cubic feet per second
COMAR	Code of Maryland Regulations
DA	drainage area
DMR	discharge monitoring report
DO	dissolved oxygen
EPA	Environmental Protection Agency
FA	future allocations
ft/sec	feet per second
GIS	Geographic Information System
HSPF	Hydrological Simulation Program in Fortran
LAs	load allocations
lb/yr	pound per year
LID	Low Impact Development
MDE	Maryland Department of the Environment
MD DNR	Maryland Department of Natural Resources
MDP	Maryland Department of Planning
mg/L	milligrams per liter
MOS	margin of safety
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
NADP	National Atmospheric Deposition Program
NPDES	National Pollutant Discharge Elimination System
SERC	Smithsonian Environmental Research Center
SR3	Sewer Repair, Replacement and Rehabilitation
SSO	sanitary sewer overflow
STATSGO	State Soil Geographic Database
STORET	STOrage and RETrieval
TMDL	Total Maximum Daily Load
TSS	total suspended solids
µg/L	microgram per liter

USACE	U.S. Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WIP	Watershed Implementation Plan
WLAs	wasteload allocations
WWTP	wastewater treatment plant

1 INTRODUCTION

On January 2, 2014, the Maryland Department of the Environment (MDE) issued Prince George's County (the County) a new municipal separate storm sewer system (MS4) permit. An MS4 is a series of stormwater sewers owned by a municipal entity (e.g., the County) that discharges the conveyed stormwater runoff into a water body (e.g., Mattawoman Creek).

The County's new MS4 permit requires that the County develop local restoration plans to address each U.S. Environmental Protection Agency (EPA)-approved total maximum daily load (TMDL) with stormwater wasteload allocations (WLAs).

As a result of the County's new MS4 permit, restoration plans are being developed for all water bodies in the County that are subject to TMDL WLAs associated with the MS4 system. The County's MS4 system has been assigned WLAs in 10 separate TMDLs addressing pollutants in 5 water body systems:

- Anacostia River
- Mattawoman Creek
- Upper Patuxent River (including Rocky Gorge Reservoir)
- Potomac River
- Piscataway Creek

This report is an initial step in the restoration plan development process for the portions of the Mattawoman watershed that are within the County. It characterizes the watershed, includes a compilation and inventory of available information, provides a review of existing reports and data, and presents some additional data and spatial analyses. Unless otherwise noted, when the report references the "Mattawoman Creek watershed," it refers to only the portion within the County, unless otherwise noted.

1.1 Purpose of Report and Restoration Planning

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (codified at Title 40 of the *Code of Federal Regulations* Part 130) require states to develop TMDLs for impaired water bodies. A TMDL identifies the maximum amount of pollutant load that the water body can receive and still meet water quality criteria. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

Figure 1-1 shows a generalized TMDL schematic. The bar on the left represents the current pollutant load (sometimes called the baseline) that exists in a water body before a TMDL is developed. The elevated load causes the water body to exceed water quality criteria. The bar on the right represents the amount that the pollutant load will need to be reduced for the water body to meet water quality criteria. Another way to convey the required load reduction is by identifying the *percent reduction* needed.

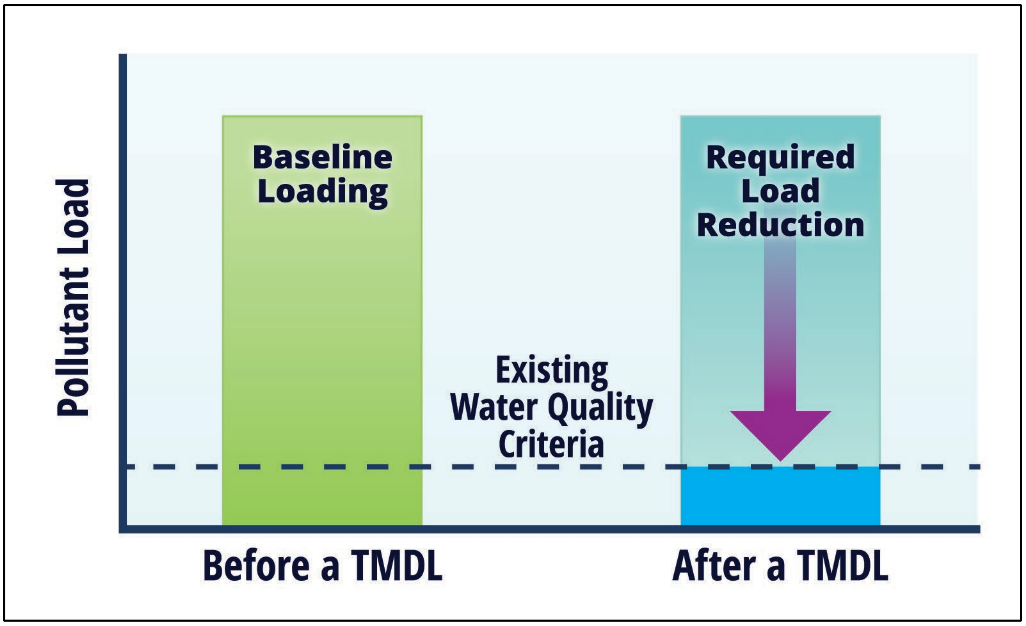


Figure 1-1. Schematic for typical pollution diet (TMDL).

A TMDL for a given pollutant and water body is composed of the sum of individual WLAs for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. The TMDL components are illustrated using the following equation:

$$TMDL = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + MOS$$

A WLA is the portion of the overall pollution diet that is assigned to permitted dischargers, such as the County's MS4 stormwater system. The County's new MS4 permit requires that the County develop local restoration plans to address each EPA-approved TMDL with stormwater WLAs.

A restoration plan is a strategy for managing the natural resources within a geographically defined watershed. For the County's Department of the Environment, this means managing urban stormwater (i.e., water from rain storms) to restore and protect the County's water bodies.

Stormwater management is most effective when viewed in the watershed context—watersheds are land areas and their network of creeks that convey stormwater runoff to a common body of water. Successful stormwater management consists of both structural practices (e.g., vegetated roadway swale) and public outreach (e.g., pet waste campaigns and education) at both the public and private levels. The restoration plan development process will address changes that are needed to the County's priorities to comply with water quality regulations, to improve the health of the streams in the County, and to create value for neighborhoods in the County's watersheds.

The overall goals of restoration planning are to:

- Protect, restore, and enhance habitat in the watershed.

- Restore watershed functions, including hydrology, water quality, and habitat, using a balanced approach that minimizes negative impacts.
- Support compliance with regional, state, and federal regulatory requirements.
- Increase awareness and stewardship within the watershed, including encouraging policymakers to develop policies that support a healthy watershed.

The first stage in completing these goals is to develop restoration plans. These plans typically:

- Identify causes and sources of pollution.
- Estimate pollutant load reductions.
- Describe management options and identify critical areas.
- Estimate technical and financial assistance needed.
- Develop an education component.
- Develop a project schedule.
- Describe interim, measurable milestones.
- Identify indicators to measure progress.
- Develop a monitoring component.

This report begins the process by collecting data needed for restoration planning and characterization of the watersheds. This will help identify potential sources and causes of the pollution.

1.2 Impaired Water Bodies and TMDLs

MDE has included the Mattawoman Creek on its Section 303(d) list of impaired streams for nutrients including total nitrogen and total phosphorus, to address eutrophication in this shallow, tidally influenced embayment of the Potomac Estuary. It was listed as impaired because of eutrophication (with high chlorophyll *a* levels), suspended solids, and evidence of biological impacts. MDE developed a TMDL to achieve a dissolved oxygen (DO) standard of 5 milligrams per liter (mg/L) at all times using chlorophyll *a* as indicator, with allocations assigned for both nitrogen and phosphorus for the various point and nonpoint sources of pollution in this watershed. EPA approved this TMDL in January 2005. The percent reduction WLAs for both nitrogen and phosphorus in the Mattawoman Creek watershed is 14 percent. In addition, EPA recently (USEPA 2010) developed an overall TMDL for the Chesapeake Bay watershed for nitrogen, phosphorus, and sediment. The percent reduction WLAs for nitrogen, phosphorus, and sediment varies by water body ranging from 10 percent to 26 percent for total nitrogen; 32 percent to 41 percent for total phosphorus; and 29 percent to 31 percent for total suspended solids. The County has developed a Watershed Implementation Plan (WIP) in response to the Chesapeake Bay TMDL (PGC DER 2012).

This report covers the watershed characterization to address the MDE TMDL for nutrients. Appendix A contains a fact sheet on this MDE TMDL. This fact sheet includes information on the TMDLs' technical approach, allocations, and other pertinent information.

1.2.1 Water Quality Standards

Water quality standards consist of designated uses, criteria to protect those uses, and antidegradation policies to protect waters from pollution. States assign designated uses based on their goals and expectations for water bodies. Each water body is assigned a designated use that should be attainable. Water quality criteria consist of narrative statements or numeric values designed to protect the designated uses. Water quality criteria describe the physical, chemical, and biological conditions necessary to support each designated use and might not be the same for all uses.

The entire Mattawoman Creek watershed has the following designated use (*Code of Maryland Regulations*[COMAR] 26.08.02.08 O): Use Class I: Water Contact Recreation, and Protection of Nontidal Warm Water Aquatic Life.

Maryland's General Water Quality Criteria states that "the waters of this State may not be polluted by…any material, including floating debris, oil, grease, scum, sludge and other floating materials attributable to sewage, industrial waste, or other waste in amounts sufficient to be unsightly; produce taste or odor; change the existing color to produce objectionable color for aesthetic purposes; create a nuisance; or interfere directly or indirectly with designated uses" [COMAR 26.08.02.03B(2)]. Specific water quality criteria also apply for the specific pollutants addressed in the TMDL for Mattawoman Creek watershed and are discussed below.

Nitrogen/Phosphorus Water Quality Criterion

Maryland does not have numeric criteria for nitrogen or phosphorus; therefore, other parameters such as DO are used in the TMDL process. Table 1-1 summarizes DO criteria applicable to the nutrients and biochemical oxygen demand (BOD) TMDL.

Table 1-1. Maryland dissolved oxygen water quality criteria

Designated Use	Period Applicable	DO Criteria
MD Use I-P	Year-round	≥ 5 mg/L (instantaneous)

Note: mg/L=milligrams per liter.

Sediment Water Quality Criterion

Non-tidal portions of the watershed are subject to Maryland's General Water Quality Criteria, for the protection of aquatic life. For tidal portions, it is based on an average Secchi disk depth equal to or greater than 0.4 meters for April 1 through October 31 of each year. Secchi depth is a measure of water clarity. The criterion is meant to protect submerged aquatic vegetation in the tidal portions of the watershed.

1.2.2 Problem Identification and Basis for Listing

Documentation for TMDLs includes discussion of the issues driving TMDL development, such as a description of the problem conditions that prompted a Section 303(d) listing and any monitoring data that were used to document and support the listing. This section provides a summary of the various problems identified in the Mattawoman Creek watershed and the data supporting the impairment decisions.

Mattawoman Creek (basin number 02-14-01-11) was first identified on the 1996 Section 303(d) list submitted to EPA by MDE. It was listed as being impaired by nutrients because of signs of eutrophication (expressed as high chlorophyll *a* levels), suspended sediments, and evidence of biological impacts. Eutrophication is the over-enrichment of aquatic systems by excessive nutrient inputs to the waterways. The nutrients act as fertilizer leading to excessive growth of aquatic plants that die and decompose, leading to bacterial consumption of DO from the water column and sediment layers. MDE only established the TMDL for nutrients (nitrogen and phosphorus) and the suspended sediments and biological impairments would be addressed at a later date, so this plan focuses only on nutrient pollution reduction.

However, because the creek is tidal and is part of the Lower Potomac River tributary strategy basin, the Chesapeake Bay Program provides the framework against which constituents such as nutrients, sediment, DO, and chlorophyll *a* concentration are measured to determine the health of the Chesapeake Bay and its tributaries. Data from two monitoring stations (MAT0016 and MAT0078) on Mattawoman Creek indicated chronic problems associated with eutrophication (low DO and high chlorophyll *a* concentrations).To support the TMDL analysis, MDE conducted specific surveys on the Creek to gather data in 2001 and 2002. Data collected during those surveys confirmed eutrophication conditions especially during critical summer low flow periods. During these periods, there is typically less streamflow available to flush the system, more sunlight to promote aquatic plant growth, and warmer temperatures, which are favorable conditions for biological processes of both plant growth and decay of dead plant matter.

Because of the generally level to moderate sloping topography and a soil texture consisting mostly of sandy soil in the creek watershed, minimum stream velocity was observed during the low flow season and indicators of eutrophication were usually found in the boundary between the tidal and non-tidal portion of the creek (between Harrison Cut and Route 225).

High chlorophyll a concentrations (158 micrograms per liter[μg/L]) and low DO (4.5 mg/L) were observed in August 2001 at Station HSC0002, which is between the outfall of the Town of Indian Head Wastewater Treatment Plant (WWTP), and the confluence between Harrison Cut and Mattawoman Creek. Another low DO (4.3 mg/L) concentration was observed at Station MAT0076 in August 2002. These observations have confirmed that the segments near these areas possess a great potential for eutrophication problems under critical low flow conditions.

1.2.3 TMDL Identified Sources

Nutrients are attributed to stormwater runoff from urban and non-urban areas, erosion and in-stream scour, subsurface drainages, septic systems, point source discharges (e.g., WWTPs), and any sanitary sewer overflows (SSOs). Sources of sediments in this watershed include agriculture and construction activities. Stream channel erosion is considered to be a most significant source of sediment. Tidal resuspension of bed sediments can also a factor in the tidal portion.

The Mattawoman Creek watershed has several point sources. The Indian Head WWTP at Harrison Cut is the major point source, having a design capacity of 0.5 million gallons per day (MGD). The following other point sources in the watershed have smaller load contributions: Lackey High School, Brandywine Receiving Station, and Lingafelt Residence. The Brandywine Station and Indian Head WWTP are within the County.

1.2.4 Previous Studies

In 2011 the County developed a Countywide WIP in response to the 2010 Chesapeake Bay Nutrient and Sediment TMDL. The WIP was finalized in 2012 and laid out a plan for best management practice (BMP) implementation and other restoration activities through 2017 and 2025. In addition to urban stormwater runoff, the WIP covered agricultural practices and upgrades to wastewater systems (i.e., municipal WWTPs and on-site wastewater systems). Although the plan is Countywide, aspects from it will be used in developing the restoration plan for the Mattawoman Creek watershed. The County's final WIP (PGC DER 2012) can be viewed at www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/FINAL_PhaseII_Report_Docs/Final_County_WIP_Narratives/PG_WIPII_2012.pdf.[1]

The Smithsonian Environmental Research Center (SERC) performed a study in 2000 that focused on nutrient and sediment dynamics in the Mattawoman Creek watershed. SERC performed long-term monitoring within this creek and adjacent watersheds to support this study, and the primary goal was to characterize the existing conditions and project water quality conditions for several future development scenarios.

The State of Maryland published its Phase I WIP in December 2010 for major basins including Mattawoman Creek. A primary goal was to identify target pollutant load reductions to be achieved by various sources and geographic areas within the state. MDE also published a Phase II WIP in October 2012, which contained detailed plans for meeting the TMDL, including target loads for various counties and the City of Baltimore, for which the individual jurisdictions were responsible. These included municipal WWTPs, urban stormwater, and septic system loads. Baseline loads and reduction targets for these types of loads were identified, along with the targets for agriculture and atmospheric deposition.

The U.S. Army Corps of Engineers (USACE, Baltimore District) developed a watershed management plan for Mattawoman Creek in 2003, in association with Charles County. The USACE Engineer Research and Development Center developed a Hydrological Simulation Program in Fortran (HSPF) model of this watershed. The Baltimore District used this calibrated model to evaluate the water quality impacts of various land use and management practices within the watershed. The study recommendations included implementing low-impact design techniques to minimize the amount of impervious surfaces in new developments, and examining stormwater retrofit opportunities in existing developments (especially small-scale housing and commercial areas).

[1]Accessed June 6, 2014.

MDE developed a comprehensive watershed report in March 2014 (MDE 2014) to document the biological impairment of the Mattawoman Creek watershed in Charles and Prince George's counties through a biological stressor identification analysis, which uses a case-control, risk-based approach to systematically and objectively determine the predominant cause of reduced biological conditions, thus enabling MDE to effectively direct corrective management action(s). The following are some key findings of this study: (a) the biological communities in this watershed are likely degraded because of acidity related stressors caused by atmospheric deposition and natural conditions in areas where the geology has little buffering capacity; (b) the biological communities are likely degraded because of inorganic pollutants (i.e., chlorides), that typically show increasing trends with urbanization and can be seasonal (e.g., salt application in winter); (c) sediment, in-stream habitat, or riparian habitat stressors were identified to be present and/or showing a significant association with degraded biological conditions; and (d) no nutrient stressors were present and/or nutrient stressors showing a significant association with degraded biological conditions.

2 WATERSHED DESCRIPTION

Mattawoman Creek is a tidally influenced embayment of the Potomac Estuary. The mainstem consists of a 23-mile non-tidal river flowing through Prince George's and Charles counties, and a tidal-freshwater estuary in Charles County. Mattawoman Creek estuary drains into the Potomac River. In the County, the estuary includes the drainage areas north of Mattawoman Creek, which is about one-fourth of the entire watershed (Figure 2-1).

The watershed is a mix of forests, wetlands, and suburban development located 12 miles south of Washington, D.C. The urbanization of forests and farmland has altered the watershed's character, especially in the headwaters. The stream runs through a broad floodplain within the Maryland coastal plain and southwest into the Mattawoman Creek estuary, which drains into the Potomac River.

The population of the Mattawoman Creek watershed is approximately 8,000 persons. This watershed portion is far less populated than some nearby watersheds. Figure 2-2 presents the population density (2010 U.S. Census population per square mile of the census tract). The western portions of the watershed within the County are the densest with a population of more than 650 people per square mile.

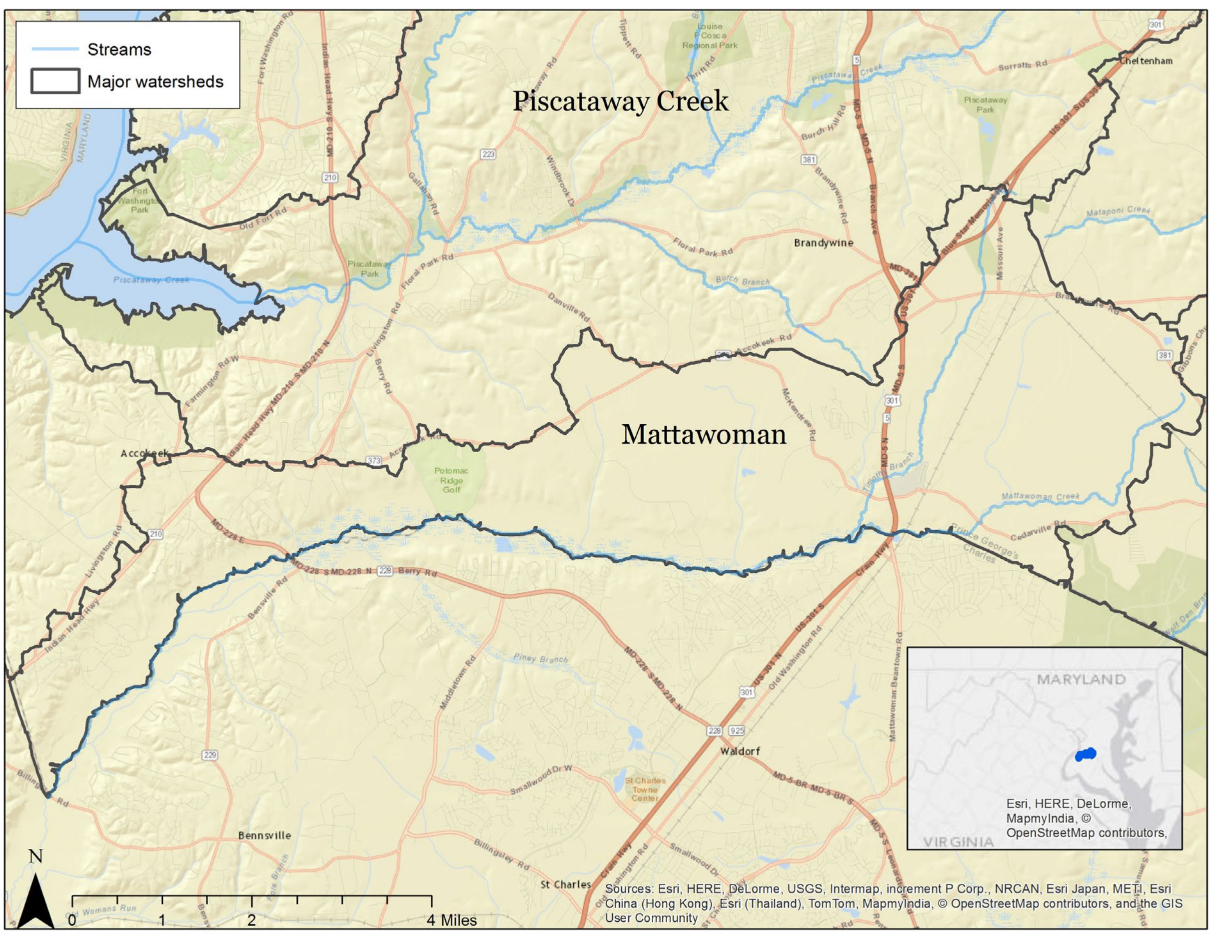
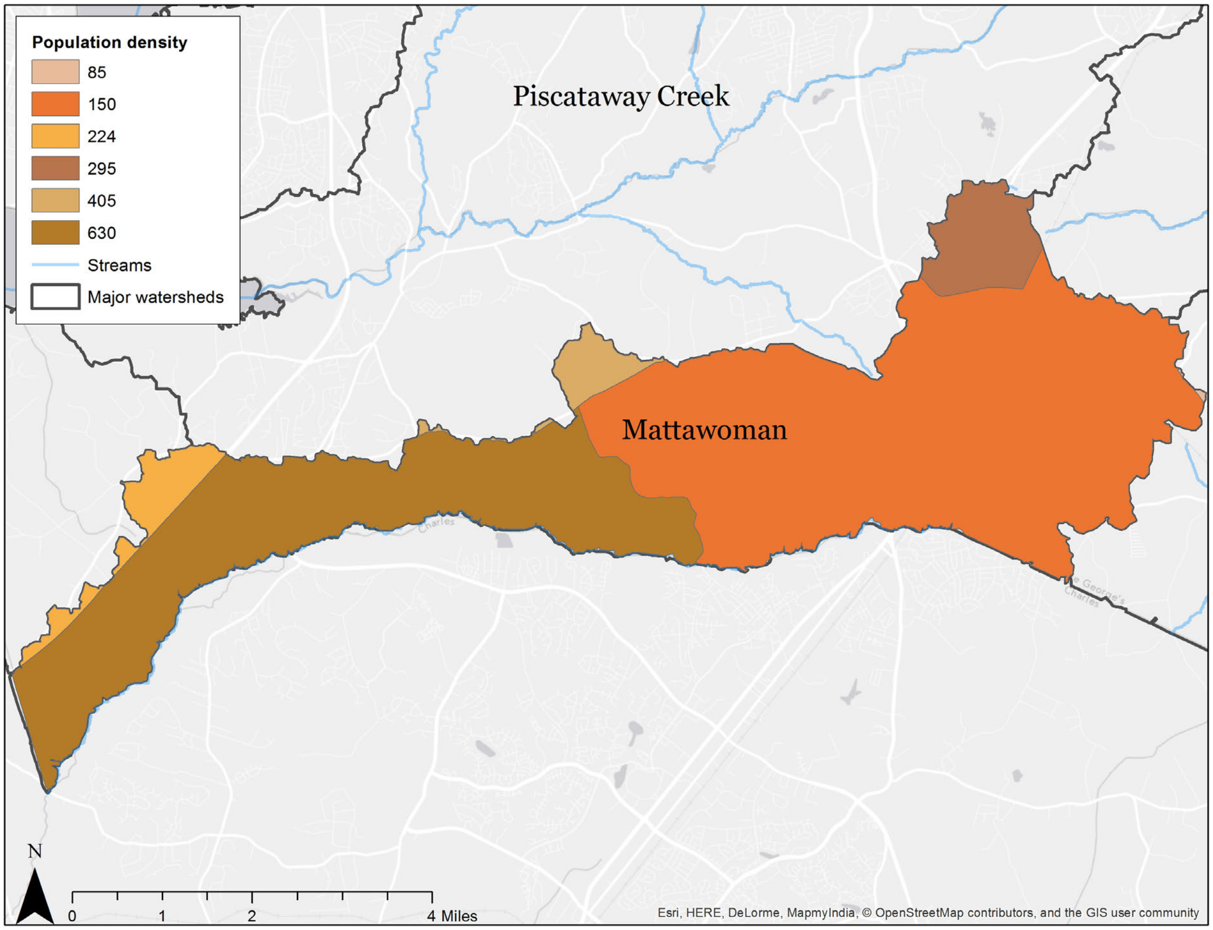


Figure 2-1. Location of the Mattawoman Creek watershed.



Source: Population data is from 2010 US Census

Figure 2-2. Population density (people per square mile) in the Mattawoman Creek watershed.

2.1 Physical and Natural Features

2.1.1 Hydrology

The Mattawoman Creek watershed is made up of nine subwatersheds in accordance with the Department of Natural Resource's 12-digit watershed designation. Some of the major tributaries include Harrison Cut, Piney Branch, Old Woman's Run, Laurel Branch, Timothy Branch and Marbury Run.

2.1.2 Climate/Precipitation

The Mattawoman Creek watershed is in a temperate area. The National Weather Service Forecast Office (2014b) reports a 30-year average annual precipitation of 39.74 inches. No strong seasonal variation in precipitation exists. On average, winter is the driest with 8.48 inches, and summer is the wettest with 10.44 inches (National Weather Service Forecast Office 2014a). The average annual temperature is 58.2 degrees Fahrenheit. The January normal low is 28.6 °F and the July normal high is 88.4 °F.

Evapotranspiration accounts for water that evaporates from the land surface (including water bodies) or is lost through plant transpiration. Evapotranspiration varies throughout the year because of climate, but is greatest in the summer. Potential evapotranspiration (Table 2-1) is the environmental demand for evapotranspiration.

Table 2-1. Average monthly (1975–2004) potential evapotranspiration (inches)

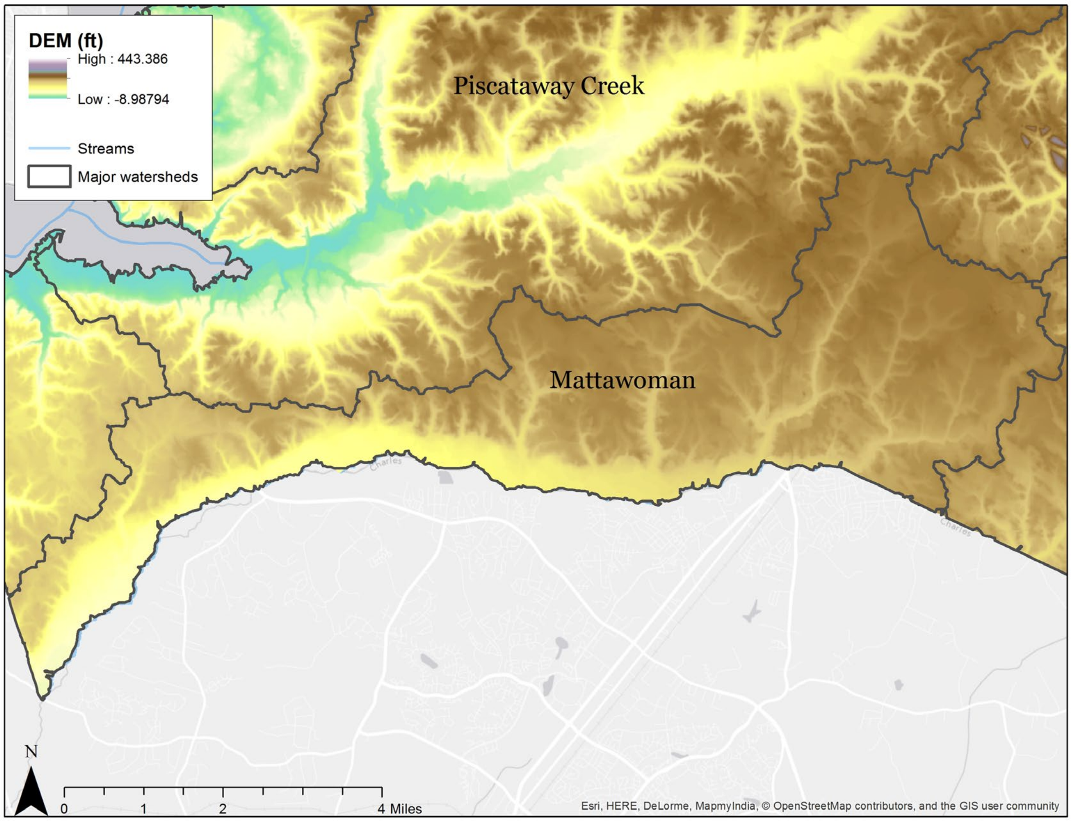
January	February	March	April	May	June
0.60	0.86	1.69	2.74	3.86	4.30
July	**August**	**September**	**October**	**November**	**December**
4.59	4.01	2.85	1.88	0.98	0.62

Source: NRCC 2014

2.1.3 Topography/Elevation

According to the Maryland Geological Survey, the Fall Line between the Atlantic Coastal Plain and the Piedmont approximates the boundary between Prince George's and Montgomery counties. The majority of the County portion of the watershed is in the coastal plain, which is underlain by unconsolidated sediments, including gravel, sand, silt, and clay (MGS 2012). The coastal plain is characterized by gentle slopes, meandering streams, and lower relief. The watershed is relatively flat with elevations typically only between sea level (at the confluence of the Potomac River) and 200 feet above sea level in the headwaters. The highest elevations in the watershed are in the eastern portion, with the lowest portions following the mainstem of Mattawoman Creek. Figure 2-3 shows a digital elevation map of the watershed that shows the variation in elevation within the entire watershed. The digital elevation map shows that there is a very gradual slope difference over the entire watershed.

The watershed slopes tend to be the transition from the upland coastal plain to the valley. Upstream portions of the valley are less steep, and therefore less noticeable on the landscape. In general, the broad valley functions as a floodplain and allows for biological and nutrient cycling from the forest interior to the stream system. The floodplain acts as a filter for pollutants coming from the developed portions of the watershed, allows for habitat connectivity between the forest and stream, and serves as a natural habitat corridor throughout the stream system. The floodplain also supports broad wetlands, allows for periodic overflow of the channels, and maintains a geographically stable stream system.



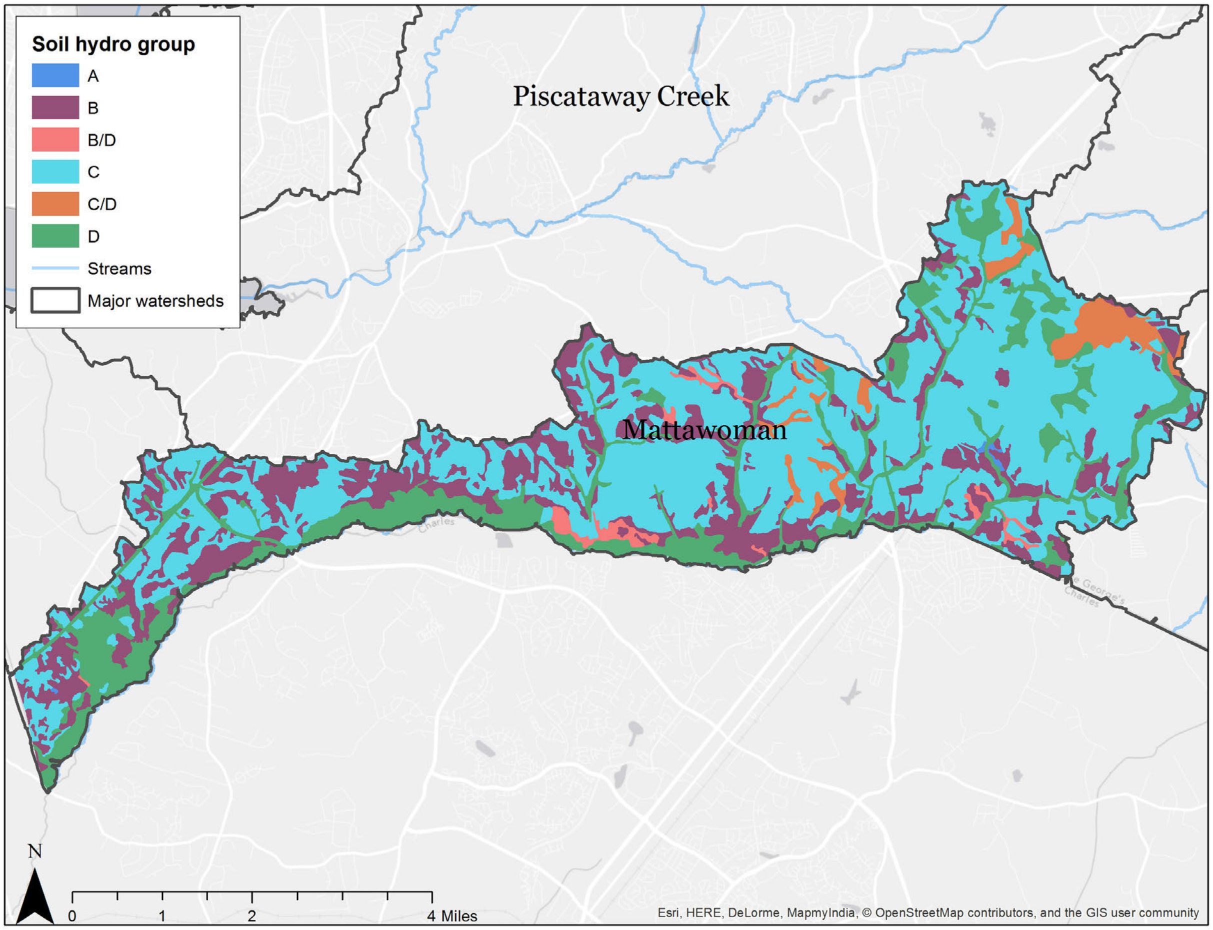
Source: DEM is from Prince George's County
Figure 2-3. Elevation in the Mattawoman Creek watershed.

2.1.4 Soils

The Coastal Plain Province is in general underlain by a wedge of unconsolidated sediments including gravel, sand, silt, and clay (MGS 2012). The soils underlying the Mattawoman Creek watershed are predominantly in the Beltsville series, which consists of nearly level to moderately sloping, moderately deep, moderately well-drained soils. Soils are strongly acidic and slowly permeable. Beltsville soils are formed in silty and moderately sandy material containing moderate amounts of clay (SCS 1974).

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service has defined four hydrologic soil groups providing a means for grouping soils by similar infiltration and runoff characteristics during periods of prolonged wetting. Poorly drained clay soils (Group D) have the lowest infiltration rates resulting in the highest amount of runoff, while well-drained sandy soils (Group A) have high infiltration rates, with little runoff.

Figure 2-4 presents the USDA hydrologic soil group data. The USDA data were null for some areas for some areas; therefore, the information was filled in with State Soil Geographic Database (STATSGO) data. The majority of the watershed is underlain by hydrologic soil group C soils. Hydrologic soil group A is the least represented in the watershed.



Source: 2002 Soils are from USDA NRCS

Figure 2-4. Hydrologic soil groups in the Mattawoman Creek watershed.

2.2 Land Use and Land Cover

Land use, land cover, and impervious area are some of the most important factors that influence the amount of pollution entering into the County's water bodies. Pollutants, like excess nitrogen or bacteria, vary on the basis of different land uses (e.g., commercial, agriculture, and parks). Increased impervious area increases the amount of runoff a rain event produces, thus transporting more pollutants to a water body in a shorter period of time.

2.2.1 Land Use Distribution

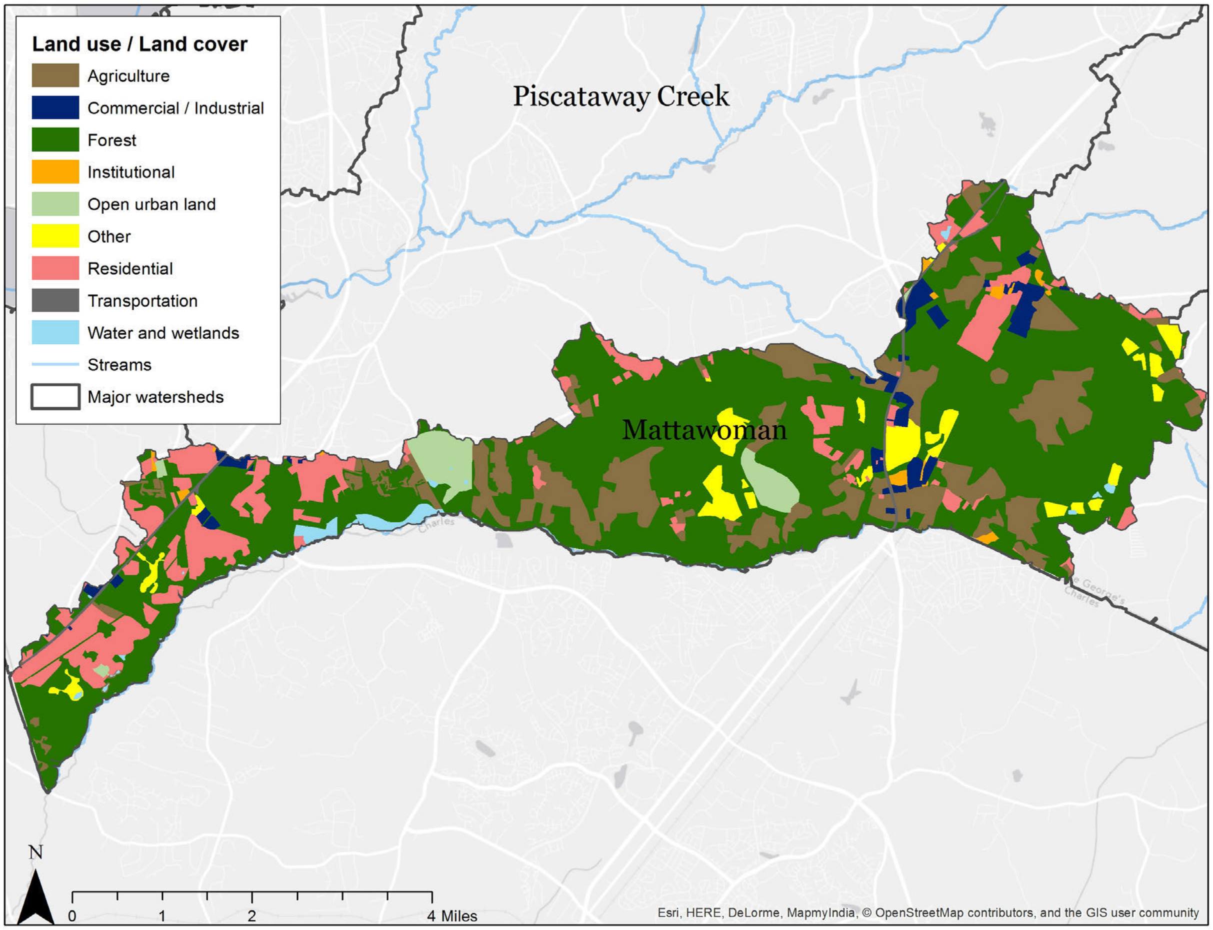
Land use information for the watershed is available from the previous watershed reports, TMDL reports, and previous restoration planning efforts, in addition to the Maryland Department of Planning (MDP) 2010 land use update (MDP 2010). Data from previous reports and the 2010 MDP are presented below for comparison and to illustrate how land use has changed in the watershed. However, only the MDP land use data are available as geographic information system (GIS) data, so these data are what will be used in the restoration plan. Land uses are made of many different land covers, such as roads, roofs, turf, and tree canopy. The proportion of land covers in each land use control the hydrologic and pollutant loading response of such uses. Table 2-2 summarizes the land uses within the County portion of Mattawoman Creek watershed on a sub-watershed basis.

Table 2-2. Mattawoman Creek watershed 2010 MDP land uses

Sub watershed	Agriculture (%)	Forest (%)	Urban (%)	Other (%)	Water and wetlands (%)
MC-1	3.0%	53.8%	39.6%	3.1%	0.4%
MC-2	0.7%	58.1%	36.8%	0.0%	4.3%
MC-3	33.0%	38.6%	23.6%	0.0%	4.9%
MC-4	14.5%	79.5%	6.1%	0.0%	0.0%
MC-5	24.0%	70.3%	2.6%	3.2%	0.0%
MC-6	15.4%	65.9%	8.2%	10.5%	0.0%
MC-7	22.2%	66.5%	11.4%	0.0%	0.0%
MC-8	15.9%	52.1%	20.6%	11.4%	0.0%
MC-9	10.7%	54.8%	33.8%	0.3%	0.4%
MC-10	52.3%	34.4%	13.1%	0.2%	0.0%
MC-11	39.4%	54.5%	6.2%	0.0%	0.0%
MC-12	16.8%	73.1%	6.3%	3.7%	0.0%
MC-13	15.0%	77.0%	1.5%	5.7%	0.7%

Source: MDP 2010 GIS Data

The main transportation corridor in the watershed is Maryland-Route 301, which runs the length of the watershed. Figure 2-5 shows the 2010 MDP land use for the watershed. Land cover in the Mattawoman Creek watershed is a mix of urban, suburban, forest, and agricultural uses. The majority of urban and suburban development is seen in the upper subwatersheds, much less in the County portion in comparison to the Charles County portion. Forest is the dominant land cover (more than 61 percent), followed by urban and agriculture uses (Table 2-3).



Source: MDP 2010

Figure 2-5. Land use in the Mattawoman Creek watershed.

Table 2-3. Mattawoman Creek watershed 2010 MDP land use in Prince George's County

Land Use	Acres	Percent of Total	Percent of Land Use Grouping
Agriculture	**2,539.8**	**15.95%**	**100.0%**
Agricultural building	57.8	0.36%	2.3%
Cropland	1,805.5	11.34%	71.1%
Feeding operations	15.0	0.09%	0.6%
Large lot subdivision (agriculture)	97.7	0.61%	3.8%
Orchards/vineyards/horticulture	0.0	0.00%	0.0%
Pasture	563.8	3.54%	22.2%
Row and garden crops	0.0	0.00%	0.0%
Forest	**9,760.1**	**61.31%**	**100.0%**
Brush	92.9	0.58%	1.0%
Deciduous forest	6,535.3	41.05%	67.0%
Evergreen forest	498.7	3.13%	5.1%

Land Use	Acres	Percent of Total	Percent of Land Use Grouping
Large lot subdivision (forest)	253.3	1.59%	2.6%
Mixed forest	2,379.9	14.95%	24.4%
Other	**599.2**	**3.76%**	**100.0%**
Bare ground	359.1	2.26%	59.9%
Beaches	0.0	0.00%	0.0%
Extractive	240.1	1.51%	40.1%
Urban	**2,877.2**	**18.07%**	**100.0%**
Commercial	193.5	1.22%	6.7%
High-density residential	47.3	0.30%	1.6%
Industrial	224.3	1.41%	7.8%
Institutional	79.9	0.50%	2.8%
Low-density residential	1,113.3	6.99%	38.7%
Medium-density residential	675.6	4.24%	23.5%
Open urban land	411.8	2.59%	14.3%
Transportation	131.5	0.83%	4.6%
Water and wetlands	**144.2**	**0.91%**	**100.0%**
Water	33.0	0.21%	22.9%
Wetlands	111.2	0.70%	77.1%

Source: 2010 MDP GIS data.

The urban area in the watershed is largely residential land (62 percent), with the majority being low-density residential (39 percent). However, in terms of the total watershed within the county, the urban land uses constitute about 18 percent. There are also significant areas of forested land (>61 percent) and agriculture (16 percent) among the non-urban portion of the County subwatersheds. Knowing this information will help during later stages in restoration planning because it will influence the types of water quality control practices—commonly known as BMPs—and where they can be installed. For instance, certain BMPs are preferred in medium-density residential areas, while other types are preferred in industrial areas.

2.2.2 Percent Imperviousness

According to Prince George's County Code, impervious area means an area that is covered with solid material or is compacted to the point where water cannot infiltrate into underlying soils (e.g., parking lots, roads, houses, patios, swimming pools, compacted gravel areas, and so forth) and where natural hydrologic patterns are altered.

Impervious areas are important in urban hydrology, in that the increased paved areas (e.g., parking lots, rooftops, and roads) decrease the amount of water infiltrating the soils to become ground water and increase the amount of water flowing to the stream channels in the watershed. This increased flow not only brings additional nutrients and other pollutants, but also increase the velocity of the streams, causing erosion and increased sediment, which makes the water muddy during periods of elevated flow such as during rain events.

Impervious area is made up of several types including buildings (e.g., roofs), parking lots, driveways, and roads. Each type has different characteristics and contribute to increased runoff and pollutant loadings in different ways. For instance driveways have a higher nutrient loading potential to waterways than roofs, due to factors such as grass clippings and potential fertilizer (accidentally spread on the drive way). Sidewalks will have a higher bacteria loading than driveways due to the amount of dogs that are walked along sidewalks. Besides the different types of impervious area, there are two subgroups of impervious land: connected and disconnected. On connected impervious land, rainwater runoff flows directly from the impervious surface to stormwater sewers, which in turn flow directly to streams. In disconnected impervious cover areas, rainwater runoff flows over grass, meadows, or forest areas before being intercepted by stormwater sewers, which then flow to streams. Directly connected impervious cover is substantially more detrimental to stream health and quality than disconnected land cover because the highly efficient conveyance system (stormwater pipes) associated with directly connected impervious cover increases both flow and pollutant transport to nearby streams.

Similar to the land use data, information on impervious area is available from the previous reports, in addition to 2009 County-specific information. Data from previous reports and the 2009 County data are presented below for comparison and to illustrate how impervious area has changed in the watershed. Only the 2009 County impervious data are available as GIS data, so these data will be used in the restoration plan.

According to MDP (2010), about 7.5 percent of the total watershed is impervious surface, which includes both Prince George's and Charles counties. Towson University (2000) data estimates the impervious cover to be 8.2 percent. Connected impervious areas are locations where stormwater runoff from an imperious area flows directly into a stream or a stormwater system, rather than flowing to a pervious area for infiltration. In this analysis, impervious surfaces in medium-density residential, high-density residential, commercial and industrial lands were assumed to be connected; whereas impervious surfaces in low-density residential, forest, and agricultural areas are considered to be disconnected (Table 2-4).

Table 2-4. Mattawoman Creek watershed M-NCCPC:PGC impervious area

Sub watershed	Area of Sub watershed (acre)	Area Impervious Total (acre)	Area Impervious Connected (acre)	Area Impervious Disconnected (acre)	% impervious	% Impervious Connected	% Impervious Disconnected
MC-1	2180.9	255.9	172.9	83.1	11.7%	7.9%	3.8%
MC-2	1101.9	83.6	31.7	51.9	7.6%	2.9%	4.7%
MC-3	1379.7	50.1	6.8	43.3	3.6%	0.5%	3.1%
MC-4	1355.8	23.9	2.9	21.0	1.8%	0.2%	1.6%
MC-5	844.1	11.1	0.4	10.7	1.3%	0.0%	1.3%
MC-6	1576.0	37.1	14.1	23.0	2.4%	0.9%	1.5%
MC-7	457.3	5.1	2.8	2.3	1.1%	0.6%	0.5%
MC-8	1590.0	214.0	184.5	29.6	13.5%	11.6%	1.9%
MC-9	1407.1	188.5	152.2	36.4	13.4%	10.8%	2.6%
MC-10	340.8	15.1	8.7	6.4	4.4%	2.6%	1.9%

Sub watershed	Area of Sub watershed (acre)	Area Impervious Total (acre)	Area Impervious Connected (acre)	Area Impervious Disconnected (acre)	% impervious	% Impervious Connected	% Impervious Disconnected
MC-11	445.9	9.2	1.1	8.0	2.1%	0.3%	1.8%
MC-12	1676.9	75.9	48.6	27.3	4.5%	2.9%	1.6%
MC-13	1580.0	19.9	2.5	17.3	1.3%	0.2%	1.1%
Total	15936.3	989.5	629.2	360.3	6.2%	3.9%	2.3%

Source: MDP 2010.

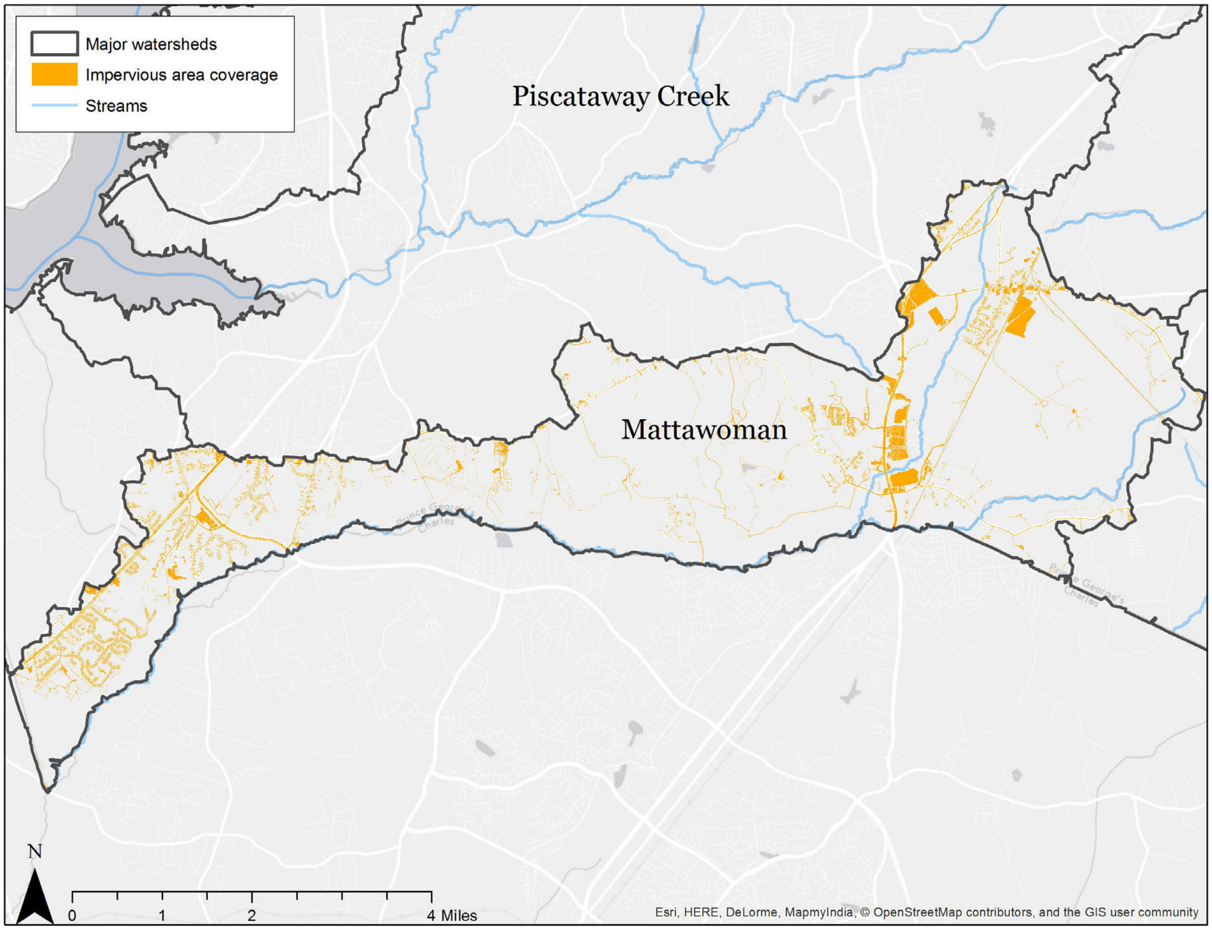
Table 2-5 presents impervious area information for the County's portion of the watershed. Currently, there are no estimates of connected impervious area in the 2009 County GIS data for comparison to previous data. This information will be estimated at a later phase of the restoration process. The majority of the impervious area in the watershed is roads and highways (36 percent of impervious area), parking lots (23 percent of the impervious area), and buildings (18 percent of the impervious area).

Table 2-5. Mattawoman Creek watershed impervious area in Prince George's County

Impervious Type	Area (acres)	Percent of Impervious Area	Percent of Total Watershed Area
Aviation	0.0	0.00%	0.00%
Bridges	0.9	0.08%	0.01%
Buildings	186.7	18.20%	1.17%
Driveways	105.6	10.29%	0.66%
Gravel surfaces	36.0	3.51%	0.23%
Other	4.6	0.45%	0.03%
Other concrete surfaces	11.3	1.10%	0.07%
Parking lots	239.3	23.33%	1.50%
Patios	7.2	0.70%	0.05%
Pools	0.9	0.09%	0.01%
Railroads	0.0	0.00%	0.00%
Roads and highways	366.7	35.74%	2.30%
Track and athletic	39.1	3.81%	0.25%
Walkways	27.7	2.70%	0.17%
Total	1,026.0	100.00%	6.44%

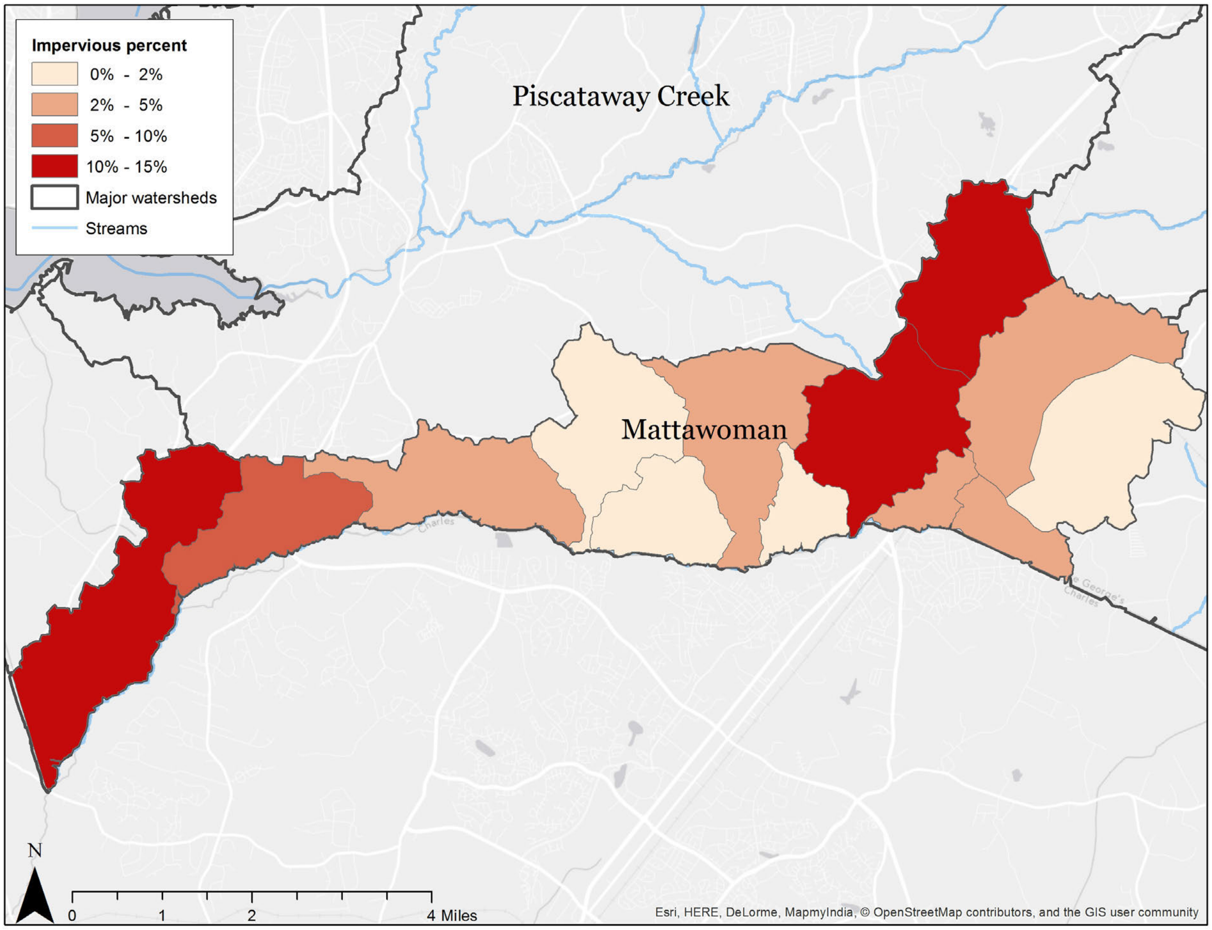
Source: 2009 Prince George's County GIS data

Figure 2-6 presents the 2009 County impervious area GIS information for the watershed, while Figure 2-7 shows the corresponding percentage impervious area calculated for each subwatershed, being used in the restoration planning process. As the figures illustrate, impervious areas are most concentrated in the southwestern portion of the watershed, which corresponds to the location of the majority of the urban areas. As with land use, the impervious areas are important to know for restoration planning.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 2-6. Impervious areas in the Mattawoman Creek watershed.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 2-7. Percent impervious areas in the Mattawoman Creek watershed.

3 WATER QUALITY AND FLOW CONDITIONS

Water quality and flow information are important parts of TMDL development and restoration planning. The water quality data helps illustrate the health of a water body. Flow data is important because it shows how water moves through the watershed. Historical flow data can also show the increase of urban stormwater runoff entering into water bodies, where, before development, the water infiltrated into the soils.

Water quality and flow data are typically available from several different sources. The TMDL reports typically provide the water quality information that was used in their development. Data can also be obtained from the *Water Quality Portal* (www.waterqualitydata.us/), which is sponsored by EPA, the U.S. Geological Survey (USGS), and the National Water Quality Monitoring Council and collects data from more than 400 federal, state, local, and tribal agencies. No surface water data was obtained from the portal. Similarly, EPA's STORET (STOrage and RETrieval) Data Warehouse was also searched for surface water quality data, but no recent data was found. MDE was contacted for additional data, but no water quality data was available for the Mattawoman Creek watershed.

The County implements its biological monitoring program to provide credible data and valid, defensible results to address questions related to the status and trends of stream and watershed ecological condition. Biological monitoring data are used to provide problem identification; documentation of the relationships among stressor sources, stressors, and response indicators; and evaluation of environmental management activities, including restoration.

3.1 Water Quality Data

Available water quality data in the Mattawoman Creek watershed is limited and outdated to support the assessment of existing water quality conditions. Several sources of information have been reviewed and summarized below in terms of the data quality and adequacy.

USGS had collected water quality data at four locations within Mattawoman Creek watershed in the 1950s. EPA's STORET database has data from March 2001 through September 2002 in the estuarine portion within Charles County (Lower Potomac River reach number 02070011).

As part of a sediment/nutrient dynamics analysis, the Smithsonian Center performed seasonal sampling of baseflows at 36 sites from March 1997 through May 2000 (SERC 2000). Out of these, there are six monitoring locations (140.2, 140.5, 145, 150, 151, and 155.5) within the Mattawoman Creek watershed where an extensive number of parameters were monitored. These parameters included water flow, total phosphate, total organic phosphorus, total phosphorus, ammonium, total nitrate, organic nitrogen, organic carbon (total and dissolved), total suspended solids, dissolved silicate, conductivity, sodium, potassium, magnesium, calcium, aluminum, iron, manganese, fluoride, chloride, and sulphate. Multiregression analyses were performed to derive water quality parameters not monitored during the study, so as to assess the sediment and nutrient dynamics within the Charles County portion of this watershed.

USACE used the Smithsonian Center water quality data (SERC 2000) to setup and calibrate HSPF models of the Mattawoman Creek watershed within Charles County. These models were used to support future water quality projections associated with different levels of development and management.

MDE compiled long-term water quality data from 1985 to 2002 at eight locations within the mainstem and tributaries of Mattawoman Creek watershed. The location, MAT0078, is at the head-end of the creek, which is about 6.1 miles upstream of the confluence of Mattawoman Creek with the Potomac River. HSC0002 is in a tributary, Harrison Cut, where Indian Head's WWTP effluent outfall discharges. Another location, MAT0016, is near the confluence and is approximately 1.2 miles from the mouth.

DO is a parameter of concern commonly associated with nutrient impairments and eutrophication-impacted water bodies. Aquatic organisms require adequate DO concentrations for survival. DO levels are typically cyclical they are influenced by temperature and photosynthesis, with levels often falling at night in impaired water bodies. Maryland has numeric criteria for DO that specify minimum concentrations.

Water quality data on DO and chlorophyll *a* at these two locations, MAT0078 and MAT0016, were used to support the development of nutrient (phosphorus and nitrogen) TMDLs for the creek. Figures 8 through 10 in MDE (2004) show the long-term water quality trends until 2002, in which high levels of chlorophyll *a* can be associated with low DO levels, exhibiting eutrophic conditions within the creek. Generally, the DO levels went below 5 mg/L and up to 3 mg/L in peak summer months, when the chlorophyll *a* levels were higher than 50 µg/L and up to 140 µg/L. The data from about 1999 through 2002 showed that samples met the chlorophyll *a* criterion of less than 50 µg/L and the DO criterion of not below 5 mg/L.

Although sediments have been attributed to biological impairment in Mattawoman Creek, MDE is planning to address sediments in a future TMDL effort.

3.1.1 Nitrogen

Nitrogen at levels higher than 10 mg/L can lead to a condition called methemoglobinemia in infants and at levels higher than 100 mg/L can lead to taste problems and physiological distress (Straub 1989). However, a more common effect of excess nitrogen and its constituent parameters is that it plays an important role in eutrophication of water bodies. *Eutrophication* is the over-enrichment of aquatic systems by excessive inputs of nutrients. It is associated with an overabundance of aquatic plant growth including phytoplankton, periphyton, and macrophytes. Nitrogen acts as a fertilizer for aquatic plant communities, leading to explosive plant growth followed by die-off and depletion of DO levels as the dead plant matter decays. Maryland does not specify numeric standards for nitrogen species; however, many TMDLs identify as endpoints, levels of nitrogen associated with maintaining DO levels to support aquatic life.

A review of SERC (2000) water quality data revealed that the flow-weighted total nitrogen levels were in the range of 0.690–0.722 mg/L at the upstream location 140.5 and in the range of 0.577–0.648 mg/L at the downstream location 155. These levels are much lower than the threshold of 10 mg/L referred to above.

3.1.2 Phosphorus

Like nitrogen, excessive loading of phosphorus into surface water bodies can lead to eutrophication by fueling aquatic plant growth. Phosphorus in fresh and marine waters exists in organic and inorganic forms. The most readily available form for plants is soluble inorganic phosphorus ($H_2PO_4^-$, HPO_4^{2-}, and PO_4^{3}), also commonly referred to as soluble reactive phosphorus. Phosphorus is also able to sorb to sediment particles and is carried into water bodies by upland and streambank erosional processes. Maryland does not have numeric criteria for phosphorus.

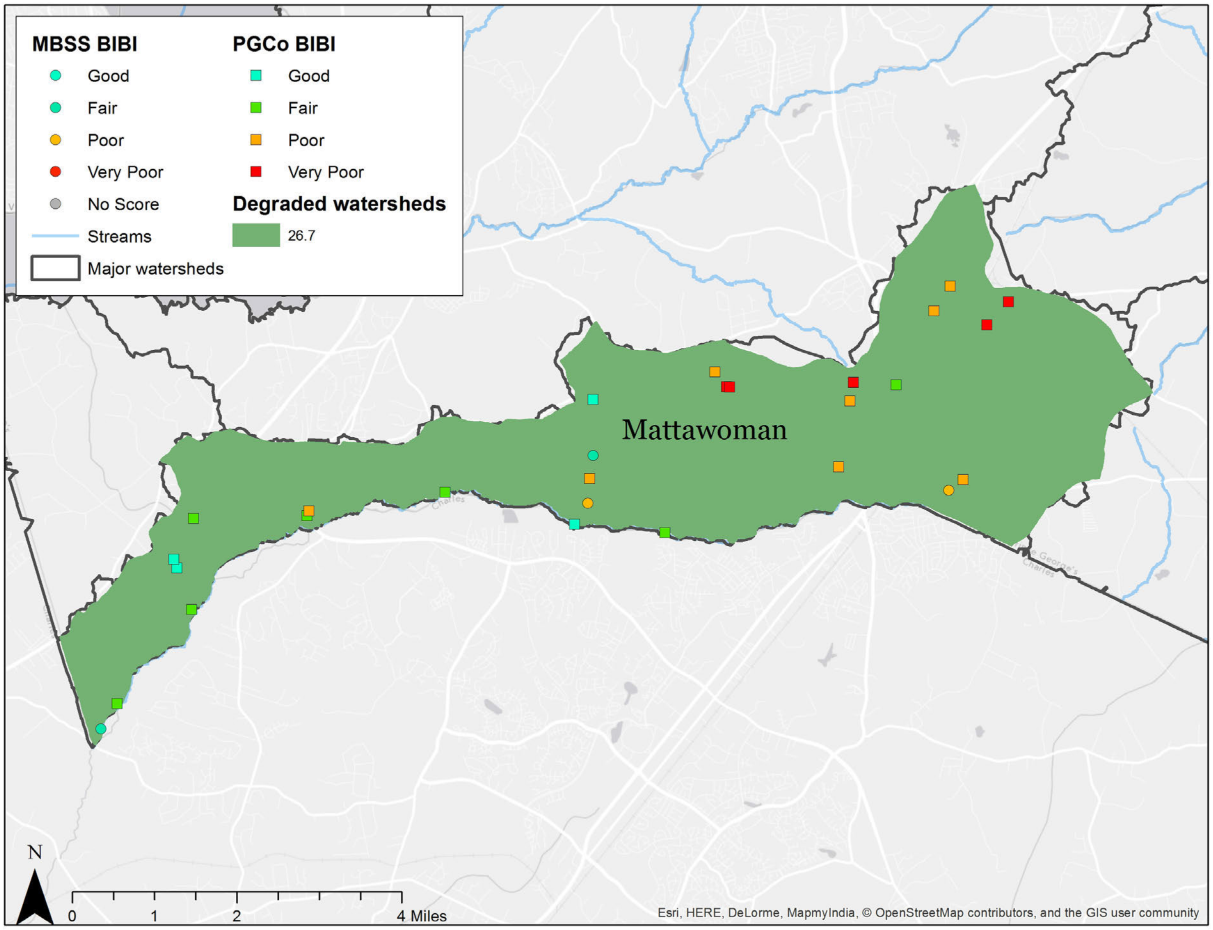
Similar to total nitrogen, a review of SERC (2000) water quality data was performed to assess the total phosphorus levels at the various monitoring locations of that study. This review revealed that the flow-weighted total phosphorus levels were in the range of 0.100–0.110 mg/L at the upstream location 140.5 and in the range of 0.081–0.119 mg/L at the downstream location 155.

3.2 Biological Station Data

Since 1999 two rounds of a Countywide bioassessment study have been completed; the first round from 1999 to 2003 and the second round from 2010 to 2013. In 2013, the third and final year of Round 2, 10 subwatersheds or subwatershed groups were assessed, including 1 in the Anacostia River basin, 5 in the Patuxent River basin, and 4 in the Potomac River basin (Millard et al. 2013). Using the Maryland Department of Natural Resources Benthic Index of Biotic Integrity (B-IBI), approximately 50 percent of the sites assessed during Year 3 were rated biologically impaired (Poor or Very Poor B-IBI rating).

Figure 3-1 provides results of the second round of benthic invertebrate and B-IBI sampling in the Mattawoman Creek watershed. Between 2001 and 2006, developed land increased 2 percent and forested land decreased 2 percent. Fifteen sites were sampled in 2013, yielding a mean B-IBI score of 3.4 (standard deviation = 0.97) and ranging from a low of 1.6 (site 31-214) to a high of 4.7 at site 31-213. The three lowest-scoring sites for this watershed (31-202, 31-206, and 31-214) were all very small streams within a quarry to the south of Accokeek Road (MD-373). There were 115 unique benthic taxa identified, of which 35 percent were the moderately tolerant Chironomidae. Habitat scores across the Mattawoman watershed were fairly high overall, with a mean score of 149 (standard deviation = 16.3; Supporting). Site 31-205 had the highest habitat score (173, Comparable) and sites 31-201 and 31-204 had the lowest scores of 111 and 133, respectively. The number of biologically degraded stream miles decreased from Round 1; however, the decrease is not statistically significant. The Round 2 estimate fell approximately 19 percent from 46 to 27 percent.

MDE also performed a biological stress identification (BSID) study published in March 2014, which included drainage areas of Mattawoman Creek in Prince George's and Charles counties. The parameters used in the BSID analysis were segregated into five groups: land use sources, and stressors representing sediment, in-stream habitat, riparian habitat, and water chemistry conditions. Through the BSID analysis, MDE identified land use sources and water chemistry parameters significantly associated with degraded fish or benthic biological conditions. Sediment conditions, riparian habitat conditions, and in-stream habitat conditions did not show significant association with Poor to Very Poor stream biological conditions (i.e., removal of stressors would result in improved biological community). Specifically, high chlorides, high conductivity, low field pH, and acid neutralizing capacity (ANC) below chronic level have been identified to show a high level of correlation with Poor to Very Poor stream biological conditions.



Source: Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech
MBSS = Maryland Biological Stream Survey

Figure 3-1. Results of benthic invertebrate and B-IBI sampling in the Mattawoman Creek watershed.

This watershed includes several heavily traveled road routes, such as Routes 301, 5, and 210 among others, connecting the urban areas of the watershed. MDE (2014b) identifies that the application of road salts in the watershed is a likely source of the chlorides and high conductivity levels. Although chlorides can originate from natural sources, most of the chlorides that enter the environment are associated with the storage and application of road salt.

MDE (2014b) also attributes the on-site septic systems and stormwater discharges to be likely sources of elevated concentrations of chloride, sulfates, and conductivity. Currently there are no specific numeric criteria in Maryland that quantify the impact of chlorides, sulfates, or conductivity on the aquatic health of non-tidal stream systems.

Low field pH levels below 6.5 were identified as significantly associated with degraded biological conditions (MDE 2012; MDE 2014b) in Mattawoman Creek watershed, and found to affect approximately 50 percent of the stream miles with Poor to Very Poor biological conditions. Low pH might allow concentrations of toxic substances (such as ammonia, nitrite, and aluminum) and dissolved heavy metals (such as copper and zinc) to be mobilized for uptake by aquatic plants and animals. Some types of plants and animals can tolerate acidic waters, but others can be acid-sensitive and be eliminated as the pH declines. Generally, the young of most species are more sensitive to environmental conditions than adults. At pH 5, most fish eggs cannot hatch. At lower pH levels, some adult fish die (USEPA 2013). Common sources of acidity include mine drainage, atmospheric deposition, runoff from mine tailings, agricultural fertilizers, and natural organic sources.

Low ANC below chronic level was identified as significantly associated with degraded biological conditions in the Mattawoman Creek watershed and found in approximately 35 percent of the stream miles with Poor to Very Poor biological conditions. ANC is a measure of the capacity of dissolved constituents in the water to react with and neutralize acids. ANC can be used as an index of the sensitivity of surface waters to acidification. The higher the ANC, the more acid a system can assimilate before experiencing a decrease in pH. Repeated additions of acidic materials, like those found in atmospheric deposition (NADP 2012), generally cause a decrease in ANC. ANC values less than 50 µ/L are considered to demonstrate chronic (highly sensitive to acidification) exposures for aquatic organisms, and values less than 200 are considered to demonstrate episodic (sensitive to acidification) exposures (Kazyak et al. 2005; Southerland et al. 2005; Southerland et al. 2007).

Non-tidal streams in the Mattawoman Creek watershed, a region in the Coastal Plains of Maryland with inherently poor buffering capacity in the rocks and soils, are more susceptible to acidification from these and other acid sources than streams in the Piedmont region. The primarily sandy soils in the Mattawoman Creek watershed provide little buffering ability.
The results of the National Atmospheric Deposition Program/National Trends Network (NADP 2012) indicate that Maryland is in or near the region of most acidic precipitation and receives some of the highest concentrations of sulfate and nitrate deposition in the United States (MD DNR 2010). The soils and geology of the Mattawoman Creek watershed has limited buffering capacity; therefore, wet and dry acid deposition falling on the landscape will experience minimal neutralization before it runs off into streams resulting in acidic waters.

In spite of the biological impairments discussed above, the assessments made by the Maryland Department of Natural Resources have found “Mattawoman represents as near to ideal conditions as can be found in the northern Chesapeake Bay” and “Mattawoman is the best, most productive tributary in the Bay.” This watershed is considered a high-quality aquatic ecosystem, and supports rare and diverse animal assemblages. Portions of the non-tidal stream system have excellent water quality and biodiversity, including one Maryland Department of Natural Resources MBSS Sentinel Site, Tier II waters, and stronghold watersheds. The Mattawoman Creek watershed contains stronghold watersheds because there are stream segments with rare, threatened, or endangered freshwater fish, amphibians, reptiles, or mussel species. It is the eighth-ranked watershed for freshwater stream biodiversity (of 137 watersheds in Maryland) and is home to 6 stream species that are referenced within the Rare, Threatened, and Endangered animals of Maryland (MD DNR 2012).

3.3 Flow Data

Flow in a water body is the result of several factors, with the most significant being rainfall and subsequent runoff; snow melt; ground water inflow into a water body; and release of water from upstream holding facilities such as reservoirs or stormwater detention systems. Flow can change over time as urbanization occurs. Urbanization results in increased impervious area (e.g., roof tops, parking lots, and roads). This area prevents water from infiltrating into the ground, resulting in more water flowing to streams during rainfall events, creating higher peak flows. These peak flows can bring higher levels of sediment and other pollutants into the water body.

USGS maintained a gauging station on Mattawoman Creek near Pomonkey, Maryland, from 1949 through 1972. This gauge (Station No. 01658000 at latitude 38° 35' 45" north and longitude 77° 03' 25" west) was approximately 12.6 miles upstream of the mouth, with a contributing drainage area of 57.7 square miles. The average discharge was 54.2 cubic feet per second (cfs) for the period of record from October 1951 through September 1972. The median flow was about 23 cfs. The highest flow (9,300 cfs) observed on Mattawoman Creek near Pomonkey occurred on August 13, 1955.

SERC (2000) also measured flows continuously from 1997 to 2000 to support the characterization of sediment and nutrient dynamics in this watershed.

4 POLLUTANT SOURCE ASSESSMENTS

Point sources are permitted through the National Pollutant Discharge Elimination System (NPDES) program. Nonpoint sources are diffuse sources that typically cannot be identified as entering a water body through a discrete conveyance at one location. Nonpoint sources can originate from land activities that contribute nutrients or total suspended solids to surface water as a result of rainfall runoff. For the TMDLs in this report, all sources of pollutant loading not regulated by NPDES permits are considered nonpoint sources.

4.1 NPDES Permitted Facilities

Under Title 40 of the *Code of Federal Regulations* section 122.2, a *point source* is described as a discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The NPDES program, established under Clean Water Act sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources, including urban stormwater systems, known as MS4s. The County is an MS4-permitted discharger.

4.1.1 MS4 (Phase I, Phase II, MDOT, Federal)

Stormwater discharges are generated by runoff from urban land and impervious areas such as paved streets, parking lots, and rooftops during precipitation events. These discharges often contain high concentrations of pollutants that can eventually enter nearby water bodies.

Under the NPDES stormwater program, operators of large, medium, and regulated small MS4s must obtain authorization to discharge pollutants. The Stormwater Phase I Rule (55 *Federal Register* 47990, November 16, 1990) requires all operators of medium and large MS4s to obtain an NPDES permit and develop a stormwater management program. Medium and large MS4s are defined by the size of the population in the MS4 area, not including the population served by combined sewer systems. A medium MS4 has a population between 100,000 and 249,999. A large MS4 has a population of 250,000 or more. The Stormwater Phase II Rule (64 *Federal Register* 68722, December 8, 1999) applies to operators of regulated small MS4s with a population less than 100,000 not already covered by Phase I; however, the Phase II Rule is more flexible and allows greater variability of regulated entities than does the Phase I Rule. Regulated, small MS4s include those within boundaries of urbanized areas as defined by the Bureau of Census and those designated by the NPDES permitting authority. The NPDES permitting authority may designate a small MS4 under any of the following circumstances: the MS4's discharges do or can negatively affect water quality; population exceeds 10,000; population density is at least 1,000 people per square mile; or contribution of pollutant loadings to a physically interconnected MS4 is evident. None of the municipal entities within the County in this watershed are covered under the Phase II MS4 permit. For municipal entities such as Pomonkey and Accokeek, the County's Phase I stormwater permit will be the mechanism to support restoration planning and implementation of pollution control measures.

In addition to municipalities, certain federal, state, and other entities are also required to obtain a Phase II MS4 permit. Table 4-1 presents these permitted other entities within the Mattawoman Creek watershed.

Table 4-1. Phase II MS4 permitted federal, state, and other entities in Mattawoman Creek watershed

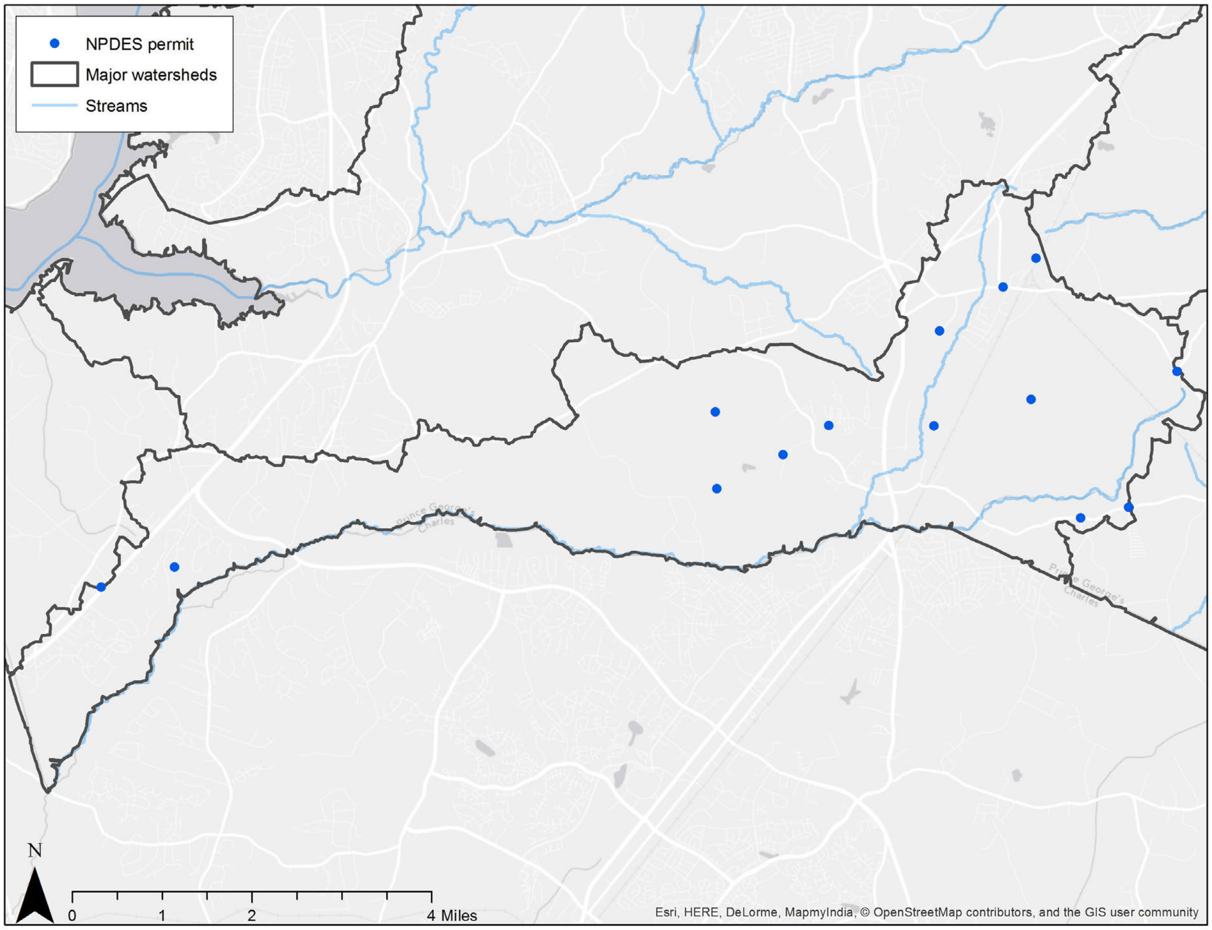
Agency	Installation/Facility
Washington Suburban Sanitary Commission	Multiple Properties
Maryland State Highway Administration	Multiple (outside Phase I Jurisdictions)

4.1.2 Other NPDES Permitted Facilities

NPDES permit information was obtained from MDE's website and EPA's Integrated Compliance Information System. Figure 4-1 shows the locations of the permitted facilities that discharge to surface water in the watershed. Because of the number of facilities, any available information on the facilities is listed in Appendix B. Depending on permit conditions, a discharger is required to submit a discharge monitoring report (DMR) that reports pollutant concentration or loading data along with other information, such as flow or pH. The required information varies by discharger and depends on the type of facility. Appendix B also includes summaries of available relevant permit limit and DMR data.

The permit review revealed that there are 14 permitted facilities in the watershed. These facilities are permitted for discharging from construction sites, mining facilities, de-watering activities, refuse sites, and swimming pools.

The County maintains stormwater pollution prevention plans (SWPPP) for its facilities. There currently are ten County facilities and nine other municipal facilities covered by the NPDES General Industrial permit and which require a SWPPP. The County currently conducts field verification of these facilities to assure that each SWPPP accurately reflects the environmental and industrial operations of the facility. If deficiencies in the SWPPP are noted, the County provides the required technical support to upgrade the plans. The County also monitors all SWPPP implementation activities through its database tracking system and provides MDE with an annual report documenting the status of each County-owned facility SWPPP.



Source: MDE and EPA ICIS database

Figure 4-1. Permitted discharges in the Mattawoman Creek watershed.

4.1.3 Wastewater

Wastewater facilities can include those publicly owned treatment works providing wastewater treatment and disinfection for sanitary sewer systems or industrial facilities providing treatment for process waters. In the Mattawoman Creek watershed, one federal facility and one municipal treatment plant within the County are permitted to discharge treated sanitary wastewater in the watershed. Table 4-2 lists these facilities, which do notfall under the purview of the MS4 permit.

Table 4-2. Wastewater treatment plants in Mattawoman Creek watershed

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MD3264Q98	Cedarville Mobile Home Park	General Permit	Mobile Home Site Operators/WWTP	10/25/10	12/01/10	11/30/15
MD0025658	Brandyvine Receiving Station (also known as Indian Head WWTP)	NPDES Individual Permit	WWTP	04/13/10	05/01/10	04/30/15

Note: WWTP = wastewater treatment plant.

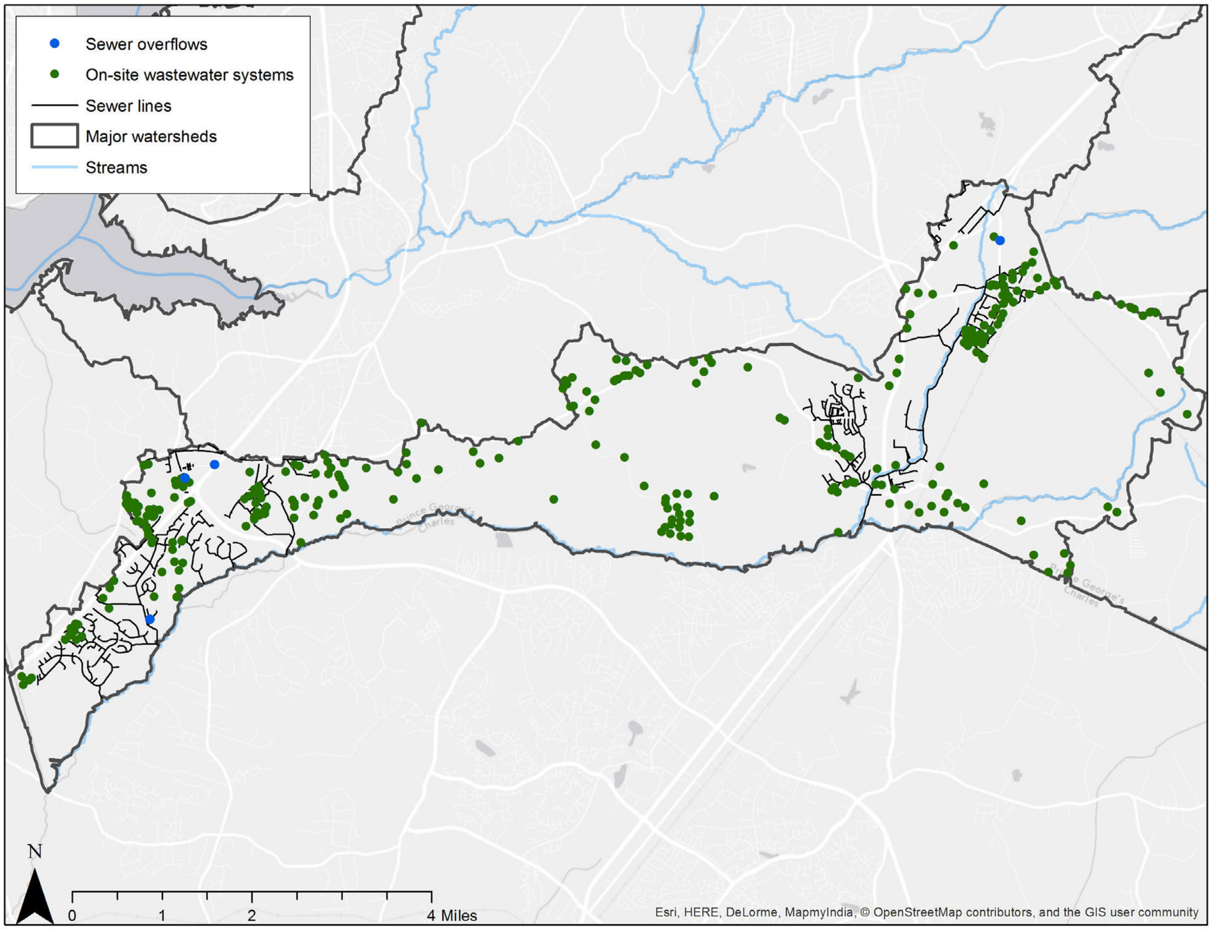
Sanitary sewers occasionally unintentionally discharge raw sewage to surface waters in events called SSOs. These events contribute nutrients, bacteria, and solids into local waterways. SSOs can be caused by sewer blockages, pipe breaks, defects, and power failures. The Maryland Reported Sewer Overflow Database contains bypasses, combined sewer overflows, and SSOs reported to MDE from January 2005 through the most recent update. Data on SSOs in the County were obtained from the database and are summarized in Table 4-3 for the Mattawoman Creek watershed. Since 2005 an estimated 31 gallons of sanitary overflows have been reported in the County. For that period, the average amount of annual overflow has been 3.5 gallons, with a minimum of 2 and a maximum of 29 gallons occurring in 2009.

Figure 4-2 shows the locations of SSOs. The Washington Suburban Sanity Commission is currently addressing problems that cause SSOs through their Sewer Repair, Replacement and Rehabilitation (SR3) Program.

Table 4-3. Summary SSO overflow (gallons) in the Mattawoman Creek watershed by year

Causes	2005	2006	2007	2008	2009	2010	2011	2012	2013
Blockage	0	0	0	0	28	0	0	0	0
Mechanical Failure	0	0	0	0	0	0	2	0	0
Roots	0	0	0	0	1	0	0	0	0
Total	0	0	0	0	29	0	2	0	0

County data from 2011 indicate that there are approximately 340 on-site wastewater systems within the watershed. Although these systems are typically not considered point sources, they are included in this section to provide a complete picture of sanitary wastewater in the watershed. These types of systems can contribute nitrogen loadings to nearby water bodies through their normal operation. Failing on-site systems can increase nitrogen, phosphorus, and bacteria levels. No information is currently available as to the age, maintenance, or level of treatment of the systems. Figure 4-2 shows the locations of on-site wastewater systems.



Source: Storm sewer pipes are from DoE and overflows from MDE, June 2014

Figure 4-2. Sanitary sewer lines, overflow sites, and on-site wastewater systems in the Mattawoman Creek watershed.

4.2 Nonpoint and Other Sources

Nonpoint sources can originate from rainfall runoff (in non-urban areas) and landscape-dependent characteristics and processes that contribute sediment, organic matter, and nutrient loads to surface waters. Nonpoint sources include diffuse sources that cannot be identified as entering the water body at a specific location. Because the County is considered a Phase I MS4, for TMDL purposes, all urban areas within the County are considered to be point sources and allocated loads are considered under the WLA component. Mechanisms under which urban or MS4 loads are generated are the same as other rainfall-driven nonpoint sources. Potential sources vary greatly and include agriculture-related activities, atmospheric deposition, on-site treatment systems, streambank erosion, wildlife, and unknown sources.

Atmospheric deposition occurs by two main methods: wet and dry. Wet deposition occurs through rain, fog, and snow. Dry deposition occurs from gases and particles. Particles and gases from dry deposition can be washed into streams from trees, roofs, and other surfaces by precipitation after it is deposited. Winds blow the particles and gases contributing to atmospheric deposition over far distances, including political boundaries, such as state boundaries.

Streams and rivers can be vulnerable to nutrient inputs from wildlife. Wild animals with direct access to streams include deer, raccoons, other small mammals, and avian species. This access to streams contributes bacteria and nitrogen to water bodies.

Development in the watershed has altered the landscape from pre-settlement conditions, which included grassland and forest, to post-settlement conditions, which include cropland, pasture, and urban/suburban areas. This conversion has led to increased runoff and flow into streams versus pre-settlement conditions, as well as streambank erosion and straightening of meandering streams. The increased erosion not only increases sediment loading to water bodies but also increases loadings of nutrients and other pollutants (e.g., polychlorinated biphenyls) that are adsorbed to the particles.

4.3 Existing BMPs

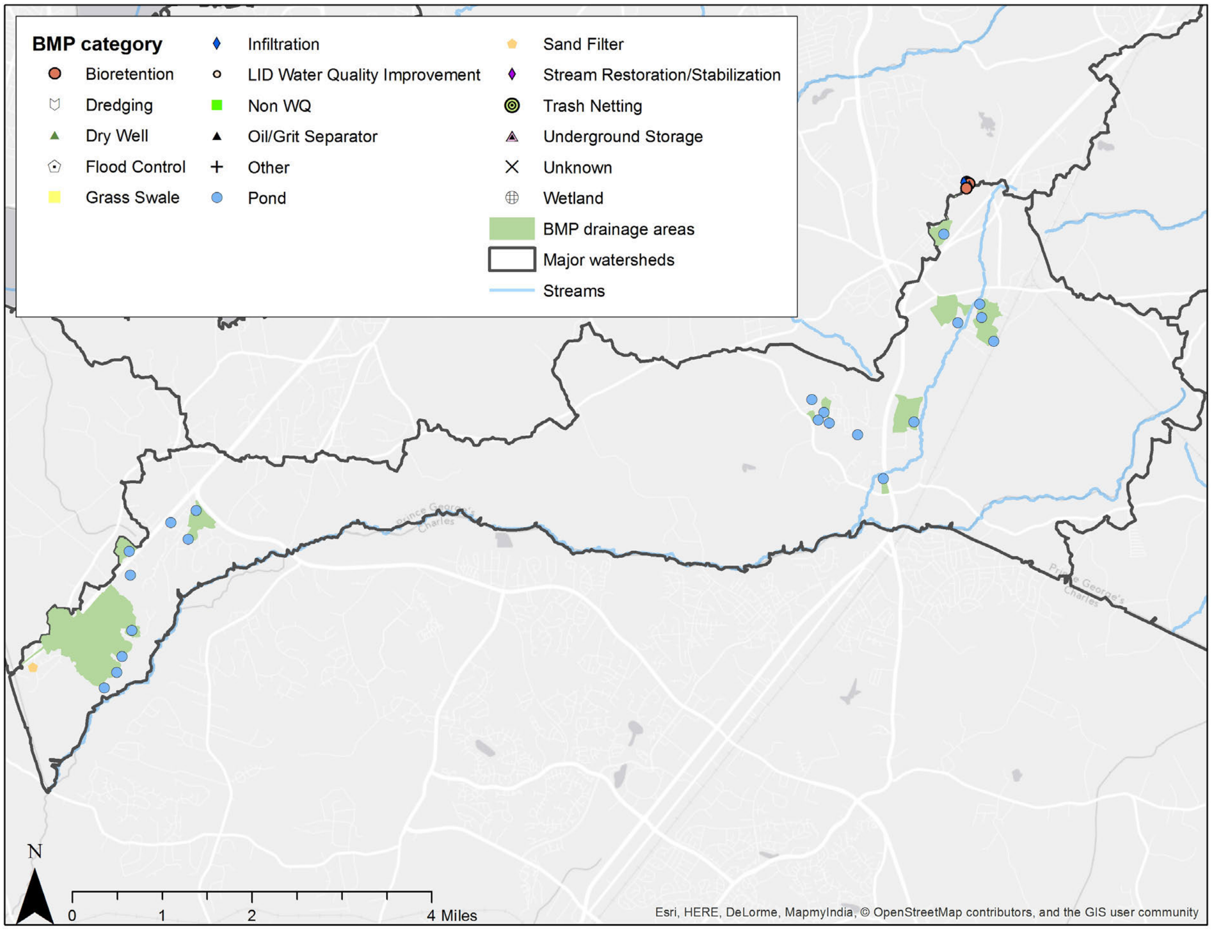
BMPs are measures used to control and reduce sources of pollution. They can be structural or nonstructural and are used to address both urban and agricultural sources of pollution. Structural practices include practices that are constructed and installed such as detention ponds, porous pavement, or bioretention systems. Nonstructural BMPs include institutional, educational, or pollution prevention practices that when implemented work to reduce pollutant loadings. Examples of nonstructural BMPs include implementation of strategic disconnection of impervious areas in a municipality, street sweeping, homeowner and landowner education campaigns, and nutrient management. Different types of BMPs remove pollutants at different levels of efficiency. Ponds tend to have lower efficiencies (but can treat larger areas), while bioretention systems and infiltration practices tend to have higher efficiencies (but can only treat smaller areas).

The County has implemented both structural and nonstructural BMPs in furtherance of a variety of programmatic goals and responsibilities including permit compliance, TMDL WLAs, flood mitigation, and others. Table 4-4 presents the list of known public and private structural BMPs in the County's portion of the Mattawoman Creek watershed. Figure 4-3 presents the locations of the BMPs in the watershed. The County also engages in street sweeping, public outreach to promote environmental awareness, green initiatives, and community involvement in protecting natural resources. Past public outreach activities include educational brochures on stormwater pollution awareness, outreach in schools, *Can the Grease* program to decrease the amount of SSOs, and recycling programs.

Table 4-4. List of BMP types in the Mattawoman Creek watershed

BMP Type	Total	Total w/DA	Total Acres Treated	Avg. Acres Treated
Bioretention	5	5	2.26	0.45
Infiltration	2	2	1.77	0.89
Pond	21	16	754.80	47.17
Total	29	23	758.83	32.99

Note: DA=drainage area.



Source: BMPs and storm sewer pipes are from DoE, June 2014

Figure 4-3. BMPs and associated drainage areas in the Mattawoman Creek watershed.

4.4 Existing Condition Analysis

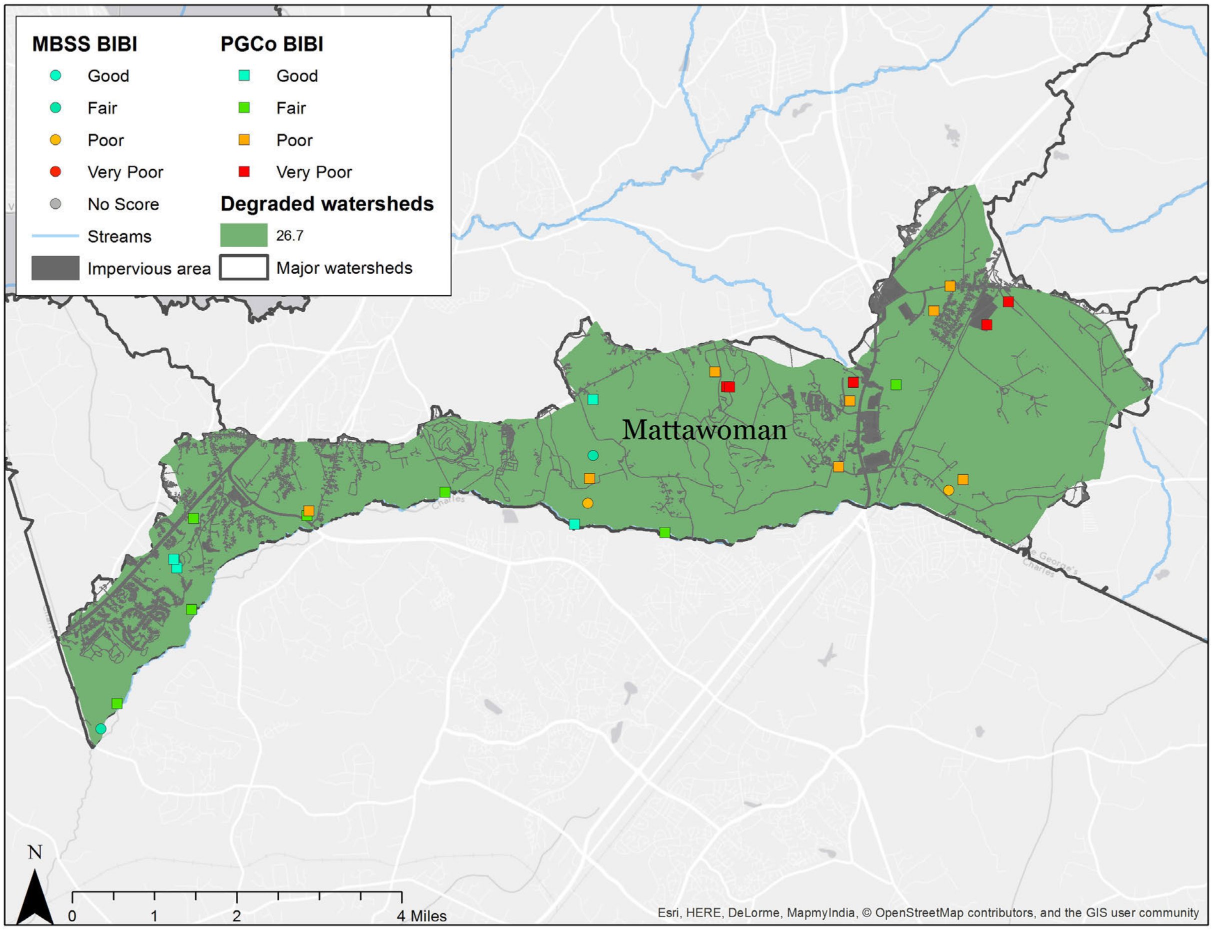
Water quality and the health of biological communities are affected by watershed characteristics such as land use and percentage of impervious cover. Multiple studies have shown that as impervious cover increases, peak runoff volumes and velocities increase as does streambank erosion (Arnold and Gibbons 1996; Schueler 1994). The purpose of this section is to examine how landscape and physical characteristics in the County might influence conditions in other portions of the County. Available data were reviewed to examine relationships between biological index scores and impervious cover and BMP locations. In addition, BMP locations are examined in relation to current land uses and impervious areas.

- Figure 4-4 compares biological scores to impervious areas.
- Figure 4-5compares biological scores to BMP locations.
- Figure 4-6 compares BMP locations to the current storm drain network.
- Figure 4-7 compares BMP locations to impervious areas.
- Table 4-5 looks at BMPs, their drainage areas, and what land use(s) they treat.

The watershed has biological integrity values of Poor, Very Poor, and some Fair and Good. The monitoring locations with Poor and Very Poor scores tend to be in the impervious areas, within Accokeek municipal area. The other Good scores are in areas surrounded by areas that have more pervious surfaces, such as turf or forested areas.

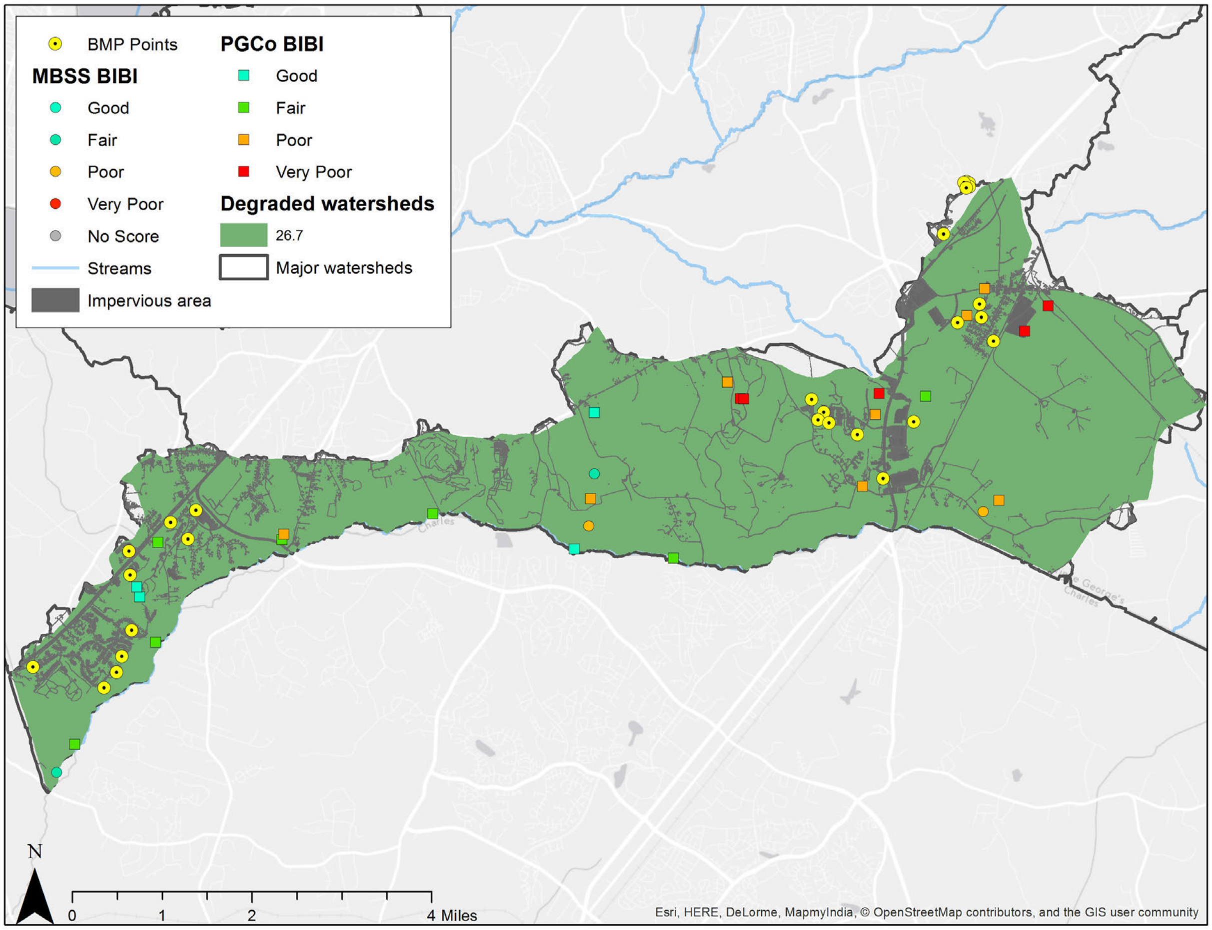
Figure 4-6 and Figure 4-7show that there are impervious areas that have storm sewers that are not treated by BMPs, for example, in the eastern and western ends of the watershed within the County. These areas might be candidate locations for BMP placement during the restoration plan development.

Table 4-5 is a compilation of BMP types in the Mattawoman Creek watershed and the land uses they drain. Stormwater ponds are the most implemented BMP. They usually treat residential and non-urban areas. Bioretention systems are the second most implemented practices. They tend to treat smaller areas, but with greater pollutant removal efficiency. Oil and grit separators and infiltration practices are tied for the third most implemented BMPs, with the separators treating more total area and impervious area; however, separators have lower removal efficiencies than infiltration practices.



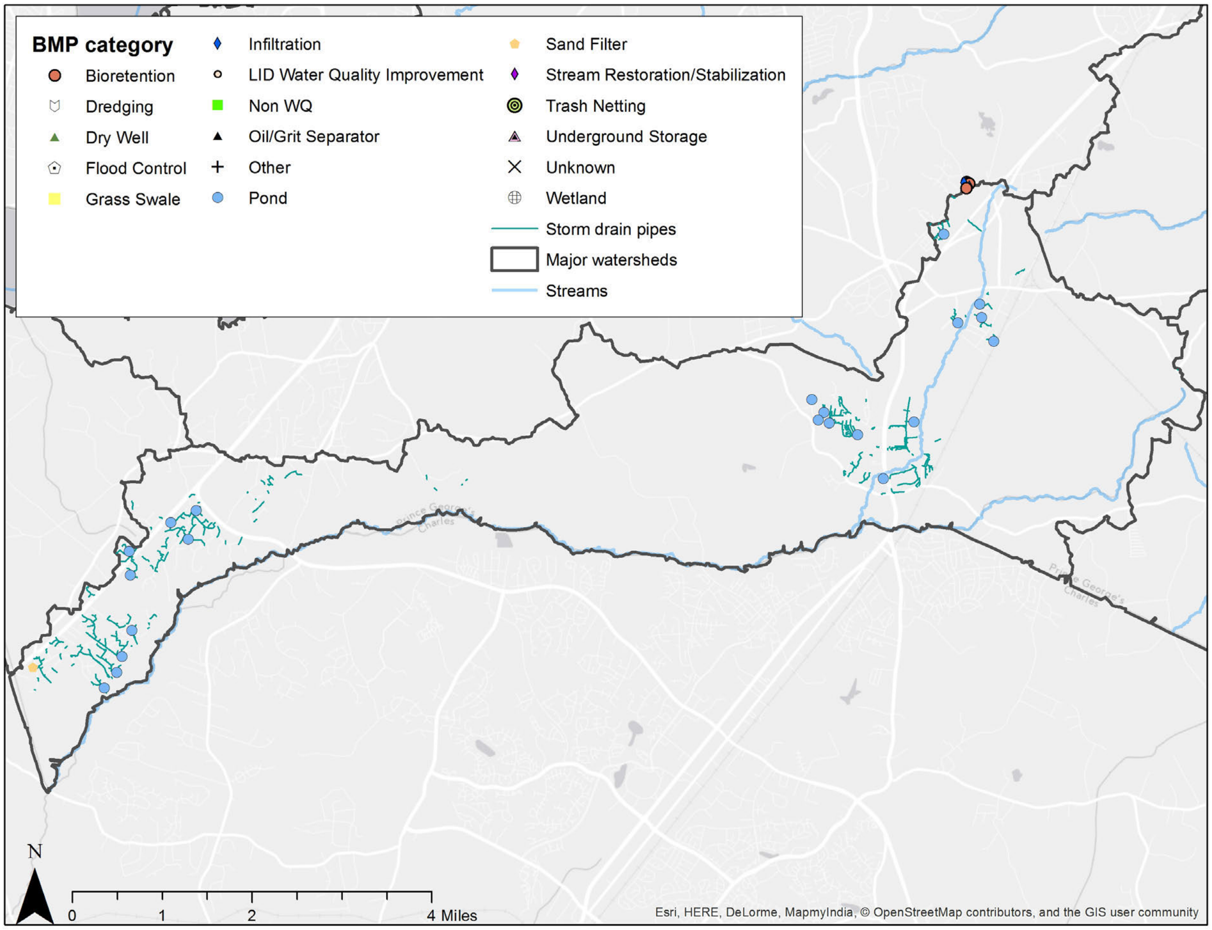
Source: Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech, 2009 impervious area from M-NCPPC 2014

Figure 4-4. Comparison of biological conditions and impervious areas in the Mattawoman Creek watershed.



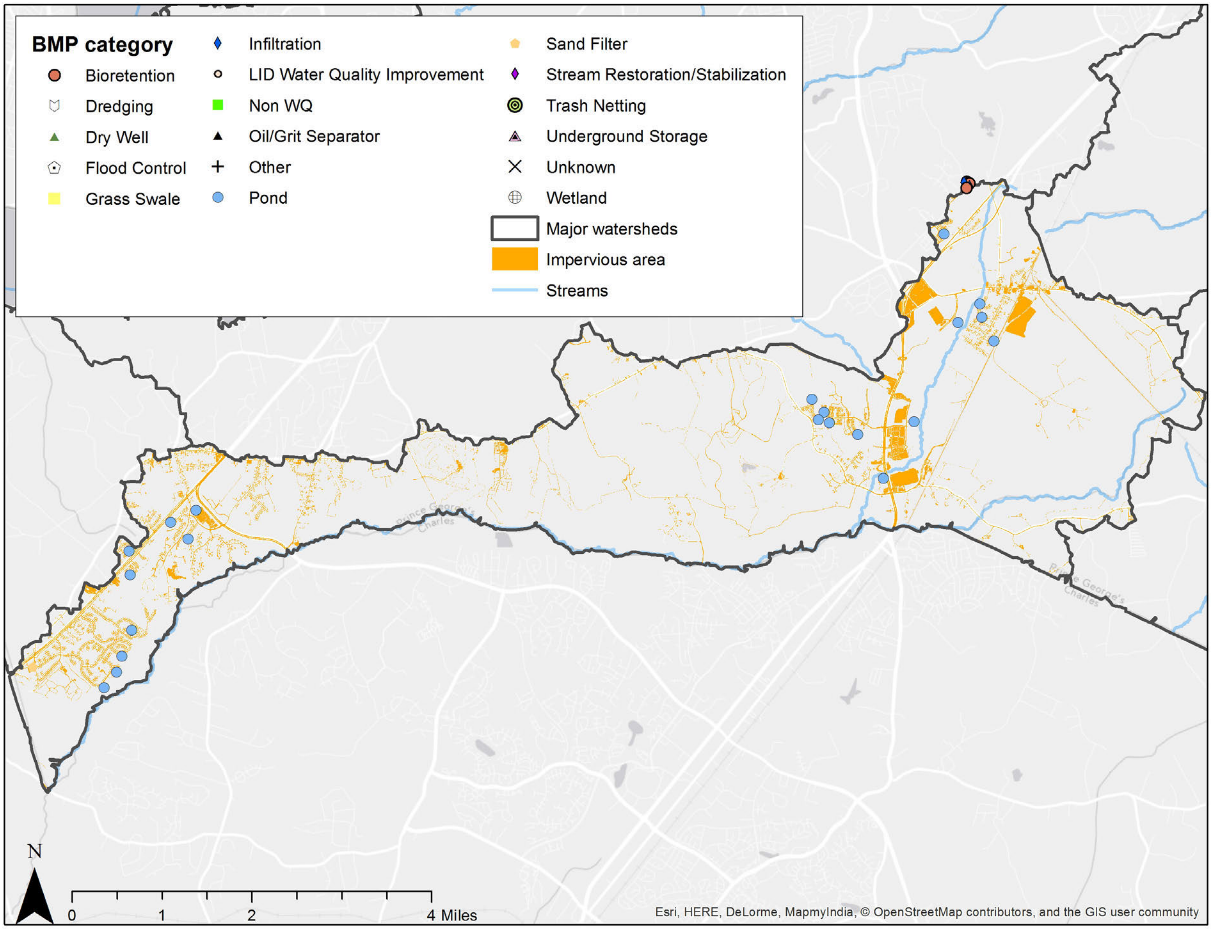
Source: BMPs are from DoE, June 2014, Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech

Figure 4-5. Comparison of biological conditions and BMP locations in the Mattawoman Creek watershed.



Source: BMPs and storm sewer pipes are from DoE, June 2014

Figure 4-6. Comparison of BMP locations and storm drain network in the Mattawoman Creek watershed.



Source: 2009 impervious area from M-NCPPC 2014, BMPs are from DoE, June 2014

Figure 4-7. Comparison of BMP locations and impervious areas in the Mattawoman Creek watershed.

Table 4-5. Summary of known BMP drainage areas, land uses, and impervious areas

BMP Type	Statistic	Commercial	Industrial	Institutional	Non-urban	Open urban	Residential	Transportation
Bioretention	Count	0	0	0	1	0	5	0
	DA (acres)	0.00	0.00	0.00	0.11	0.00	2.08	0.00
	Imp DA (acres)	0.00	0.00	0.00	0.00	0.00	0.33	0
Infiltration	Count	0	0	0	1	0	2	0
	DA (acres)	0.00	0.00	0.00	1.96	0.00	3.36	0.00
	Imp DA (acres)	0.00	0.00	0.00	1.10	0.00	1.38	0
Pond	Count	3	2	1	14	2	14	1
	DA (acres)	101.05	214.70	0.31	1,156.90	53.64	2,181.86	64.10
	Imp DA (acres)	66.27	122.25	0.00	76.29	8.41	560.74	0

Note: This table only includes information for BMPs with geospatial drainage area (DA) information.

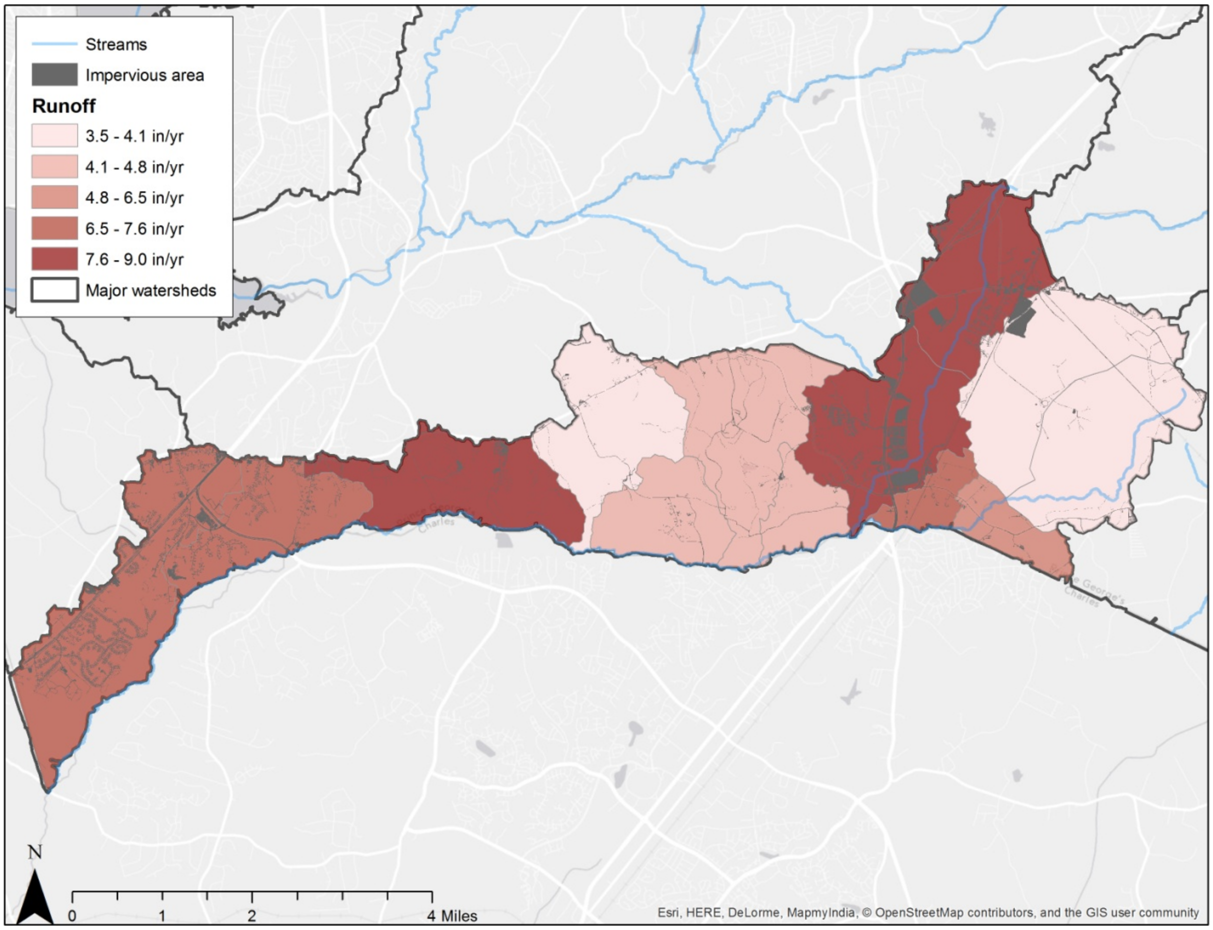
4.5 Stressor Loading Analysis

As described above, water quality and the health of biological communities are affected by watershed characteristics such as land use and percentage of impervious cover. On the basis of land cover characteristics, there is substantial literature on annual median concentrations for connected impervious, disconnected impervious, and pervious areas. Multiplied by annual runoff volumes from each of these land covers, this develops the projected runoff loads of the various stressors. These stressors are total nitrogen, total phosphorus, total suspended solids (TSS), BOD, and fecal coliforms. The first four parameters are measured in pounds per acre per year, while the latter is measured by billion counts (MPN) per acre per year.

The purpose of this section is to examine how these landscape and physical characteristics in the watershed might influence conditions in their local watershed. Given their individual characteristics, this analysis highlights subwatersheds (smaller portions of the watershed) where runoff and pollutant loads are elevated. The most elevated subwatersheds are candidates for increased restoration activities to help restore watershed functions. The least elevated watersheds are candidates for preservation measures. The following figures relate how impervious surfaces are closely correlated to the extent of stressor loading.

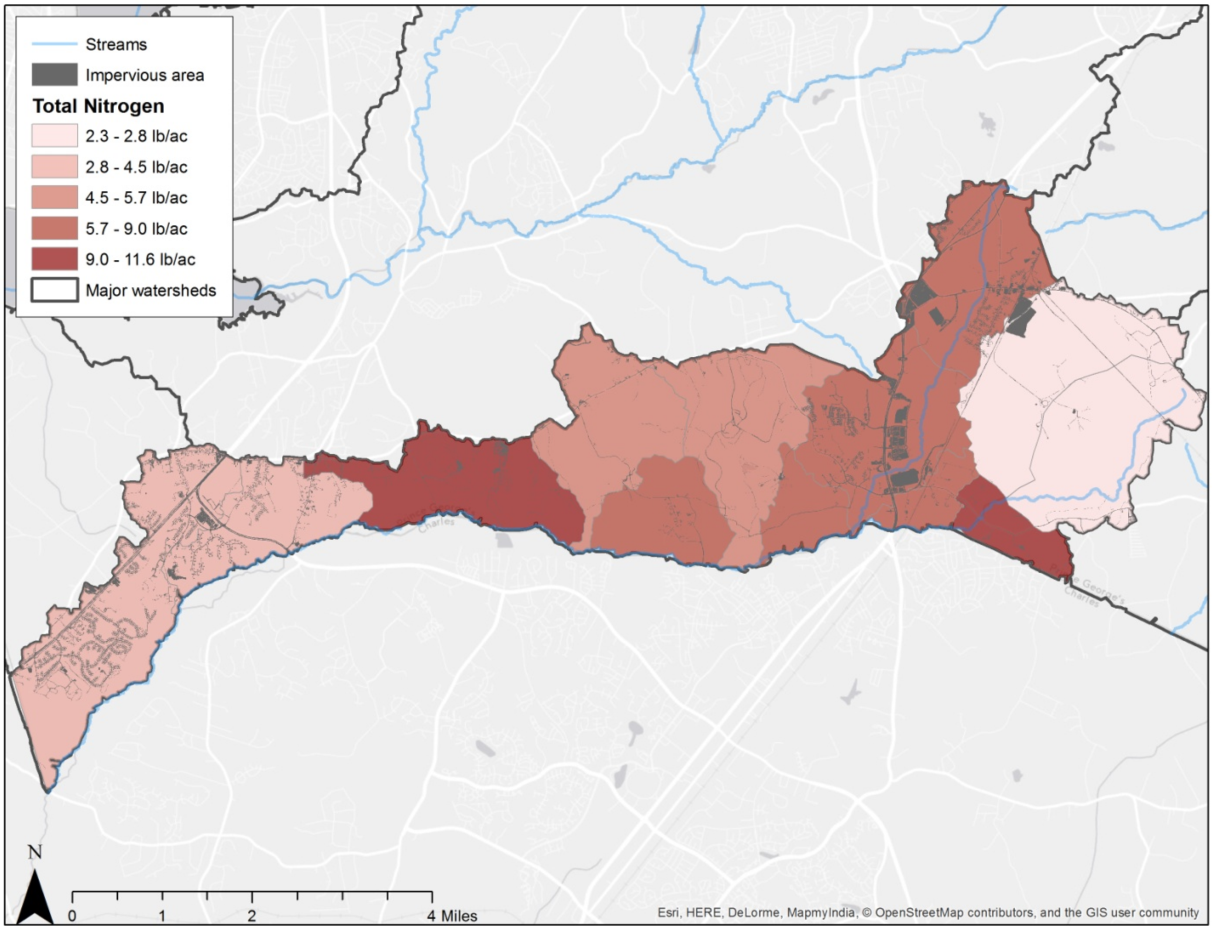
- Figure 4-8 presents the variation in runoff amount throughout the watershed.
- Figure 4-9 presents the variation in total nitrogen loading rates throughout the watershed.
- Figure 4-10 presents the variation in total phosphorus loading rates throughout the watershed.
- Figure 4-11 presents the variation in TSS loading rates throughout the watershed.
- Figure 4-12 presents the variation in BOD loading rates throughout the watershed.
- Figure 4-13 presents the variation in fecal coliform loading rates throughout the watershed.

Figure 4-8 illustrates how runoff is affected by impervious cover. Although this watershed is listed only for total phosphorus and total nitrogen, the BMPs undertaken to control these pollutants should help in reducing other pollutant loads also. The urban areas of Pomonkey and Accokeek creeks, as anticipated, generate larger runoff volumes (6.5 to 9 inches per year) than the remainder of the subwatersheds. Conversely, the middle segment and the southeastern portion of Mattawoman Creek watershed within the County show higher nutrient loads emanating from primarily agricultural and forestry land covers. The subwatersheds with relatively larger density of onsite wastewater systems do exhibit larger BOD loads. The subwatersheds with larger nutrient loads will be focused on in the restoration planning.



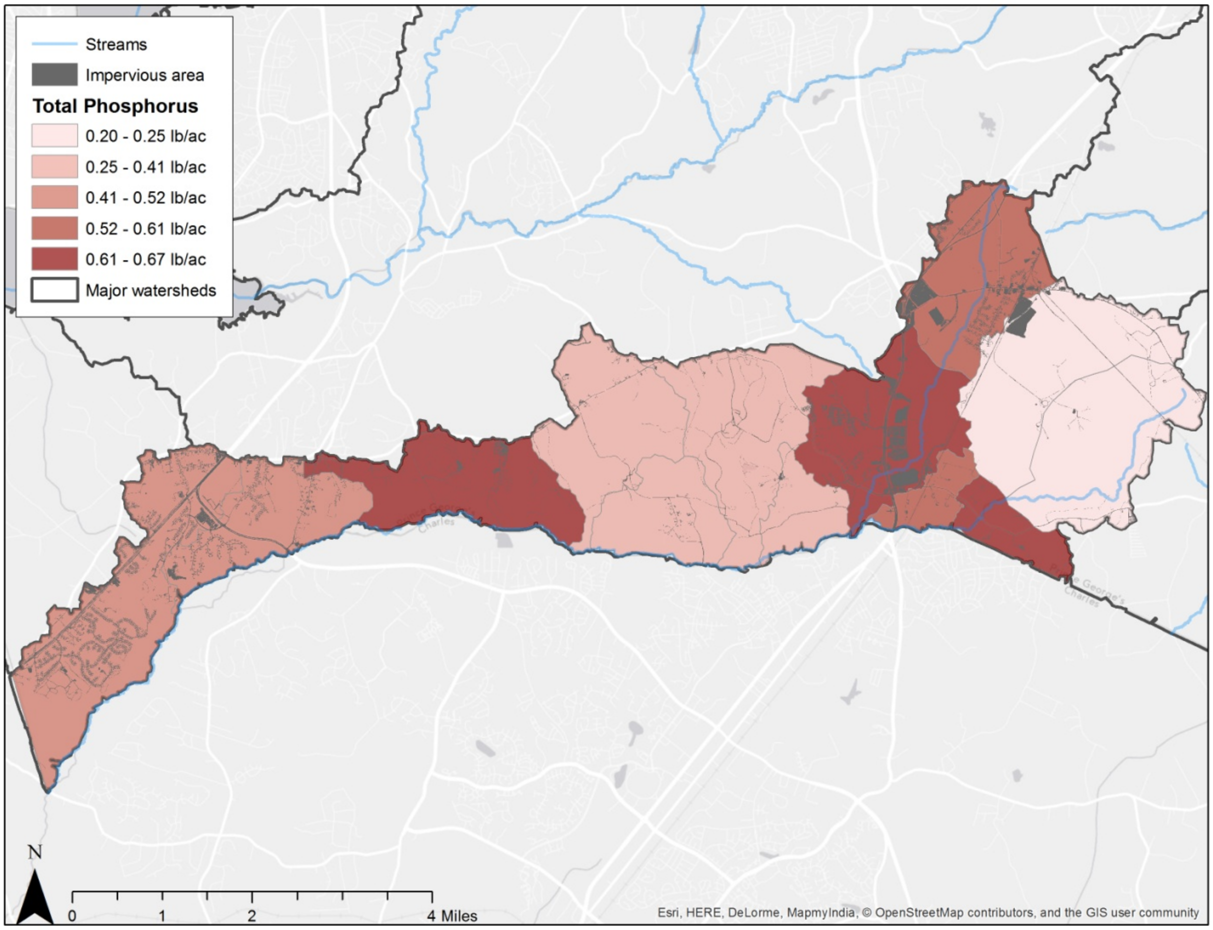
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-8. Comparison of runoff amount and impervious areas in the Mattawoman Creek watershed.



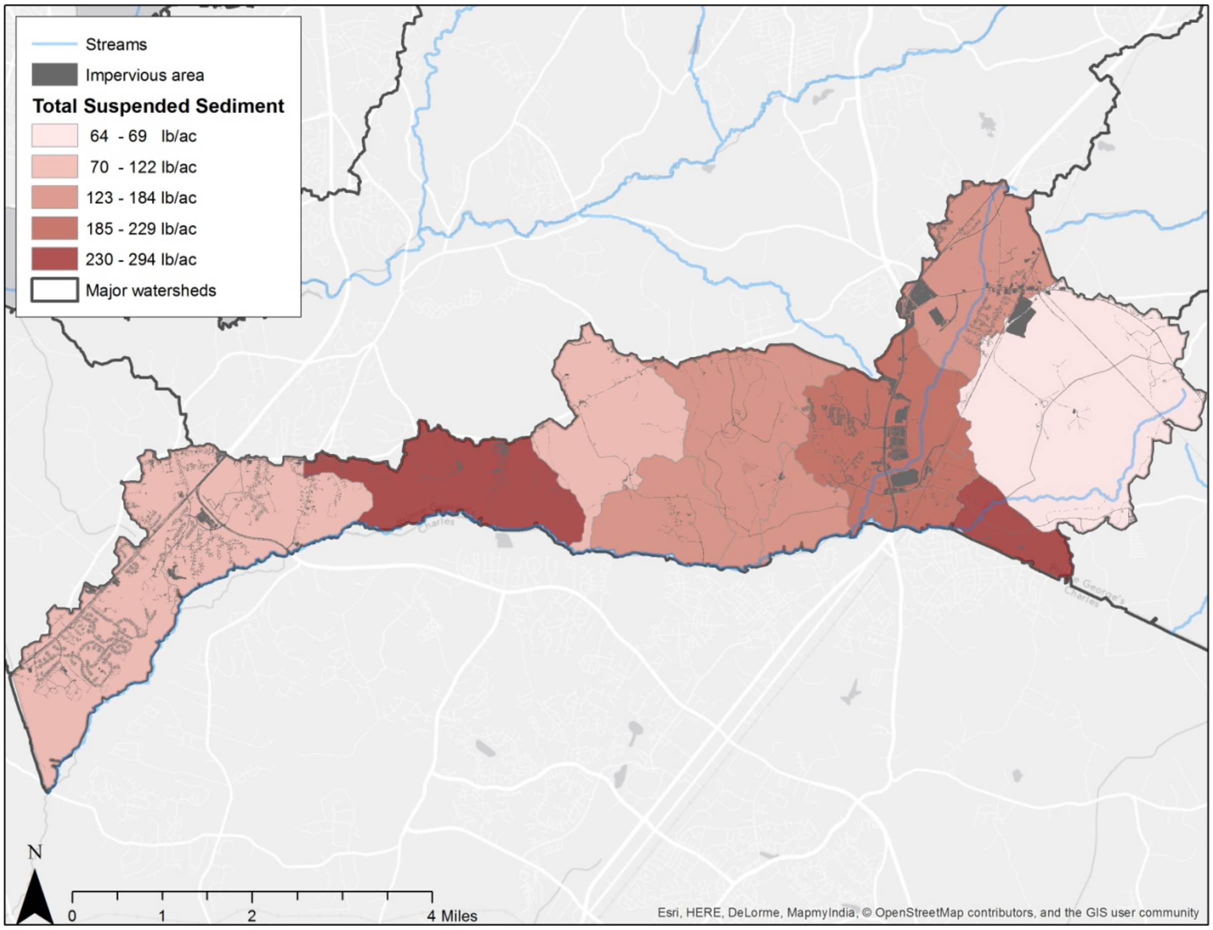
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-9. Comparison of total nitrogen loading rates and impervious areas in the Mattawoman Creek watershed.



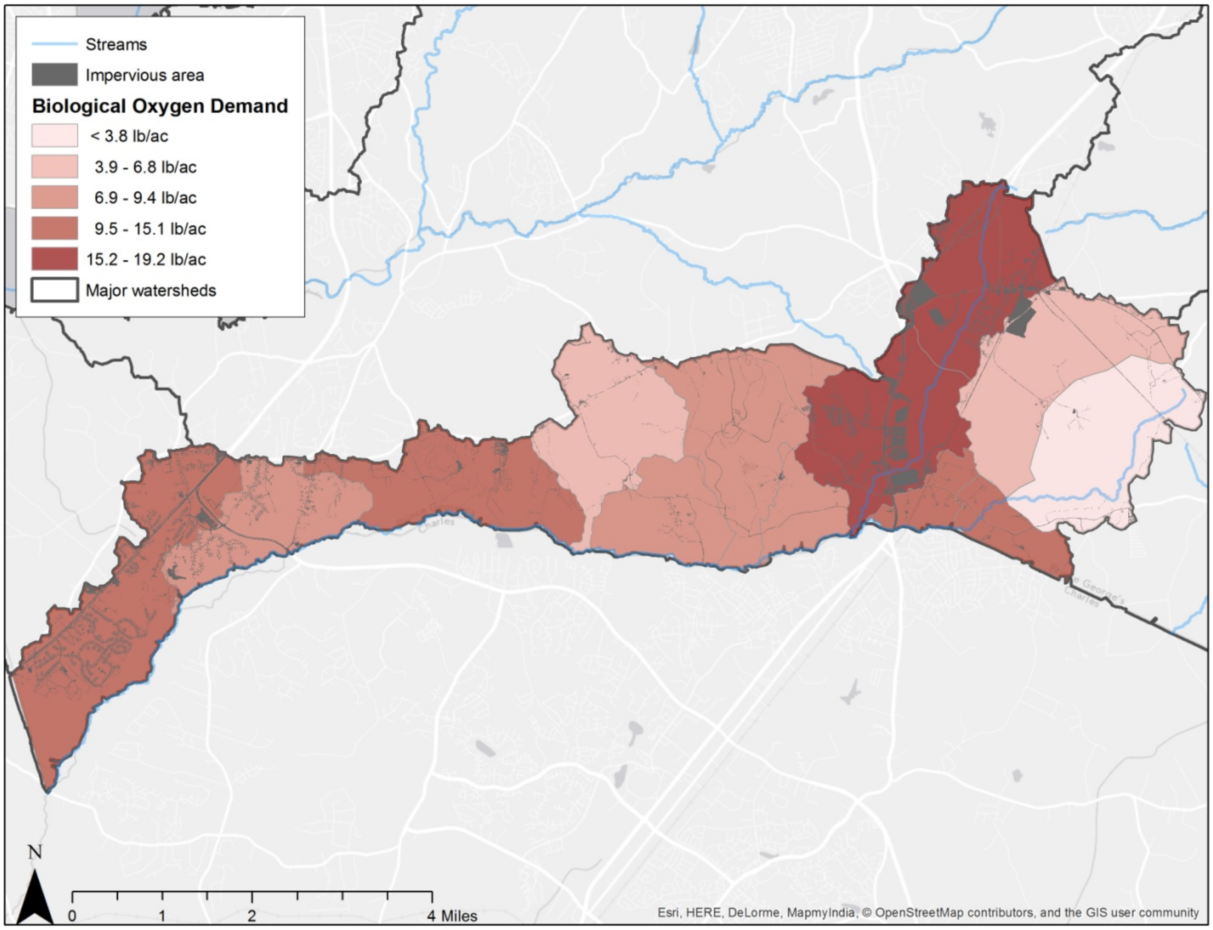
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-10. Comparison of total phosphorus loading rates and impervious areas in the Mattawoman Creek watershed.



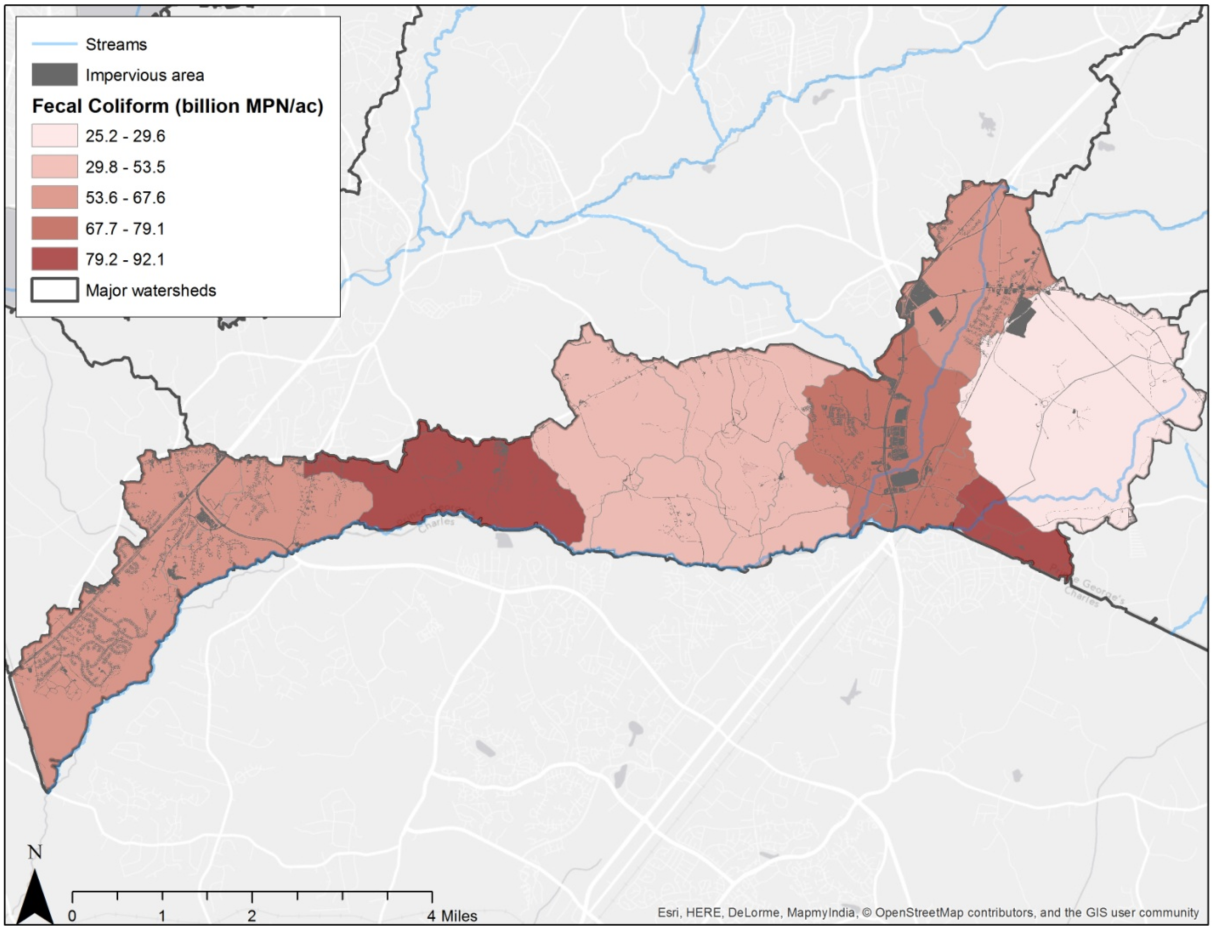
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-11. Comparison of total suspended sediments loading rates and impervious areas in the Mattawoman Creek watershed.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-12. Comparison of BOD loading rates and impervious areas in the Mattawoman Creek watershed.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-13. Comparison of fecal coliform loading rates and impervious areas in the Mattawoman Creek watershed.

5 NEXT STEPS

As previously discussed, the County is in the beginning phases of developing restoration plans for the EPA-approved TMDLs in the County. This is a multistep process and this report represents the initial phase of the plan development process by collecting the necessary data and beginning to process the information. Additional phases will be completed through the remainder of 2014, culminating in final plans submitted to MDE by January 2, 2015. Future phases include analyses to (1) look at the amount of pollutant loads that need to be reduced; (2) estimate reductions from the current and past County restoration activities; (3) determine the current load reduction gap; and (4) estimate the remaining amount of restoration activities that are still required to meet TMDL goals. The restoration plans will be developed once these analyses are complete.

Restoration plans typically:

- Identify causes and sources of pollution.
- Estimate pollutant load reductions.
- Describe management options and identify critical areas.
- Estimate technical and financial assistance needed.
- Develop an education component.
- Develop a project schedule.
- Describe interim, measurable milestones.
- Identify indicators to measure progress.
- Develop a monitoring component.

The restoration plans will be developed over the summer and early fall and expected to be available for public comment in November. For more information concerning the restoration plans or the public meeting, please visit the County's Department of the Environment website at www.princegeorgescountymd.gov/sites/stormwatermanagementor contact Lilantha Tennekoon at 301-883-6198 or ltennekoon@co.pg.md.us.

Once finalized, the restoration plans will lead to additional BMP implementation, public outreach, and opportunities for the public to help in the watershed restoration process. The County is already conducting many of the activities that will be described in the plans, but the rate of implementation activities will increase. BMPs will be installed through the County's Public-Private Partnership Program, capital improvement projects, and grants. Additional BMPs are expected to be implemented from Rain Check Rebates and the Alternative Compliance program through the County's recently implemented Clean Water Act Fee. There will also be an increase in pollutant-focused public outreach initiatives. The public will also be encouraged to take small steps that will add up to be part of the restoration solution.

The restoration plan will explore different ways the County can monitor, track, and report restoration progress towards meeting the TMDL reduction goals. There are several different options for monitoring and tracking progress. The County expects to use a combination of monitoring activities. The County will report annual progress as part of its NPDES MS4 permit reporting requirements. In addition, the restoration plans describe adaptive approaches that will reevaluate current strategies on the basis of the progress that has occurred and possibly suggest new implementation strategies.

The County's NPDES MS4 permit also requires the County to develop detailed watershed assessments for each County watershed by January 2019. These assessments will be larger studies that will build off the initial watershed characterization reports and restoration plans. The assessments will include the current water quality conditions, identification and ranking of water quality problems, prioritized water quality improvement projects, and load reduction benchmarks for meeting applicable TMDL reduction goals.

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APPENDIX A: TMDL FACTSHEETS

Chesapeake Bay Watershed Nutrient and Sediment TMDL

Mattawoman Creek Nitrogen and Phosphorus TMDL

Chesapeake Bay Watershed Nutrient and Sediment TMDL

Source Document: U.S. Environmental Protection Agency, Region 3, Water Protection Division and Region 3, Chesapeake Bay Program Office and Region 2 Division of Environmental Planning and Protection. 2008. Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment. December 29, 2010.

Water Body Type: Chesapeake Bay tidal and non-tidal watershed and contributing subwatersheds.

Pollutant: Total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS)

Designated Uses: Migratory fish spawning and nursery, open water fish and shellfish, and shallow water Bay grasses.

Size of Watershed: 64,000 square miles

Water Quality Standards:

Dissolved oxygen (DO): See Table 3-4 of report.

Chlorophyll *a*: Concentrations of chlorophyll *a* in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in ecologically undesirable consequences—such as reduced water clarity, low DO, food supply imbalances, proliferation of species deemed potentially harmful to aquatic life or humans or aesthetically objectionable conditions—or otherwise render tidal waters unsuitable for designated uses

Secchi depth: See Table 3-5 of report.

Analytical Approach: Chesapeake Bay Airshed Model (wet deposition regression, and Community Multiscale Air Quality Model); SPARROW; Phase 5.3 Chesapeake Bay Watershed Model (HSPF)

Date Approved: Approved December 29, 2010

Introduction

The Total Maximum Daily Load (TMDL) analysis for the Chesapeake Bay watershed (Figure 1) addresses TN, TP, and sediment loads on an annual average basis. Reductions in these pollutants will address DO, chlorophyll *a*, and clarity impairments in the Chesapeake Bay.

This fact sheet provides summary data related to the TMDL and includes specific information related to allocations made for Prince George's County, Maryland.

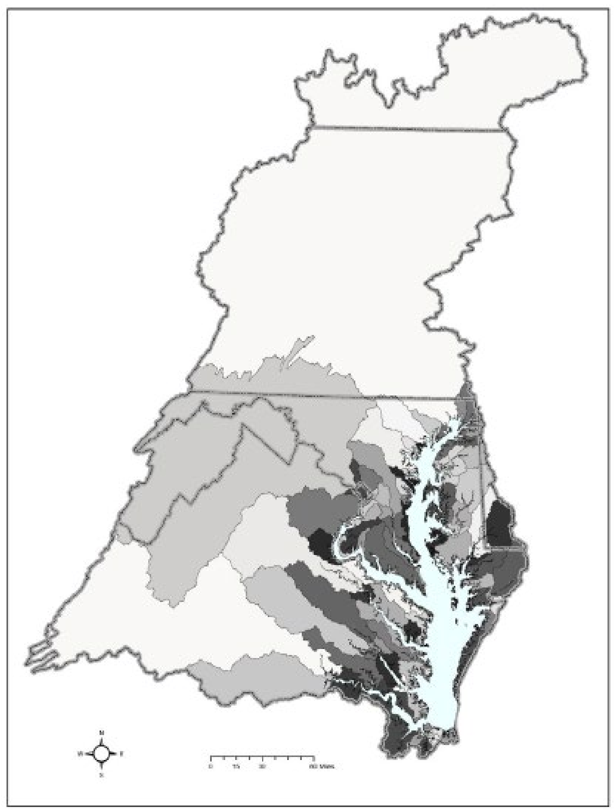

Figure 1. Overall Chesapeake Bay watershed and segment subwatersheds.
Source: USEPA 2010.

Problem Identification and Basis for Listing

Water quality impacts from excessive nutrients and sediment throughout the Chesapeake Bay watershed cause excessive algal growth, low DO, and reduced water clarity in the Chesapeake Bay. Suspended sediment reduces light availability, impacting underwater Bay grass communities. In addition, sediment can transport other pollutants, such as bacterial and phosphorus. Most of the Chesapeake Bay tidal segments were listed as impaired or threatened water that requires a TMDL. Factors for their listing included low DO, insufficient submerged aquatic vegetation, excess chlorophyll *a*, biological/nutrient indicators, TN, TP, TSS, biological oxygen demand, and pH. Many of the impaired segments are addressed by either consent decree or memoranda of understanding with the states.

Applicable Data

The Chesapeake Bay tidal monitoring program was established in 1984 to collect water quality data monthly at more than 150 stations throughout the 92 Chesapeake Bay tidal segments in Delaware, the District of Columbia, Maryland, and Virginia. Twenty-six parameters are monitored, and various other data are also collected, including shallow water monitoring benthic infaunal communities, Bay grass surveys, phytoplankton and zooplankton monitoring, and fisheries population monitoring. The monitoring is designed to support the bay states' 303(d) listing decision-making. In addition to tidal monitoring, there is a network of streamflow gauges and water quality sampling sites throughout the Chesapeake Bay watershed. These data were used to calibrate and verify the Phase 5.3 Chesapeake Bay Watershed Model.

Sources

Point sources of nutrients and sediment include municipal wastewater facilities, industrial wastewater facilities, combined sewer overflow systems, sanitary sewer overflow systems, National Pollution Discharge Elimination System (NPDES) permitted stormwater, and Concentrated Animal Feeding Operations. Nonpoint sources of nutrients and sediment include agricultural runoff, atmospheric deposition, on-site treatment system (septics), stormwater runoff, runoff from forested areas, streambank and tidal shoreline erosion, and wildlife and natural background.

Technical Approach

The two primary models used in the development of the TMDL were the Phase 5.3 Chesapeake Bay Watershed Model and the Chesapeake Bay Water Quality and Sediment Transport Model. The models are designed to simulate the 10-year hydrologic period from 1991 through 2000. The Watershed Model is responsible for simulating the loading and transport of nutrients and sediment from pollutant sources in the watershed and can provide loading estimates for management scenarios. The Water Quality Model simulates estuarine hydrodynamics, water quality, sediment transport, and living resources in the Chesapeake Bay. The model predicts water quality that results from management scenarios, and ensures that the allocated loads developed in the TMDL will meet water quality standards.

The Phase 5.3 Chesapeake Bay Watershed Model was calibrated for 1985–2005, using streamflow and water quality data from this time period. The segment outlets were intentionally designed to be in proximity to in-stream flow gauges and water quality monitoring stations. The model considers inputs from manure, fertilizers, atmospheric deposition, land use-based nonpoint sources, septic systems, regulated stormwater runoff, and wastewater treatment and discharge facilities.

The Chesapeake Bay Water Quality Model is based on a three-dimensional hydrologic transport model (CH3D) with a eutrophication model (CE-QUAL-ICM) to allow prediction of water quality in the Chesapeake Bay, based on the changes in the loading from the watershed. The hydrodynamic model was calibrated for 1991–2000. The Water Quality Model receives loads from nonpoint sources entering the tidal system at tributary fall lines from each of the Chesapeake Bay segments, based on inputs from the Watershed Model, and directly as runoff below the fall lines. Point sources are also incorporated based on their location in the tidal waters. The model incorporates atmospheric deposition of nutrients directly on the Chesapeake Bay tidal surface waters. Shoreline erosional loads are also included.

Allocations

The baseline scenario represents modeled loads for 2009. Wasteload and load allocations were made at the Chesapeake Bay segment level. Several of the bay segments are partially within Prince George's County. The Maryland Department of the Environment then allocated to the county level. The TMDL scenario represents the maximum nutrients and sediment loads to meet water quality standards. Reductions to each of the sectors is based on a limit of technology upgrades to wastewater treatment plants, no reductions to forest lands, and equal percent reductions from the nonpoint source sectors (MDE 2012). These factors are also modified by credit for existing nutrient and sediment reduction practices that are already in place and consideration for geographic proximity and relative impacts of the local load on Chesapeake Bay water quality. See Table 1 for TMDL allocations and reductions from baseline. Overall, there is a 9.32 percent reduction from baseline to the TMDL TN target, and a 3.61 percent reduction from baseline to the TMDL TP target. Table 2 provides annual allocations to urban loading sources for the County. County-level sediment allocations were not provided.

Table 1. Baseline and annual allocations to Prince George's County (delivered loads)

Sector	TN		
	2009 Load (lbs/year)	TMDL (lbs/year)	% Reduction
Agriculture	198,439	150,520	24.15%
Urban	832,131	628,709	24.45%
Septic	93,098	62,562	32.80%
Forest	200,386	198,993	0.70%
Point sources	1,670,919	1,674,936	-0.24%b
Total	2,994,973	2,715,720	9.32%
Sector	**TP**		
	2009 Load (lbs/year)	**TMDL (lbs/year)**	**% Reduction**
Agriculture	37,275	31,017	16.79%
Urban	106,306	68,923	35.17%
Septic	--[a]	--	--
Forest	6,850	6,744	1.55%
Point sources	61,786	97,880	-58.42%[b]
Total	212,217	204,564	3.61%

Source: DER 2012.

Notes:

[a] Septics are not considered a source of phosphorus in the Chesapeake Bay Model.

[b] Negative reductions account for growth in wastewater treatment plants.

Table 2. Annual allocations to urban loading sources in Prince George's County and percent reductions from 2009

Sector	TN (lbs/year)	% Reduction	TP (lbs/year)	% Reduction
County Phase I/II MS4	360,740	22.56%	29,394	38.58%
Municipal Phase II MS4	101,202	20.21%	8,796	34.65%
Bowie	36,746	18.26%	3,136	30.70%
Other Municipal	64,456	21.28%	5,660	36.65%
Nonregulated	18,807	24.86%	1,122	44.54%
Construction	83,805	37.22%	22,253	30.14%
SHA Phase I/II MS4	41,414	21.18%	3,880	36.02%
State Phase II MS4	10,168	21.57%	877	37.58%
Regulated Industrial	5,027	21.89%	502	36.38%
Extractive	7,546	16.16%	2,099	26.45%
Total	**628,709**	**24.45%**	**68,923**	**35.17%**

Source: DER 2012.

References

MDE (Maryland Department of the Environment). 2012. Maryland's Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL. Developed by the University of Maryland, Maryland Department of Planning, Maryland Department of Agriculture, Maryland Department of the Environment and Maryland Department of Natural Resources.

Prince George's County Maryland, Department of Environmental Resources (DER). 2012. Revised Draft, Prince George's County, Maryland – Phase II Watershed Implementation Plan, For Inclusion in the Maryland Final Phase II Watershed Implementation Plan.

Mattawoman Creek Nitrogen and Phosphorus TMDL

Source Document:	MDE (Maryland Department of the Environment). 2004. Total Maximum Daily Loads of Nitrogen and Phosphorus for Mattawoman Creek in Charles County and Prince George's County, Maryland. Document Version January 15, 2005.
Water Body Type:	Tidal Mattawoman Creek
Pollutant:	Nitrogen and phosphorus
Designated Uses:	Use I – Water Contact: Recreation, Fishing, and Protection of Aquatic Life and Wildlife
Size of Watershed:	97.6 square miles
Water Quality Standards:	Dissolved oxygen (DO) ≥ 5 mg/L at all times chlorophyll *a* < 50 µg/L
Indicators:	DO, chlorophyll *a*
Analytical Approach:	Steady state application of Water Analysis Simulation Program (WASP) 5.1 for critical low-flow condition and for average annual flow condition
Date Approved:	Approved January 5, 2005

Introduction

The Total Maximum Daily Load (TMDL) was established to address eutrophication in Mattawoman Creek (Figure 1), a shallow, tidally influenced embayment of the Potomac Estuary, by assigning allocations for nitrogen and phosphorus.

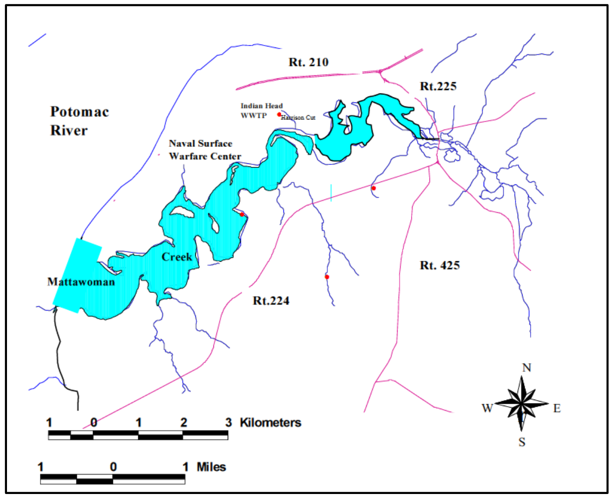

Figure 1. Anacostia River watershed
Source: MDE 2004.

Problem Identification and Basis for Listing

Mattawoman Creek (basin number 02-14-01-11) was first identified on the 1996 303(d) list submitted to the U.S. Environmental Protection Agency by the Maryland Department of the Environment (MDE). It was listed as being impaired by nutrients due to signs of eutrophication (expressed as high chlorophyll *a* levels), suspended sediments, and evidence of biological impacts.

Applicable Data

Data from two monitoring stations (MAT0016 and MAT0078) on Mattawoman Creek indicated chronic problems associated with eutrophication (low DO and high chlorophyll *a* concentrations). To support the TMDL analysis, specific surveys were conducted on the creek to gather data in 2001 and 2002. Data collected during those surveys confirmed eutrophication conditions especially during critical summer low-flow periods.

Sources

The watershed includes the Indian Head Naval Surface Warfare Center.

Technical Approach

The TMDL analysis employed a steady state application of the WASP 5.1 model. A critical low-flow loading condition was assessed as well as an average annual flow loading condition. For the purpose of municipal separate storm sewer system (MS4) permit implementation, it is assumed that only the average annual flow condition/allocations are relevant because there is presumed to be no stormwater flows during low-flow critical conditions.

Low-flow nonpoint source loads were derived from concentrations observed during low-flow sampling in 2001 multiplied by the estimated critical low flows. For the non-low flow assessment, nonpoint source loadings were calculated by multiplying the estimated annual regional nutrient land use load coefficients with the area of land use in each subwatershed.

Allocations

Total allocations for the average annual flow condition are provided in the Mattawoman Creek TMDL (Table 1) and point source allocations are detailed in a technical memo distributed in conjunction with the TMDL report (Table 2) (MDE 2004).

Table 1. Mattawoman Creek TMDL for average annual flow condition

	TN	TP
	(lbs/yr)	
LA	116,699.00	5,304.00
WLA	85,784.00	11,786.00
FA	9,689.00	673.00
MOS	5,814.00	404.00
TMDL	217,986.00	18,167.00

Source: MDE 2004.
Note: TN = total nitrogen; TP = total phosphorus; LA = load allocation; WLA = wasteload allocation; FA = future allocation; MOS = margin of safety.

Table 2. Mattawoman Creek TMDL point source allocations for average annual flow condition

Point Source Name	Permit Number	Loads (lbs/year)		Flow (MGD)
		TN	TP	
Town of Indian Head Wastewater Treatment Plant	MD0020052	22,830	4,566	0.5
Lackey High Wastewater Treatment Plant	MD0023159	684	164	0.009
Brandywine Receiving Station	MD0025658	684	164	0.009
Lingafelt Residence	MD0063070	34	8	0.00045
Charles County[a]		46,618	5,213	--
Prince George'sCounty[a]		9,546	1,069	--
Indian Head Naval Surface Warfare Center	NA[b]	5,388	602	--

Note:
[a] Allocations for all urban stormwater sources on the Mattawoman watershed, including all National Pollutant Discharge Elimination System (NPDES)-regulated dischargers.
[b] Future Phase II MS4 permit.

References

MDE (Maryland Department of the Environment). 2004. Final Technical Memorandum: Nutrient Point Sources in the Mattawoman Creek Watershed. Document Version January 9, 2004.

APPENDIX B: NPDES PERMITTED DISCHARGERS

Table B-1. Active NPDES permits in the Mattawoman Creek watershed in Prince George's County

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MD09S0378	Brandywine High-Voltage Electrical Ducts	NPDES Individual Permit	National Security	07/20/09	07/20/09	07/19/14
MD3264Q04	Cedarville Mobile Home Park	NPDES Individual Permit	Mobile Home Site Operators	03/01/03	04/01/04	03/31/09
MD3264Q98	Cedarville Mobile Home Park	General Permit	Mobile Home Site Operators/Waste Water Treatment Plant	10/25/10	12/01/10	11/30/15
MDG344179	Gott Company-Brandywine Pt	General Permit	Petroleum Bulk Stations & Terminals	12/19/13	12/19/13	12/11/17
MDG498011	Aggregate Industries-Accokeek (gaslight) Sand and Gravel	General Permit	Mineral Mine	12/01/11	12/01/11	04/30/15
MDG498033	Robindale	General Permit	Mineral Mine	12/20/10	12/20/10	04/30/15
MDG499762	Aggregate Industries - Queen Sand & Gravel	General Permit	Mineral Mine	n/a	n/a	n/a
MDG675139	Cedarville State Forest	General Permit	Not reported	06/04/12	06/04/12	02/28/17
MDG767031	Chaddsford Community Association Pool	General Permit	Swimming Pool	09/19/08	10/01/08	05/31/12
MDR000590	Beretta USA Corp	General Permit	Stormwater Discharge	03/13/03	03/13/03	11/30/07
MDR000667	Accokeek Auto Parts	General Permit	Stormwater Discharge	03/21/03	03/21/03	11/30/07
MDR000847	Brandywine Auto Parts, Inc.	General Permit	Stormwater Discharge	03/21/03	03/21/03	11/30/07
MDR001173	Brandywine Power Facility	General Permit	Stormwater Discharge	05/23/03	05/23/03	11/30/07
MDR001681	Soil Safe, Inc.	General Permit	Stormwater Discharge	03/05/03	03/05/03	11/30/07
MDR001719	Bardon, Inc. - Reeder Sand & Gravel	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a

Table B-2. Available permit limits for NPDES permits in the Mattawoman Creek watershed in Prince George's County

NPDES ID	Outfall	Parameter	Minimum	Maximum	Unit	Statistical Base
MD3264Q98	001	BOD	30	30	mg/L	Maximum Monthly Average
MD3264Q98	002	BOD	30	30	mg/L	Maximum Monthly Average
MD3264Q98	001	Total Nitrogen	10	10	mg/L	Maximum Monthly Average
MD3264Q98	002	Total Nitrogen	10	10	mg/L	Maximum Monthly Average
MD3264Q98	MW1	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW2	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW3	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW4	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW5	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW6	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW7	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW8	Total Nitrogen	10	10	mg/L	Quarterly Average
MD3264Q98	MW9	Total Nitrogen	10	10	mg/L	Quarterly Average

Note: BOD = biochemical oxygen demand; mg/L=milligrams per liter.

Table B-3. Summary of available discharge information for NPDES permits in the Mattawoman Creek watershed in Prince George's County

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD3264Q98	001	BOD	1.00	2.69	11.00	mg/L	Maximum Monthly Average
MD3264Q98	MW1	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW2	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW3	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW4	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW5	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW6	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW7	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW8	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	MW9	Fecal Coliform	3.00	3.00	3.00	MPN/100mL	Quarterly Average
MD3264Q98	001	Flow	0.018	0.062	0.748	gpd	Monthly Average
MD3264Q98	MW1	Nitrate	0.02	0.020	0.02	mg/L	Quarterly Average
MD3264Q98	MW2	Nitrate	0.09	0.145	0.2	mg/L	Quarterly Average
MD3264Q98	MW3	Nitrate	1.20	1.20	1.20	mg/L	Quarterly Average
MD3264Q98	MW4	Nitrate	0.02	0.020	0.02	mg/L	Quarterly Average
MD3264Q98	MW5	Nitrate	0.02	0.020	0.02	mg/L	Quarterly Average
MD3264Q98	MW6	Nitrate	0.5	0.710	0.92	mg/L	Quarterly Average
MD3264Q98	MW7	Nitrate	0.08	0.140	0.2	mg/L	Quarterly Average
MD3264Q98	MW8	Nitrate	0.02	0.210	0.4	mg/L	Quarterly Average
MD3264Q98	MW9	Nitrate	0.02	0.060	0.1	mg/L	Quarterly Average
MD3264Q98	MW1	Phosphate	0.05	0.050	0.05	mg/L	Quarterly Average
MD3264Q98	MW2	Phosphate	0.08	0.080	0.08	mg/L	Quarterly Average
MD3264Q98	MW3	Phosphate	0.04	0.040	0.04	mg/L	Quarterly Average
MD3264Q98	MW4	Phosphate	0	0.015	0.03	mg/L	Quarterly Average
MD3264Q98	MW5	Phosphate	0.11	0.355	0.6	mg/L	Quarterly Average
MD3264Q98	MW6	Phosphate	0	0.015	0.03	mg/L	Quarterly Average
MD3264Q98	MW7	Phosphate	0.16	0.280	0.4	mg/L	Quarterly Average
MD3264Q98	MW8	Phosphate	0.03	0.030	0.03	mg/L	Quarterly Average
MD3264Q98	MW9	Phosphate	0.03	0.030	0.03	mg/L	Quarterly Average
MD3264Q98	MW1	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW2	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW3	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW4	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW5	TKN	0.5	0.800	1.1	mg/L	Quarterly Average
MD3264Q98	MW6	TKN	0.5	0.500	0.5	mg/L	Quarterly Average

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD3264Q98	MW7	TKN	0.5	0.550	0.6	mg/L	Quarterly Average
MD3264Q98	MW8	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW9	TKN	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	001	Total Nitrogen	1.20	6.42	9.90	mg/L	Maximum Monthly Average
MD3264Q98	MW1	Total Nitrogen	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW2	Total Nitrogen	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW3	Total Nitrogen	1.20	1.20	1.20	mg/L	Quarterly Average
MD3264Q98	MW4	Total Nitrogen	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW5	Total Nitrogen	0.5	0.800	1.1	mg/L	Quarterly Average
MD3264Q98	MW6	Total Nitrogen	0.9	0.900	0.9	mg/L	Quarterly Average
MD3264Q98	MW7	Total Nitrogen	0.5	0.650	0.8	mg/L	Quarterly Average
MD3264Q98	MW8	Total Nitrogen	0.5	0.500	0.5	mg/L	Quarterly Average
MD3264Q98	MW9	Total Nitrogen	0.5	0.500	0.5	mg/L	Quarterly Average
MDG344179	001	Flow	6.50	35.75	65.00	gpd	Daily Maximum
MDG344179	001	Flow	6.50	35.75	65.00	gpd	Quarterly Average
MDG498011	001	Flow	2,203	62,580	269,280	gpd	Daily Maximum
MDG498011	001	Flow	2,203	33,685	110,160	gpd	Monthly Average

Note: TKN = total Kjeldhal nitrogen; BOD = biochemical oxygen demand; mg/L=milligrams per liter; MPN/100mL=most probable number (MPN) per 100 milliliters;gpd=gallons per day.