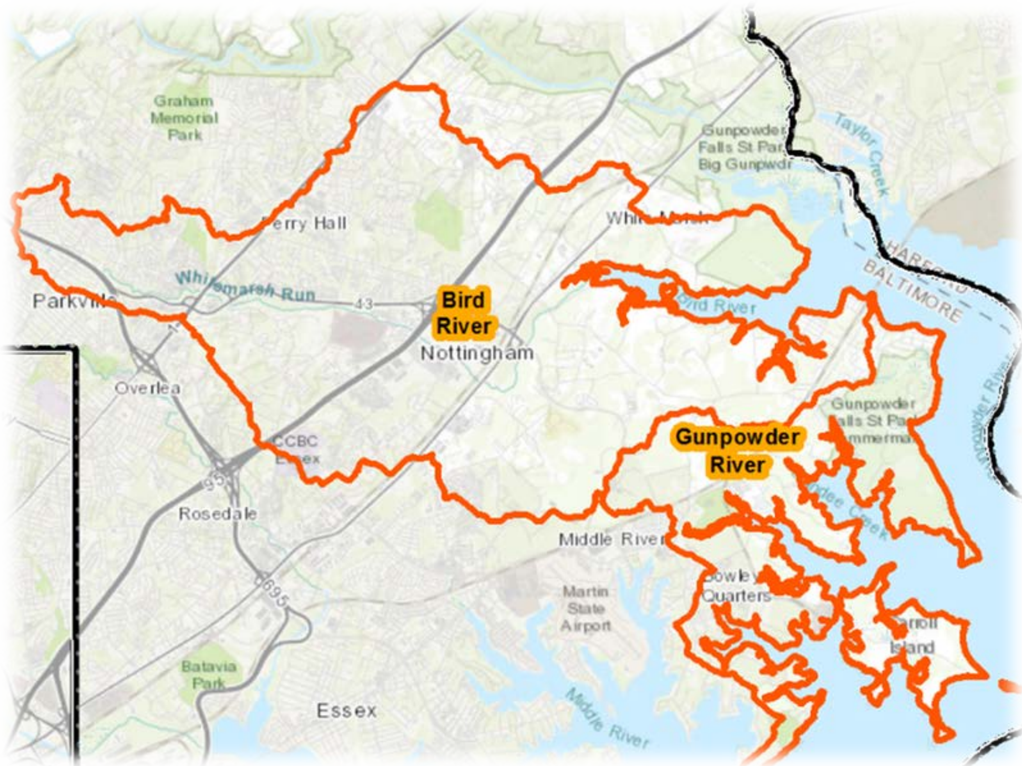
BALTIMORE COUNTY
TMDL IMPLEMENTATION PLAN

Polychlorinated Biphenyls in
Bird River and Gunpowder River



Baltimore County Executive Kevin Kamenetz
and the County Council
Vincent J. Gardina, Director
Department of Environmental Protection and Sustainability
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List of Abbreviations

ARA	**Antibiotic Resistance Analysis**
BMP	**Best Management Practice**
BOD	**Biological Oxygen Demand**
BSID	**Biological Stressor Identification**
BST	**Bacteria Source Tracking**
CBP	**Chesapeake Bay Program**
CFR	**Code of Federal Regulations**
Chl a	**Chlorophyll a**
COMAR	**Code of Maryland Regulations**
CWA	**Clean Water Act**
DO	**Dissolved Oxygen**
DPW	**Department of Public Works**
ED	**Extended Detention**
EOF	**Edge of Field**
EOS	**Edge of Stream**
EPA	**U.S. Environmental Protection Agency**
EPS	**Environmental Protection & Sustainability**
FSA	**Farm Service Administration**
HSG	**Hydrologic Soil Groups**
HUC	**Hydrologic Unit Code**
IP	**Implementation Plan**
LA	**Load Allocation**
lbs/yr	**Pounds per Year**
MAST	**Maryland Assessment Scenario Tool**
MD	**Maryland**
MDA	**Maryland Department of Agriculture**
MDE	**Maryland Department of Environment**
MDP	**Maryland Department of Planning**
µg/l	**Micrograms per Liter**
mg/l	**Milligrams per Liter**

MGD	**Million Gallons per Day**
MGS	**Maryland Geological Survey**
MOS	**Margin of Safety**
MPN	**Most Probable Number**
MPR	**Maximum Practicable Reduction**
MS4	**Municipal Separate Storm Sewer System**
NLCD	**National Land Cover Dataset**
NMP	**Nutrient Management Plan**
NOAA	**National Oceanic and Atmospheric Administration**
NPDES	**National Pollutant Discharge Elimination System**
NPS	**Nonpoint Source**
NSA	**Neighborhood Source Assessment**
OIT	**Office of Information Technology**
PAA	**Pervious Area Assessment**
PAI	**Office of Permits Approvals & Inspections**
POM	**Particulate Organic Matter**
PS	**Point Source**
RTG	**Reservoir Technical Group**
SCWQP	**Soil Conservation and Water Quality Plan**
SSA	**Science Services Administration**
SSO	**Sanitary Sewer Overflow**
SWAP	**Small Watershed Action Plan**
SWM	**Stormwater Management**
TMDL	**Total Maximum Daily Load**
TN	**Total Nitrogen**
TP	**Total Phosphorus**
TSI	**Trophic State Index**
TSS	**Total Suspended Solids**
URDL	**Urban Rural Demarcation Line**
USGS	**United States Geological Survey**
USLE	**Urban Soil Loss Equation**
WAG	**Watershed Advisory Group**
WIP	**Watershed Implementation Plan**

WLA	**Waste Load Allocation**
WQBEL	**Water Quality Based Effluent Limitations**
WQIA	**Water Quality Improvement Act**
WQLS	**Water Quality Limited Segment**
WQMP	**Water Quality Management Plan**
WRAS	**Watershed Restoration Action Strategy**
WWTP	**Waste Water Treatment Plant**

This Implementation Plan (IP) has been prepared to address the presence of Polychlorinated Biphenyls (PCBs) in the Bird River and Gunpowder River that has been found to be negatively affecting the aquatic community, and posing a human health risk. The amount of reduction in PCB inputs has been determined by a Total Maximum Daily Load (TMDL) developed by the Maryland Department of the Environment (MDE) in the document titled *Total Maximum Daily Load of Polychlorinated Biphenyls in the Gunpowder River and Bird River Subsegments of the Gunpowder River Oligohaline Segment, Baltimore County and Harford County, Maryland*, and after a public comment period, submitted to the US Environmental Protection Agency (EPA) Region 3 for review and approval. EPA approved the TMDL October 3, 2016.

1.1 What is a TMDL?

A TMDL has two different meanings. It is the document that is produced by MDE when any Maryland water body is listed on the state's 303(d) list of impaired and threatened waters. MDE must then submit the TMDL to EPA for approval. Any time a TMDL document is developed, extensive scientific study is done on the pollutant of concern in the listed water body. This study is done with the goal of finding the maximum load of the pollutant that the water body can receive and still meet Maryland's water quality standards. It is often thought of as a "pollution diet" for the watershed. All of the studying and monitoring that is done in preparing the TMDL document boils down to a single maximum load number that will be the target for pollution reduction in the water body. This number is also called a TMDL. In other words, the goal of the TMDL document is to justify the TMDL number, which can be found within the TMDL document.

The TMDL number is expressed as a sum of all the different sources of the pollutant plus a margin of safety (MOS). The MOS value helps to account for any lack of knowledge or understanding concerning the relationship between loads and water quality and also for any rounding errors in the TMDL calculation (calculation format shown below). Expressing the TMDL in terms of this simple equation makes it easier to see where pollution reduction efforts need to be focused. In other words, which sources can be reduced to reach the final TMDL number, by how much they need to be reduced, and which pollution sources are not practical for reduction. The sources that make up the final TMDL number are categorized as either Load Allocation (LA) or Waste Load Allocation (WLA). LAs are all non-point source loads, meaning that they do not come from a single source or pipe. LAs include agricultural runoff, forest runoff, and upstream loads. WLAs are all point source loads, meaning that they do come from a single traceable source. WLAs are further categorized as process water or stormwater. Process water WLA comes from sources that have permits allowing them to release a specific amount of a pollutant into the water. They include individual industrial facilities, individual municipal facilities, and mineral mining facilities. Stormwater WLA is any stormwater that is regulated by a municipal separate storm sewer systems (MS4) permit, water from industrial facilities permitted to release stormwater, and all runoff from construction sites.

All Baltimore County urban stormwater is regulated under Baltimore County's MS4 permit. That means that stormwater WLA includes all of the water that runs to any storm drain within the watershed area. The MOS is the final part of the equation. The MOS can be implicit, meaning that the final TMDL was calculated in such a way that it accounted for any errors without needing to tack an explicit MOS to the end of the sum of load sources equation. When an explicit MOS is necessary, it is assumed that a 5% reduction of the final TMDL number will be sufficient.

TMDL Sum of Load Sources Equation:

TMDL	=	**LA**	+	**WLA Stormwater**	+	**WLA Process Water**	+	**MOS**

1.1.1 How is the Final TMDL Determined?

The process of determining the TMDL number can be very complex. Pollution data are regularly collected throughout Maryland by many different federal, state, and local government agencies as well as universities and watershed organizations. The agency or organization may send individuals out to the stream to collect and measure information about the watershed as part of a study or regular monitoring program. Data are also collected from the many different monitoring stations that are located throughout Maryland's watersheds. Some of these monitoring stations have been collecting water data for decades. The U.S. Geological Survey and the Maryland Department of Natural Resources monitoring stations are often used as the data source for Maryland TMDLs. To find out who is keeping an eye on your watershed see MDE's Water Quality Monitoring Web Page.

Complex scientific models are often used to help find a practical number for the total reduction. Models often use existing monitoring data and observations about the watershed area in a calculation that determines the TMDL number. The type of model used and the complexity of the model vary by pollutant, water body type, and complexity of flow conditions. The specific model used for this TMDL is explained in Section 3.

In all cases, scientists first find a baseline load for the pollutant. The baseline load is how much of the pollutant is in the water body at the time of the study, before restoration actions specifically developed to reach the TMDL number are implemented. The calculated target number, that is the TMDL, is the final goal. It could be thought of as the finish line in the TMDL process. That is not to say that other restoration efforts will not continue once that target is reached, but that the water body will be able to meet state water quality standards and can be removed from the list of impaired and threatened waters for that particular pollutant.

When calculating the TMDL number, a percent reduction and load reduction are usually calculated as well. The load reduction is the difference between the baseline load and the TMDL target. Think of it as the amount that needs to be removed from the system in order to reach the target. The percent reduction is the percentage of the baseline load that needs to be removed in order to reach the TMDL target.

1.2 Geographic Area

Pollution reduction goals are determined by watershed. A watershed is all the land area where all of the water that runs off that land and all the water running under that land drain into the same place. Everything within a watershed is linked by a common water destination. Watersheds exist at many levels: some very large, and some quite small. Identifying your watershed is similar to identifying your current location on a map. You could say you are in the United States, or that you are in Maryland, or that you are in your kitchen at your specific street address. Similarly, you could say that you are in the Mid-Atlantic Region Watershed, which drains to the Atlantic Ocean, Long Island Sound and Riviere Richelieu, a tributary of the St.

Lawrence River. You could also say that you are in the Upper Chesapeake Bay Watershed, which includes the area of drainage to the Chesapeake Bay that is north of the Maryland-Virginia line. Both would describe a watershed that you are located in. However, watersheds can become much more specific.

A system was established by the U.S. Geological Survey for dividing the U.S. into successively smaller hydrologic units. Each hydrologic unit is identified by a hydrologic unit code (HUC), which range from two to twelve digits. The smaller the scale of the watershed, the more digits it has in its code. For example, the Mid-Atlantic Region is a 2-digit watershed and the Upper Chesapeake Bay is a 4-digit watershed. The 6-digit unit, also known as the "basins" unit, is to serve as the common scale for watershed assessments at the national level, but the condition of these basins can be determined based on an aggregation of assessments of even smaller watershed units. Maryland has chosen to go the route of assessing smaller watershed units. As a result, TMDLs are determined at the 8-digit watershed scale. For a further explanation of HUCs or to see maps of watersheds at different HUC levels, go to: USGS Hydrologic Unit Maps. If you would like to know which Maryland 8-digit watershed you are located in, go to MDE's Find My Watershed Map.

It is important to note that 8-digit watersheds can overlap multiple counties and may, therefore, have several regulating authorities.

1.2.1 Bird River/Gunpowder River Geographic Area

The Bird River is a watershed that covers a total land area of approximately 16,530 acres, all within Baltimore County. The Gunpowder River has a land drainage area of approximately 12,560 acres, with about 5,860 acres within Baltimore County (some of the Gunpowder River's watershed is within neighboring Harford County). The Bird River watershed begins in the East-central portion of Baltimore County, flowing eastward before discharging into the tidal Gunpowder River and Chesapeake Bay along the Baltimore County and Harford County boundary. This TMDL Implementation Plan will specifically address the area of the watershed and watershed tributaries that are located in Baltimore County.

The further disposition of the watershed will be addressed during Section 5 of this IP which presents the watershed characterization. Below, Figure 1-1 provides a map of the watersheds of the Bird River and Gunpowder River location within Baltimore County.

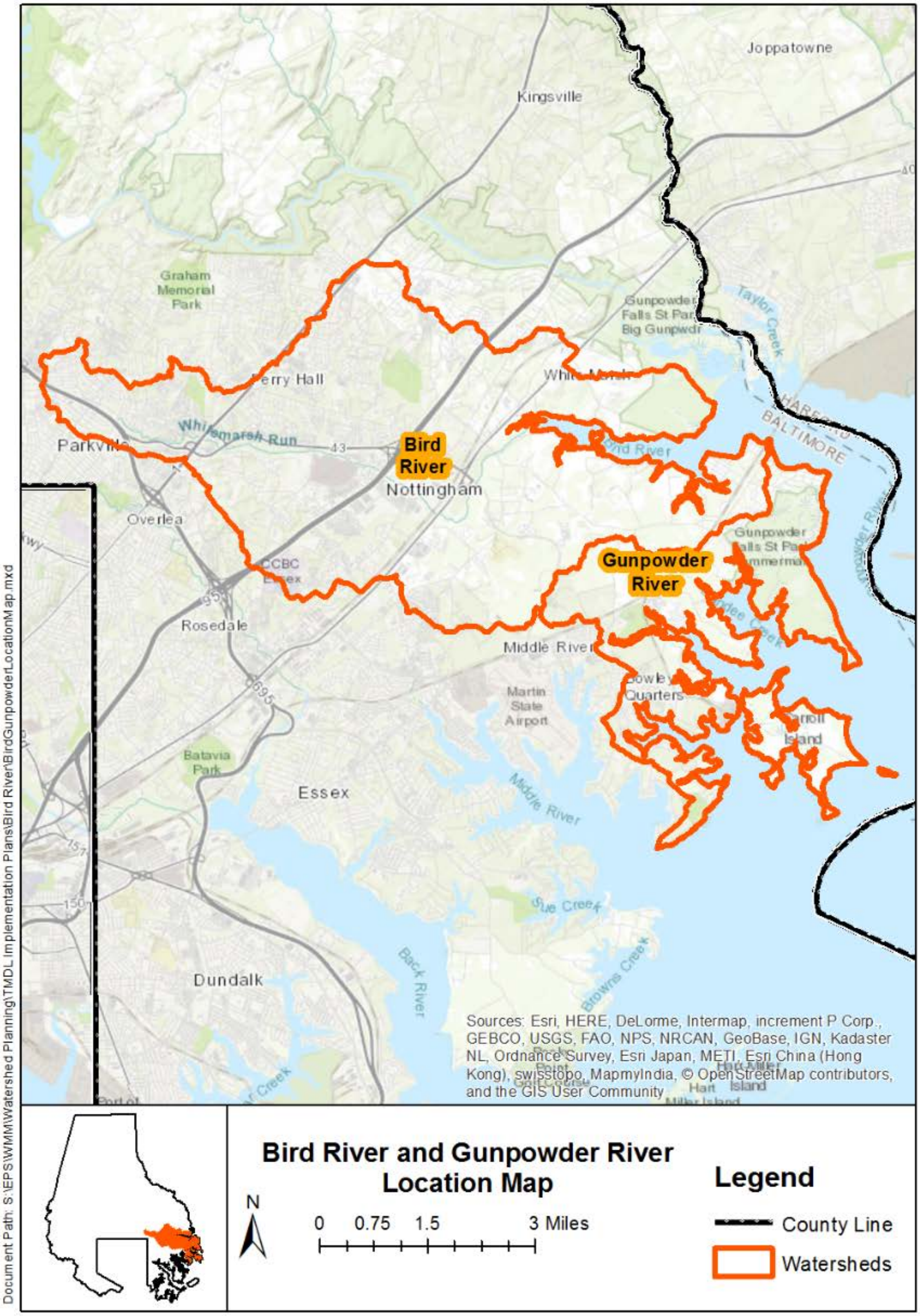

Figure 1-1: Bird River and Gunpowder River Watersheds within Baltimore County

1.3 Goal of the TMDL Implementation Actions

TMDL Implementation Plan Objective:

Through a cooperative effort of Baltimore County Department of Environmental Protection and Sustainability, other county agencies, local watershed associations, and the general public, to provide a comprehensive plan of action for achieving TMDL targets and ultimately restoring the health of Baltimore County waters to acceptable water quality standards.

Baltimore County is required to reduce pollution in its waterways; the plans to meet these reductions need to be in place within one year of TMDL issuance by MDE. More on the legal requirements for these implementation plans will be discussed in depth during Section 2 of this document. The goal of this IP is to set the "road map" for the county to reach the goal of reducing pollutant loads in the water to meet water quality standards.

1.4 Document Organization

The Baltimore County TMDL implementation plans provide the following information to explain the necessity of the TMDL Implementation Plan and to develop a management strategy that will be followed in order to meet county TMDL reduction targets. The County will take an adaptive management approach that will include periodic assessments to determine progress and identify changes needed in the management strategy to meet the reduction targets in a timely, cost effective manner.

Section 1: Introduction

This Introduction states the pollutant that is being addressed by the TMDL IP, and the watershed for which the IP was developed. It provides a background on what a TMDL is and how the TMDL is determined. A general description of the geographic area for the specific IP is provided. The Introduction also states the overall goal of the TMDL IP and summarizes the actions that have been identified to bring Baltimore County to that goal. It also includes a brief summary of the contents of the thirteen sections of the TMDL Implementation Plan.

Section 2: Regulatory Policy and Planning

This part of the document describes the administration and legal authority that mandates the development of Baltimore County's TMDL implementation plan and oversees its fulfillment. It will provide a background of how various regulating authorities and policies are related to the requirement to develop a TMDL Implementation Plan. It will also summarize the various planning guidance documents that have been produced to assist in the development of TMDL Implementation Plans and how TMDL Implementation Plans fit in the overall Baltimore County planning context.

Section 3: TMDL Summary

The section summarizes the original TMDL document that was submitted by MDE and approved by the EPA. The summary includes: when the TMDL was developed, what is impaired, why the TMDL was developed, a description of the analysis process that was used to determine the total maximum daily load targets, the baseline year of data collection and analysis, the results from that analysis, and a further break down of the target loads by source sector.

Section 4: Literature Summary

Each TMDL IP will address a specific pollutant. This part of the document provides an overview of the pollutant that is summarized from published literature. The literature summary includes known sources of the pollutant, the impacts associated with the pollutant, the pathways and transformations of the pollutant, and other relevant ecological processes that affect how the pollutant can be controlled and regulated.

Section 5: Watershed Characterization

Characterization of the watershed will include geographical and technical information for the portion of the watershed that is specific to each TMDL IP. Each characterization will describe the watershed acreage, population size, geology and soils, topography, land use, streams, infrastructure related to watershed pollution sources, implemented restoration projects since the baseline year, and changes in pollutant load since the baseline year.

Section 6: Existing Data Summary

This section will include a summary of Baltimore County's existing monitoring data that will be pertinent to the pollutant in question. It may also include some data received from sources other than Baltimore County, such as data from the Maryland Department of the Environment, or other relevant sources.

Section 7: Summary of Existing Restoration Plans

Previous planning efforts will be summarized in this section. Water Quality Management Plans (WQMP) and Small Watershed Action Plans (SWAP) applicable to the IP area are identified. The process and goals for SWAP development are explained.

Section 8: Best Management Practice Efficiencies

This section is an explanation of the best management practices that will be used for removing the particular pollutant and the known efficiency of those best management practices. A table will be found in this section of BMPs and the known reduction efficiency for the pollutants that can be reduced by each BMP. BMP efficiencies will also include a discussion of the uncertainty and research needs for BMPs.

Section 9: Implementation

The implementation section will provide a description of programmatic, management, and restoration actions; and pollutant load reduction calculations to meet the pollutant reduction target for the specific pollutant. For each of the programmatic, management, and restoration actions there will be a list of responsible parties, actions, timeframe of actions, and performance standards.

Section 10: Assessment of Implementation Progress

Assessment of implementation progress will give Baltimore County a formal method of reporting on the development of implementation and of describing the progressive success of implementation actions. The section will include a description of tracking and reporting mechanisms, and a monitoring plan that includes progress monitoring as well as BMP effectiveness monitoring.

Section 11: Continuing Public Outreach Plan

This part of the document will be a continuing public outreach plan. It will encourage public involvement in the implementation process, extending beyond the finalization of this document.

Section 12: References

A list of references used in the creation of this document.

The Legal Authority, Policy, and Planning Framework section will present, in brief, the background on the legal requirements that pertain to the development of Total Maximum Daily Loads (TMDLs), and the preparation of TMDL Implementation Plans. This section will also cover the planning framework for the development of the TMDL Implementation Plans (IP). Furthermore, this section is intended to provide the context for the development of this TMDL Implementation Plan and understanding of the linkage between water quality and the TMDL.

Whether at the federal or state level there are a number of processes at work that result in the regulations that must be followed to remain within the law. First, legislation is passed by an elected governing body (e.g. Congress, state legislature), and once passed and signed by the executive branch, they become Acts (laws), such as the Clean Water Act. In order to provide guidelines in maintaining compliance with these laws, it is often necessary that regulations be issued to specify the law's requirements. A regulation is a rule issued by a government agency that provides details on how legislation will be implemented, and may set specific minimum requirements for the public to meet if they are to be considered in compliance with the law. These regulations may come in various forms, such as the Code of Federal Regulations (CFR), or Code of Maryland Regulations (COMAR). The information that follows is generally taken from CFR and COMAR.

Under the Code of Federal Regulations (CFR), Title 40 encompasses the regulations enforced by the U.S. Environmental Protection Agency (EPA). These regulations include not only those related to water quality, but also air quality, noise, and a variety of land based regulations (oil operations, etc.)

2.1 Regulatory and Policy Framework

The ultimate regulatory authority for protecting and restoring water quality rests with the federal government through legislative passage of the Clean Water Act in 1972 and subsequent amendments. Prior to the Clean Water Act (1972), the Federal Water Pollution Control Act (1948) served as the basis for controlling water pollution. The Clean Water Act significantly amended the Federal Water Pollution Control Act and established the basic structure for regulating discharges of pollutants into the waters of the United States. Major amendments were enacted in 1977 and 1987 that further strengthened and expanded the Clean Water Act of 1972. The 1987 amendments incorporated the requirement that stormwater discharges from urban (municipal) areas be required to obtain a permit for discharge and that stormwater discharges from industrial sources also be permitted. There have been a number of minor amendments and reauthorizations over the years that have resulted in the law as it now stands.

There are several significant provisions of the Clean Water Act that pertain to TMDLs. These provisions include the requirement that states adopt Water Quality Standards by designating water body uses and set criteria that protect those uses. The Clean Water Act also requires states to assess their waters and provide a list (known as the 303(d) list) of waters that are impaired. The list specifies the impairing substance and requires that a TMDL be developed to address the impairment.

Through policy (memos dated November 22, 2002 and November 12, 2010) the US EPA has indicated that the pollutant loads attributable to regulated stormwater discharges are to be included in the Waste Load Allocation as a point source discharge and not as part of the non-point load. The initial memo also affirmed that the Water Quality-Based Effluent Limitations

(WQBELs) in Municipal Separate Storm Sewer System (MS4) permits may be expressed in the form of Best Management Practices (BMPs) and not as numeric limits for stormwater discharges. The second memo clarified that when the MS4 permits are expressed in the form of BMPs, the permit should contain objectives and measurable elements (e.g., schedule for BMP installation or level of BMP performance). By providing both an expected level of BMP performance and a schedule of implementation of the various practices, Baltimore County will have addressed this requirement. This plan once approved by Maryland Department of the Environment (MDE) will be enforceable under the terms of the permit.

2.2 Maryland Use Designations and Water Quality Standards

In conformance with the Clean Water Act, the State of Maryland has developed use designations for all of the waters in the state of Maryland, along with water quality standards to maintain the use designations.

Designated uses define an intended human and aquatic life goal for a water body. It takes into account what is considered the attainable use for the water body, for protection of aquatic communities and wildlife, use as a public water supply, and human uses, such as recreation, agriculture, industry, and navigation. Water quality standards include both the Use Designation and Water Quality Criteria (numeric standards). Water Quality Criteria are developed to protect the uses of a water body.

2.2.1 Use Class Designations

Every stream, lake, reservoir, and tidal water body in Maryland has been assigned a Use Designation. The Use Designation is linked to specific water quality standards that will enable the Designated Use of the water body to be met. A listing of the Use Designations follows:

- Use I: Water contact recreation, and protection of nontidal warmwater aquatic life.
- Use II: Support of estuarine and marine aquatic life and shellfish harvesting (not all subcategories apply to each tidal water segment)
    - Shellfish harvesting subcategory
    - Seasonal migratory fish spawning and nursery subcategory (Chesapeake Bay only)
    - Seasonal shallow-water submerged aquatic vegetation subcategory (Chesapeake Bay only)
    - Open-water fish and shellfish subcategory (Chesapeake Bay only)
    - Seasonal deep-water fish and shellfish subcategory (Chesapeake Bay only)
    - Seasonal deep-channel refuge use (Chesapeake Bay only)
- Use III: Nontidal cold water – usually considered natural trout waters
- Use IV: Recreational trout waters – waters are stocked with trout

The letter "P" may follow any of the Use Designations, if the surface waters are used for public water supply. There may be a mix of Use Classes within a single 8-digit watershed; for example, Gwynns Falls has Use I, Use III, and Use IV Designations depending on the subwatershed.

Table 2-1: Designated Uses and Applicable Use Classes

Designated Uses	Use Classes							
	I	I-P	II	II-P	III	III-P	IV	IV-P
Growth and Propagation of fish (not trout), other aquatic life and wildlife	✓	✓	✓	✓	✓	✓	✓	✓
Water Contact Sports	✓	✓	✓	✓	✓	✓	✓	✓
Leisure activities involving direct contact with surface water	✓	✓	✓	✓	✓	✓	✓	✓
Fishing	✓	✓	✓	✓	✓	✓	✓	✓
Agricultural Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Industrial Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Propagation and Harvesting of Shellfish			✓	✓				
Seasonal Migratory Fish Spawning and Nursery Use			✓	✓				
Seasonal Shallow-Water Submerged Aquatic Vegetation Use			✓	✓				
Seasonal Deep-Water Fish and Shellfish Use			✓	✓				
Seasonal Deep-Channel Refuge Use			✓	✓				
Growth and Propagation of Trout					✓	✓		
Capable of Supporting Adult Trout for a Put and Take Fishery							✓	✓
Public Water Supply		✓		✓		✓		✓

2.2.2 Water Quality Criteria

Water quality criteria are developed to protect the uses designated for each water body. Certain standards apply over all uses, while some standards are specific to a particular use. The criteria are based on scientific data that indicate threats to aquatic life or human health. For the protection of aquatic communities the criteria have been developed for fresh water, estuarine water, and salt water. The criteria have been further based on acute levels (have an immediate negative effect) and chronic levels (have longer term effects). The human health criteria are based on drinking water levels, organism consumption levels, or a combination of drinking water and organism consumption levels, or recreational contact bacteria levels.

Dissolved oxygen criteria for all Use Designations is 5 mg/L, except for Use II Designations and special criteria for drinking water reservoir hypolimnion waters (bottom waters of the reservoir).

Bacteria criteria are based on human health concerns, and apply to all Uses, with additional bacteria criteria applicable in shellfish waters. Since none of the local TMDLs are related to the shellfish criteria, they are not discussed here. The human health criteria are based on either the geometric mean of 5 samples or single sample criteria based on the frequency of full body contact, these criteria are displayed in Table 2.2. For the freshwater bacteria TMDLs the indicator bacteria *E. coli* has been used in the development of the TMDL, therefore serves as the water quality end point. The human health recreational contact bacteria criteria are displayed in

Table 2-2. The table displays both the geometric mean for bacteria and single sample maximum allow bacteria concentrations based on the frequency of full body contact.

Table 2-2: Bacteria Criteria for Human Health (MPN/100 ml)

Indicator	Steady State Geometric Mean Density	Single Sample Maximum Allowable Density			
		Frequent Full Body Contact Recreation	Moderately Frequent Full Body Contact Recreation	Occasional Full Body Contact Recreation	Infrequent Full Body Contact Recreation
Freshwater (Either Apply)					
Enterococci	33	61	78	107	151
E. coli	126	235	298	410	576
Marine					
Enterococci	35	104	158	275	500

2.3 Planning Guidance

In March of 2008 the EPA released a guidance document on the development of watershed plans entitled *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. The handbook laid out nine minimum elements to be included in watershed plans, commonly called the "a through i" criteria. The criteria include:

a. An identification of the causes and sources or groups of sources that will need to be controlled to achieve the load reductions estimated in the watershed plan.

b. Estimates of pollutant load reductions expected through implementation of proposed Non-point Source (NPS) management measures.

c. A description of the NPS management measures that will need to be implemented.

d. An estimate of the amounts of technical and financial assistance needed to implement the plan.

e. An information/education component that will be used to enhance public understanding and encourage participation.

f. A schedule for implementing the NPS management measures.

g. A description of interim, measurable milestones for the NPS management measures.

h. A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards.

i. A monitoring component to evaluate effectiveness of the implementation efforts over time.

EPA now evaluates watershed plans on the basis of the above criteria in consideration of its grant funding. The State of Maryland is also increasingly using the above criteria for funding consideration. Baltimore County has used these criteria since the publication of the handbook in the development of its Small Watershed Action Plans; and will use the criteria in the development of this TMDL Implementation Plan.

Maryland Department of the Environment (MDE) developed a guidance document in conjunction with local government representatives entitled *Maryland's 2006 TMDL Implementation Guidance for Local Governments*, which provides a framework for the development of TMDL Implementation Plans. MDE has also provided guidance on the development of TMDL Implementation Plans related to specific pollutants. Guidance for specific pollutants includes:

- PCBs
- Bacteria
- Mercury
- Trash

These guidance documents have been taken into consideration in the development of the Baltimore County TMDL Implementation Plans.

2.4 Water Quality Standards Related to This Implementation Plan

Bird River (MD 02-13-08-03) watershed has a Use IV designation in non-tidal streams which includes recreational trout waters, along with a small portion of Use I designated streams which includes water contact recreation, and protection of aquatic life. The tidal areas of the watershed fall under Use II subclasses 1, 2, and 3 for the tidal portion of Bird River.

Gunpowder River (MD 02-13-08-01) watershed covers a great deal of area, including all Use Class Designations at some point throughout the watershed. This TMDL is specific to the tidal embayment, however which has a Use II designation for the support of estuarine and marine aquatic life and shellfish harvesting.

The PCB TMDL is predicated on the fish tissue concentrations of PCBs associated with Fish Advisories.

The United States Food and Drug Administration (USFDA) established a guidance level for fish tissue of 0.3 mg/kg. The targeted water quality end point will be fish tissue concentrations of PCBs of <0.3 mg/kg.

COMAR 26.08.02.03-2.G(4) establishes the Maryland water quality criteria for PCB concentrations in water for the protection of aquatic life and human health. These are detailed in Table 2-3.

Table 2-3: PCBs Water Quality Standards

<table>
<tr><th rowspan="3">Substance</th><th colspan="4">Aquatic Life (µg/L)</th><th colspan="3">Human Health</th></tr>
<tr><th colspan="2">Fresh Water</th><th colspan="2">Salt Water</th><th rowspan="2">Drinking Water + Organism (µg/L)</th><th rowspan="2">Organism Only (µg/L)</th><th rowspan="2">Drinking Water MCL (mg/L)</th></tr>
<tr><th>Acute</th><th>Chronic</th><th>Acute</th><th>Chronic</th></tr>
<tr><td>Polychlorinated Biphenyls (PCBs)</td><td></td><td>.014</td><td></td><td>.03</td><td>.00064</td><td>.00064</td><td>.0005</td></tr>
</table>

Since Bird River and Gunpowder River do not supply drinking water, only the aquatic life and fish consumption (organism only) apply. The TMDL analysis indicated that the water quality concentration of PCBs was significantly lower than the most conservative water quality criteria. Therefore, the water column concentrations are not of concern and the only water quality that applies is the fish tissue concentration.

3.0 Introduction

This section provides a brief summary of the information contained in the Maryland Department of the Environment (MDE) document titled *Total Maximum Daily Load of Polychlorinated Biphenyls in the Gunpowder River and Bird River Subsegments of the Gunpowder River Oligohaline Segment, Baltimore County and Harford County, Maryland*, approved by the U.S. Environmental Protection Agency (EPA) October 3, 2016 (MDE, 2015).

3.1 TMDL Background

MDE first listed Bird River on the State 303d list as impaired for PCBs in fish tissue in 2006. This causes an impairment to the water quality of Bird River based on its designated uses. The TMDL established in the MDE document is to ensure that the “fishing” designated use, which is protective of human health related to the consumption of fish, in the Gunpowder River Oligohaline Segment, and in this case its Bird River tidal subsegment, is supported; however, this TMDL will also ensure the protection of all other applicable designated uses within the segment. For more information you may also review the MDE webpage regarding designated uses for water bodies.

Aside from the hazards to the natural functions of ecosystems and organisms, PCBs and their hazards to human health have caused the State of Maryland to set limits on PCB concentrations in the environment. These limits include considerations for PCBs present in the water column, PCBs that stick (adsorb) to sediments, and PCBs present in fish. For protection of human health the maximum allowable concentration of PCBs in the water column is 0.64 nanograms per liter (ng/L), while for the protection of aquatic life there are limits for freshwater and saltwater at 14 and 30 ng/L respectively (COMAR 26.08.02.03-2). In terms of water column concentrations of PCBs, Bird River and Gunpowder River do not exceed the thresholds discussed here, and are meeting applicable water column criteria. Although PCBs do not readily dissolve in water, it is still important for scientists to understand how these toxins are distributed within the waterbody. As they do not readily dissolve in water, PCBs do sorb to sediments and their environmental mobility is somewhat related to sediment movements, however there is not a MDE listing threshold for PCB concentration in sediment. That said, the TMDL can provide some guidance on the target for PCB concentrations in sediment that may be needed to satisfy the fish tissue concentration target which will be discussed further on in this section.

In addition to the water column criteria described above, fish tissue monitoring can also serve as an indicator of PCB water quality conditions. The Maryland fish tissue monitoring data is used to issue fish consumption advisories/recommendations and determine whether Maryland waterbodies are meeting the “fishing” designated use. Only data results from the analysis of skinless fillets, the edible portion of fish typically consumed by humans, is used for assessment purposes and development of this TMDL. Currently Maryland applies 39 ng/g as the tPCB fish tissue listing threshold (MDE, 2015). When concentrations of PCBs in fish tissue exceed this threshold, the water body is considered to be unsupportive of the “fishing” designated use. The EPA human health criterion was developed solely based on organism consumption, as water consumption does not pose any risk for cancer development at environmentally relevant levels. The only human health risk associated with PCB exposure is through the consumption of aquatic organisms, which is addressed by the water column and sediment endpoints applied within this TMDL developed to be supportive of the "fishing" designated use for the embayment.

In review, the limits of contamination as set by MDE are shown in Table 3-1 below.

Table 3-1: MDE Thresholds for Listing a Waterbody as Impaired by PCBs

Source	Concentration Limit
Water Column (Human Health)	0.64 ng/L
Water Column (Freshwater Aquatic Life)	14 ng/L
Water Column (Saltwater Aquatic Life)	30 ng/L
Sediment	not set
Fish Tissue	39 ng/g

Monitoring for tPCB concentrations in the tidal water column took place in 2012 and 2013 within the Gunpowder and Bird Rivers. Sediment samples were also collected at each tidal sampling location, which helps to characterize influences of tidal forces on PCB fate. Some of these tidal samples were taken from the boundary between the water body segments specific to this TMDL and the Chesapeake Bay mainstem (these samples are marked as "Boundary" in the table below). Non-tidal water column monitoring was conducted along with tidal monitoring to help characterize pollutant loadings from upstream sources. Fish tissue monitoring was also employed which assists in the determination of whether the designated use of "fishing" is being met in the water body in question. Table 3-2 displays the results of the monitoring programs which were used for TMDL development. Gunpowder River and Bird River results are shown separately. Mean tPCB concentrations above the aforementioned MDE thresholds are highlighted.

Table 3-2: Results of MDE Reviewed Monitoring Programs for TMDL Development

Water Body	Source	Water Type	Sample Years	Sample Size	tPCB Concentration			Units
					Maximum	Minimum	Mean	
Gunpowder River	Fish Tissue	Tidal	2012/2013	60	173.20	19.50	77.64	ng/g
	Sediment	Tidal	2012	10	24.86	0.00	15.66	ng/g
		Tidal (Boundary)		2	21.42	7.89	14.65	ng/g
	Water Column	Tidal	2012/2013	14	0.59	0.01	0.38	ng/L
		Tidal (Boundary)	2012/2013	3	0.69	0.29	0.43	ng/L
		Non-Tidal (Watershed)	2012/2013	3	0.45	0.01	0.29	ng/L
		Non-Tidal (Upstream)	2012/2013	7	0.01	0.00	0.00	ng/L
Bird River	Fish Tissue	Tidal	2012/2013	40	476.30	57.90	276.60	ng/g
	Sediment	Tidal	2012	4	38.40	9.69	20.45	ng/g
	Water Column	Tidal	2012/2013	8	1.69	0.02	0.61	ng/L
		Non-Tidal	2012/2013	15	0.76	0.00	0.25	ng/L

The above table is useful for showing why this TMDL is specific to PCB in fish tissue, as the reviewed monitoring data show that only the mean fish tissue concentrations are currently exceeding the threshold for impairment.

Even though fish tissue concentrations are the only monitored metric which indicate an impairment due to PCBs, it is important to remember that fish bioaccumulate toxins in their bodies based on the concentrations of PCBs in the surrounding environment. As seen in Table

3-1 above, Maryland does not have a standard PCB concentration limit for sediments, and for this TMDL have instead used an analysis on the bioaccumulation potential of the toxin in fish tissue (using a set of formulae) to determine the necessary concentrations of PCBs in the water column and sediment to allow for the fish tissue concentration requirements to eventually be met.

In order to reach the required TMDL listing threshold for PCBs in fish tissue, MDE predicts that water column concentrations of PCBs must be reduced to levels much lower than the regulatory listing limits. By a similar analysis, MDE predicts that sediment concentrations must also be greatly reduced from current conditions indicated by monitoring results shown in Table 3-2. MDE's analyses predict that in order to meet the fish tissue endpoint of the TMDL, that water column concentrations of PCBs in Gunpowder River should be no greater than 0.060 ng/L, and in Bird River no greater than 0.022 ng/L. Additionally, sediment concentrations of PCBs in Gunpowder River should be no greater than 1.560 ng/L, and in Bird River no greater than 1.130 ng/L. Table 3-3 below shows required water column and sediment concentrations of PCBs in order to be supportive of the fish tissue concentration limit of 39 ng/g.

Table 3-3: MDE Limits on PCB Concentration in Water Column and Sediment to Support the Designated Use of "Fishing"

<table>
<tr><th colspan="2">Source</th><th>Target Concentration</th></tr>
<tr><td rowspan="2">Water Column</td><td>Gunpowder</td><td>0.060 ng/L</td></tr>
<tr><td>Bird</td><td>0.022 ng/L</td></tr>
<tr><td rowspan="2">Sediment</td><td>Gunpowder</td><td>1.560 ng/g</td></tr>
<tr><td>Bird</td><td>1.130 ng/g</td></tr>
</table>

3.2 TMDL Development

Bird River and Gunpowder River are separate segments, although the Bird River connects to the Gunpowder River in a tidal area and the model simulates them as one system. The area of modelling was divided into six segments for analysis, with the understanding that different areas of an embayment may experience accumulation or attenuation of pollutants at different rates and through varying methods. The model accounts for many factors, including tides, atmospheric deposition, volatilization, freshwater inputs, settling, and exchanges (flux) between water column and bottom sediments. Using these features of the model allows MDE to simulate tPCB concentrations over time in various media, and estimate pollutant load reductions that would be required for the water body to meet its water quality standards. Figure 3-1 below, produced by MDE, shows the six segments of the area modeled.

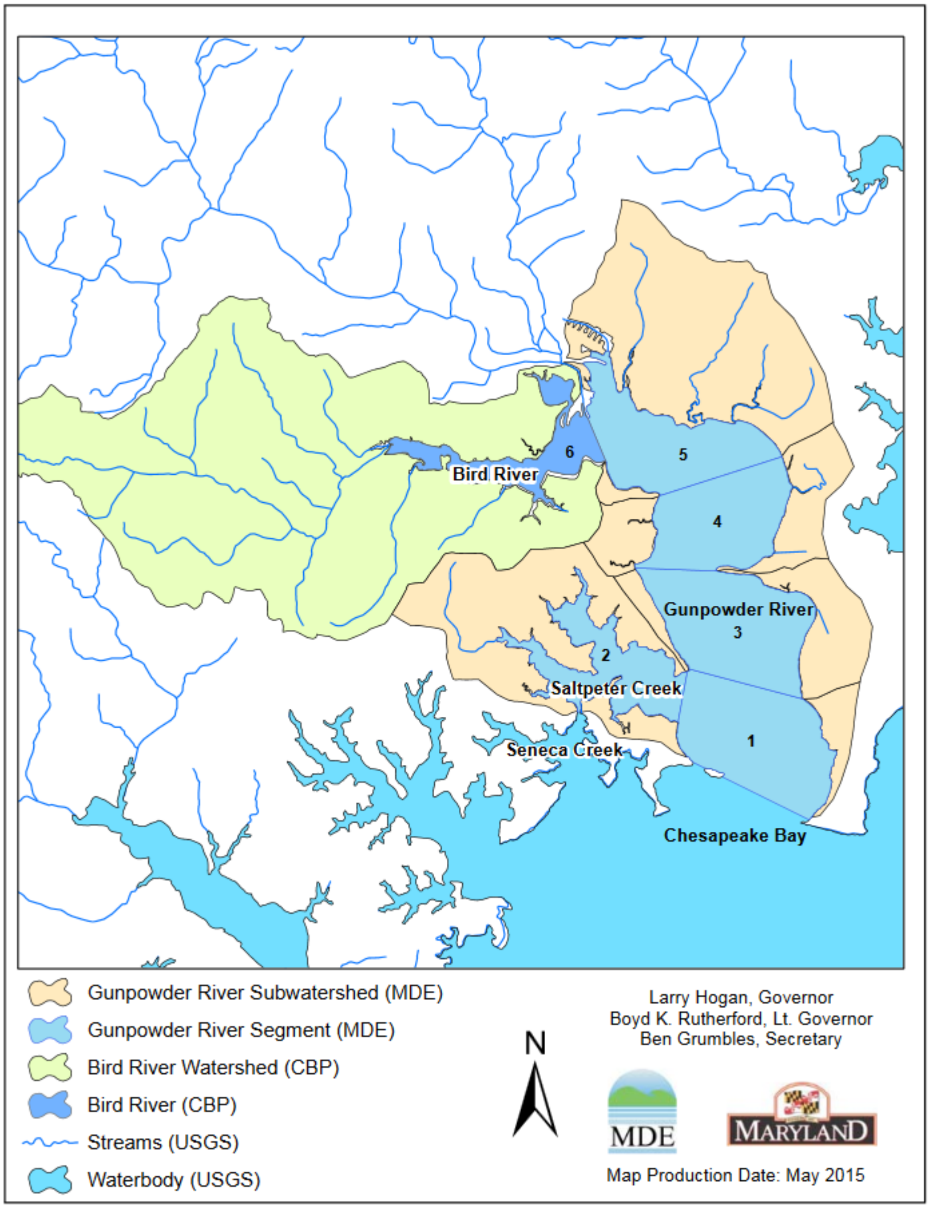

Figure 3-1: Model Segments and Subwatersheds of the Gunpowder and Bird Rivers (MDE, 2015)

3.3 TMDL Results

Using the model described above, and the monitoring data available to MDE, a baseline load of tPCBs was developed. Table 3-4 and Table 3-5 below display the loading for Gunpowder and Bird River by source.

Table 3-4: Baseline tPCB Loading to Gunpowder River by Source

Source		tPCBs (g/year)
Chesapeake Bay Mainstem Influence		34.0
Discharge from Gunpowder Falls and Little Gunpowder Falls		0.2
Direct Atmospheric Deposition to Gunpowder		65.5
Non-Regulated Stormwater Runoff		9.6
Nonpoint Sources Subtotal		**109.3**
C.P. Crane Power Generating Station		155.0
Regulated Stormwater Runoff	Harford County	2.2
	Baltimore County	0.7
Inputs from Bird River	Baltimore County	6.4
Point Sources Subtotal		**164.3**
Total		**273.6**

Table 3-5 Baseline tPCB Loading to Bird River by Source

Source		tPCBs (g/year)
Gunpowder River Influence		49.2
Direct Atmospheric Deposition to Bird River		6.4
Non-Regulated Stormwater Runoff		3.7
Nonpoint Sources Subtotal		**59.3**
Regulated Stormwater Runoff	Baltimore County	6.4
Point Sources Subtotal		**6.4**
Total		**65.7**

3.4 TMDL Reduction Targets by Source Sector

The model scenario determined the necessity for a 65% overall reduction in the Gunpowder River and an 84% overall reduction in Bird River from baseline loads from all sources. Different sources contribute different amounts of the total load and, based upon a multitude of factors (e.g. feasibility of reduction, anticipated compliance with reduction requirements) are targeted differently for mitigation.

All TMDLs must include a Margin of Safety (MOS) to account for the many uncertainties in simulation of water quality factors. To account for these uncertainties, MDE has applied a 5% MOS to this study to ensure an adequate and environmentally protective TMDL. Below, Table 3-6 and Table 3-7 display the target PCB loads by source sector for each water body.

Table 3-6: TMDL Goals and Reductions Required by Source Sector in Gunpowder River

Source		Baseline tPCBs (g/year)	TMDL Goal (g/year)	Percent Reduction Required (%)
Chesapeake Bay Mainstem Influence		34.0	1.25	96
Discharge from Gunpowder Falls and Little Gunpowder Falls		0.2	0.2	0
Direct Atmospheric Deposition to Gunpowder		65.5	65.5	0
Non-Regulated Stormwater Runoff		9.6	9.6	0
Nonpoint Sources Subtotal		**109.3**	**76.55**	**30**
C.P. Crane Power Generating Station		155.0	5.74	96
Regulated Stormwater Runoff	Harford County	2.2	0	0
	Baltimore County	0.7	0	0
Inputs from Bird River	Baltimore County	6.4	See Table 3-7	See Table 3-7
Point Sources Subtotal		**164.3**	**15.04**	**91**
Margin of Safety		**-**	**4.82**	**-**
Total		**273.6**	**96.41**	**65**

Table 3-7: TMDL Goals and Reductions Required by Source Sector in Bird River

Source		Baseline tPCBs (g/year)	TMDL Goal (g/year)	Percent Reduction Required (%)
Gunpowder River Influence		49.2	5.02	90
Direct Atmospheric Deposition to Bird River		6.4	1.92	70
Non-Regulated Stormwater Runoff		3.7	1.11	70
Nonpoint Sources Subtotal		**59.3**	**8.05**	**86**
Regulated Stormwater Runoff	Baltimore County	6.4	1.92	70
Point Sources Subtotal		**6.4**	**1.92**	**70**
Margin of Safety		**-**	**0.52**	**-**
Total		**65.7**	**10.49**	**84**

The tables above demonstrate that there is a 0% reduction required for Baltimore County Stormwater inputs to the Gunpowder River, and a 70% reduction from Baltimore County Stormwater inputs to the Bird River. To reach the target loads of PCBs shown above, Baltimore County will be focusing on achieving the reductions to all sources of the toxin that are within the County’s jurisdiction. Given that Bird River’s regulated stormwater is the only source of PCBs within the County’s jurisdiction, the proposed implementation actions in this document will focus on reducing inputs within the Bird River watershed.

This section of the Implementation Plan provides an overview of the pollutant in question summarized from published literature. The literature summary includes known sources of the pollutant, the impacts associated with the pollutant, the pathways and transformations of the pollutant, and other relevant ecological processes that affect how the pollutant can be controlled and regulated.

This review pertains to direct and indirect effects of Polychlorinated biphenyls (PCBs) on tidal and non-tidal watersheds, specifically those effects that are relevant to Back River. This is not intended to be an exhaustive review of primary literature, but rather a summary of the sources, pathways and biological effects of PCBs from literature available to Baltimore County Department of Environmental Protection and Sustainability.

PCBs belong to a broad family of man-made organic chemicals, known as chlorinated hydrocarbons, that were manufactured and used in hundreds of industrial and commercial applications the following types of products from 1929 to 1979:

- electrical equipment
- flexible PVC coating
- fluorescent lighting ballasts
- plastics
- flame retardants
- sealants such as caulking
- wood flooring finishes
- carbonless copy paper
- paints
- printing ink
- pesticides
- hydraulic fuel
- lubricants

(Bierman, et al., 2009); (Mikszewski, 2004); (EPA, 2013).

4.1 Sources

Although manufacture of these items using PCBs has stopped in the United States, there may be many products that were made prior to the ban that are still in use today. The manufacturing of PCBs is almost completely banned in the United States today, with a phase-out of their inclusion in products in the 1970s. Rising concerns about the toxicity and persistent nature of PCBs in the environment led to a federal ban on the sale and production of PCBs in 1979. It is still legal to use PCBs in applications where they will be totally enclosed; this mainly includes large scale transformers and capacitors. The legal ban also allows for up to 50 ppm of PCBs in products today as PCBs can form as byproducts from the manufacture of other materials. Because of this legality, many products produced today that are made with yellow pigment and dyes contain the chemical congener PCB 11 (Grossman, 2013). Unfortunately, PCBs are being released into the environment by leaks, spills, and accidental burning of PCB-containing equipment. Hazardous waste sites that contain PCBs can leak and introduce them into the environment. Illegal or improper disposal of PCB containing materials, such as dumping materials into landfills that are not meant to handle hazardous waste, can contribute to PCB pollution (Environmental Protection Agency, 2013). One third of all PCBs produced in the U.S. currently reside in the natural environment (Mikszewski, 2004) .For more information on PCB use and history see A BMP Tool Box for Reducing PCBs and Mercury in Municipal Stormwater: section 2.

PCBs released to land and water totaled over 74,000 lbs between 1987 and 1993, 99 percent of which was released to land areas. The majority of these releases occurred in 1990 from PCB use in non-ferrous wire drawing and insulating industries (Environmental Protection Agency, 2013). There are several pathways by which the PCBs released to land areas are eventually transported into waterways. In fact, most of the PCBs released into the environment are bound to aquatic sediments (Mikszewski, 2004). This is partly because PCBs are insoluble in water, but dissolve easily in fats, hydrocarbons, and other organic compounds (Dobson & van Esch, 1993) as cited by (United Nations Environment Programme, 1999).

Major pathways that carry these PCB sources to the water body include urban runoff, and erosion of PCB containing sediment (Davis, Hetzel, Oram, & Mckee, 2007). PCBs are water repelling organic chemicals, so their transportation is dependent on sorption to organic carbon and sediments (Bierman, et al., 2009). When PCB contaminants leak or spill, rain water can easily wash the PCB laden sediments into nearby streams or into storm drains, which are unfiltered and connect directly to local water bodies. The PCB bound sediments may then remain suspended in the water column or settle on the bottom of the water body often becoming buried by the natural deposition of clean sediments, thus reducing human exposure to the chemical (Davis, Hetzel, Oram, & Mckee, 2007) (Mikszewski, 2004). However, elevated flow rates, erosion, and other natural or human disturbances can expose the contaminated sediment, re-introducing the PCBs into the water column, and ultimately into the food web (Davis, Hetzel, Oram, & Mckee, 2007). Bottom feeding organisms, feed off of fine organic material or algae on the floor of the water body and so they are naturally consuming these exposed PCB containing sediment particles. (Davis, Hetzel, Oram, & Mckee, 2007) (Mikszewski, 2004). Waste water effluent and atmospheric deposition are other pathways that are only minor contributors (Davis, Hetzel, Oram, & Mckee, 2007). For more information on PCB pathways see A BMP Tool Box for Reducing PCBs and Mercury in Municipal Stormwater: section 3.

4.2 Exposure

Main conduits of human exposure are through contact with contaminated ground or aquatic sediments, through ingestion of contaminated plants and animals, and direct contact with PCBs.

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs are considered a probable human carcinogen (Bierman, et al., 2009) (a substance and/or exposure that can lead to cancer), and have been shown to cause cancer in other animals. (Environmental Protection Agency, 2013) Risks of cancers, such as non-Hodgkin lymphoma for example, have been specifically linked to the substance (Mikszewski, 2004).

PCBs have also been shown to cause a number of serious non-cancer health effects in animals including effects on the immune system, reproductive system, nervous system, endocrine system (Environmental Protection Agency, 2013). PCBs have also been linked to developmental effects such as learning disorders and low birth weights (Bierman, et al., 2009). In children, they can cause severe neurological problems such as impaired motor and cognitive functions (Mikszewski, 2004). PCBs have 209 distinct structural arrangements, called congeners, each with their own unique chemical properties (Mikszewski, 2004). Lipophilic PCBs can be transferred from a mother to her infant through breast feeding (Mikszewski, 2004). Laboratory animals exposed to PCBs developed liver damage, skin irritation, reproductive dysfunction, and cancer among other health problems (Mikszewski, 2004). Additional information regarding the potential health effects of PCBs may be found here: http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/effects.htm. For an in-depth review of research from an international group of experts on the health effects of PCBs, see: World Health Organization Concise International Chemical Assessment Document 55.

4.3 Bioaccumulation and Biomagnification

PCBs have a tendency to bioaccumulate in individuals, especially in marine environments. Bioaccumulation occurs as organisms come in contact with a pollutant which persists in the body of those individuals, accumulating an amount of the pollutant over time. These organisms then may be consumed by predators, who then experience the effects of biomagnification (Mader, 1997) as cited by (McShaffrey, 2012). For example, small macroinvertebrates can consume and absorb the PCBs as they dig in sediment for food; eventually those macroinvertebrates are eaten by small fish, which are then eaten by medium size and large size fish. Each organism collects some of the chemical in their bodies at a rate faster than the body can remove it. Eventually, humans may consume the medium to large fish that have been building up this chemical in their bodies from consecutive PCB contaminated meals. Bioaccumulating chemicals can build up and stay in human bodies too, especially when humans eat large quantities of fish. Sometimes this process is generally referred to as bioaccumulation, while some sources may separate bioaccumulation (individual organisms accumulating a pollutant in their body) and biomagnification (increases in concentrations of pollutants as predators consume contaminated prey, causing a magnifying effect of the pollutant concentrations). Some people may develop serious health problems, such as cancer and neurological problems in children. Others may never exhibit any health problems. It is impossible to know who will be affected by consuming PCB contaminated fish (Michigan Department of Community Health). For more on bioaccumulation, see Michigan Department of Community Health's *What is Bioaccumulation?*

4.4 Environmental Fate

Once in the environment, PCBs do not readily break down and therefore may remain for long periods of time cycling between air, water, and soil. PCBs can be carried long distances and have been found in snow and sea water in areas far away from where they were released into the environment. As a consequence, PCBs are found all over the world. In general, the lighter the form of PCB, the further it can be transported from the source of contamination (EPA, 2013).

Natural processes remove PCBs from the environment over time. PCB congeners can have different levels of chlorination, meaning that they differ in the number of chlorine atoms attached their two benzene rings. Each of these distinct PCB chemical compounds, which differ in the number of chlorine atoms and the position of the chlorine on the benzene rings, is a separate PCB congener. Highly chlorinated PCBs tend to be more persistent in the environment because they are more resistant to biodegradation. This is in part because the more highly chlorinated congeners bind more tightly to sediments and microorganisms that are capable of degrading PCBs cannot get to those strongly bound PCB molecules (Mikszewski, 2004) (Environmental Protection Agency, 2013). Once released from sediments, PCBs volatize, meaning they will become vaporized and released to the atmosphere, relatively rapidly in water (Environmental Protection Agency, 2013). In the vapor phase, the PCBs most often transform by reacting with hydroxyl radicals in the atmosphere. When this reaction occurs, the resulting chemicals have estimated half-lives ranging from 12.9 days to 1.31 years, meaning the amount of the substance in the atmosphere will be naturally reduced by half in that amount of time (Environmental Protection Agency, 2013).

It is possible, through natural processes, to reduce the number of chlorine atoms on the PCB chemical compound, making the PCBs more likely to detach from aquatic sediments

(Mikszewski, 2004) (Environmental Protection Agency, 2013). Certain anaerobic organisms are able to dechlorinate PCBs and have demonstrated this in natural environments (Mikszewski, 2004). There are several pathways by which this process can occur, but scientists have not yet defined all of these pathways (Mikszewski, 2004).

4.5 Remediation

PCBs are traditionally controlled by specialized sediment incineration and by land filling (Mikszewski, 2004). Both methods require dredging of river sediments and can result in other potentially negative environmental effects. Other emerging technologies include application of activated carbon to contaminated sediments to reduce the bioavailability of the existing contaminant (Patmont et al., 2015). Other PCB removal methods may be less damaging, but many are still experimental as it is extremely challenging to remediate large areas of PCB contaminated, aquatic sediment.

For a further review of available literature on PCB reducing BMPs see A BMP Tool Box for Reducing PCBs and Mercury in Municipal Stormwater: sections 4 &5 and also see Emerging Technologies for the In Situ Remediation of PCB-Contaminated Soils and Sediments: Bioremediation and Nanoscale Zero-Valent Iron, 2004.

Please refer to the Bird River Watershed Characterization Report developed as Volume 2 of the Small Watershed Action Plan (SWAP) completed in April 2014.

The Bird River Watershed Characterization Report is intended to summarize information on geomorphological, hydrological, and biological factors that may affect water quality and the condition of other natural resources. In addition, this report identifies and assesses the human impact on the watershed. Portions of this section are derived from the Bird River SWAP.

5.1 Location

The Bird River watershed is within the Eastern Piedmont and Coastal Plain regions of Maryland, located north and east of the City of Baltimore (Figure 5-1). It drains to the tidal Gunpowder River just north of where the Gunpowder enters the Chesapeake Bay. The Bird River SWAP area includes several towns (Fullerton, Perry Hall, White Marsh and Chase) and is approximately 16,408 acres (26 square miles) or 5 percent of the overall Gunpowder River watershed.

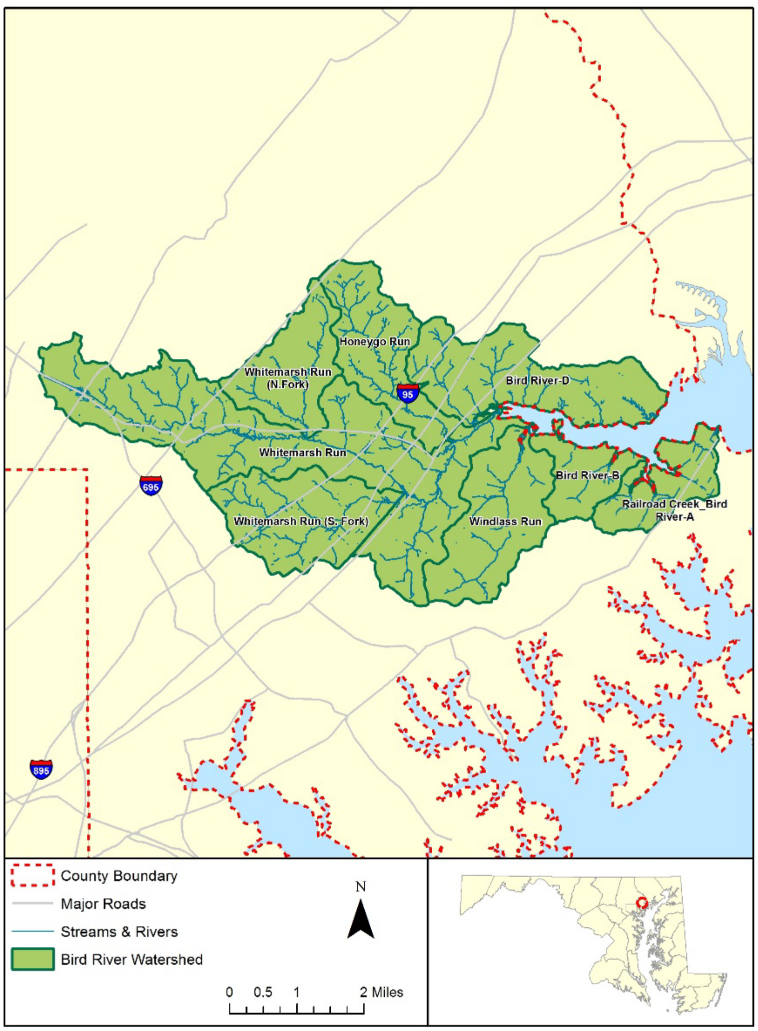

Figure 5-1: Bird River Watershed Location

The Bird River watershed contains eight smaller drainage areas called subwatersheds (Figure 5-2). In addition to characterizing the entire watershed, analyses were conducted on a subwatershed scale to provide detailed information for smaller areas and to focus restoration and preservation efforts. Also, success of restoration efforts can be more easily monitored and measured on this smaller scale. Subwatersheds and corresponding acreages are listed in Table 1-1.

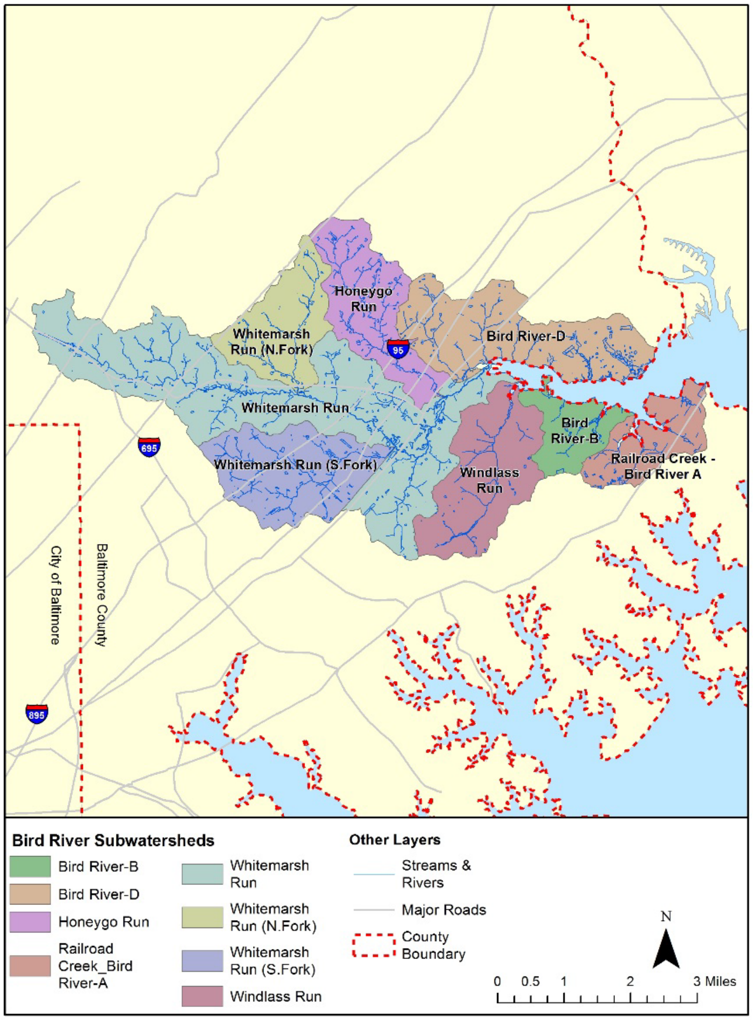

Figure 5-2: Bird River Subwatersheds

The Bird River watershed covers 26 square miles in southeastern Baltimore County. For the purposes of watershed planning, Baltimore County used stream maps and topography to divide the Bird River watershed into eight subwatersheds, ranging in size from 770 acres to 5,454 acres (Figure 5-2; Table 5-1).

Table 5-1: Bird River Subwatershed Areas

Subwatershed	Area (Acres)	Area (Sq. Miles)
Bird River-B	770.41	1.20
Bird River-D	2,360.10	3.69
Honeygo Run	1,644.93	2.57
Railroad Creek_Bird River-A	991.90	1.55
Whitemarsh Run	5,454.42	8.52
Whitemarsh Run (N. Fork)	1,374.42	2.15
Whitemarsh Run (S. Fork)	1,884.09	2.94
Windlass Run	1,927.90	3.01
Total	**16,408.18**	**25.64**

5.2 Soils

Soil conditions are important when evaluating water quantity and quality in streams and rivers. Soil type and moisture conditions, for example, affect how land may be used and its potential for vegetation and habitat. Soils are an important consideration for projects aimed at improving water quality and/or habitat. Baltimore County's GIS soils layer was used for the soils data analysis and is a representation of the Baltimore County Soil Survey, published by USDA/ Natural Resources Conservation Service (NRCS) in 1976.

5.2.1 Hydrologic Soil Groups

The Natural Resource Conservation Service (NRCS) classifies soils into four hydrologic soil groups (HSG) based on runoff potential. Runoff potential is the opposite of infiltration capacity (ability for the soil to absorb precipitation). Soils with high infiltration capacity will have low runoff potential, and vice versa. Infiltration rates are highly variable among soil types and are also influenced by disturbances to the soil profile (e.g., land development activities). For example, urbanization in watersheds with high infiltration rates (e.g., sands and gravels) will have a greater impact than urbanization in watersheds consisting mostly of silts and clays, which have low infiltration rates. The four hydrologic soil groups are A, B, C, and D, where group A soils generally have the lowest runoff potential and Group D soils have the greatest.

Brief descriptions of each hydrologic soil group are provided below. Further explanation of each can be found in the USDA/NRCS publication, Urban Hydrology for Small Watersheds, also called Technical Release 55 (USDA 1986).

- Group A soils include sand, loamy sand, or sandy loam types. These soils have a high infiltration rate and low runoff potential even when thoroughly wet. These consist mainly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.
- Group B soils include silt loam or loam types. They have a Mod. infiltration rate when thoroughly wet. These soils mainly consist of somewhat deep to deep, Mod.ly well to well drained soils with Mod.ly fine texture to Mod.ly coarse texture. These soils have a Mod. rate of water transmission.
- Group C soils are sandy clay loam. These soils have a low infiltration rate when thoroughly wet. These types of soils typically have a layer that hinders downward movement of water and soils with Mod.ly fine or fine texture. These soils have a low rate of water transmission.
- Group D soils include clay loam, silty clay loam, sandy clay, silty clay, or clay types. These soils have a very low infiltration rate and high runoff potential when thoroughly wet. These consist mainly of clays with high swell potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission.

Visualized in Table 5-2 and Figure 5-3, the soils in the Bird River watershed are mostly divided between soil groups B and C (those with Mod. and low infiltration rates, respectively). The distribution of hydrologic soil groups is patchy, with a few solid blocks of soils in groups A and D, the very well drained soils and very low infiltration rate soils. The large blocks of Group D correspond to areas of dense urbanization and large areas of impervious surface.

Table 5-2: Bird River Subwatershed Hydrologic Soil Group Categorization (2014)

Subwatershed	**Hydrologic Soil Group (% of Subwatershed)**			
	A	**B**	**C**	**D**
Bird River-B	20.57	36.13	38.63	4.67
Bird River-D	2.95	22.19	55.03	19.83
Honeygo Run	13.60	34.80	48.34	3.26
Railroad Creek_Bird River-A	4.47	39.46	50.81	5.26
Whitemarsh Run	10.28	23.09	40.53	26.10
Whitemarsh Run (N. Fork)	14.33	25.11	50.74	9.83
Whitemarsh Run (S. Fork)	11.95	12.51	50.73	24.81
Windlass Run	8.97	35.92	53.29	1.83
Total	**10.89**	**28.65**	**48.51**	**11.95**

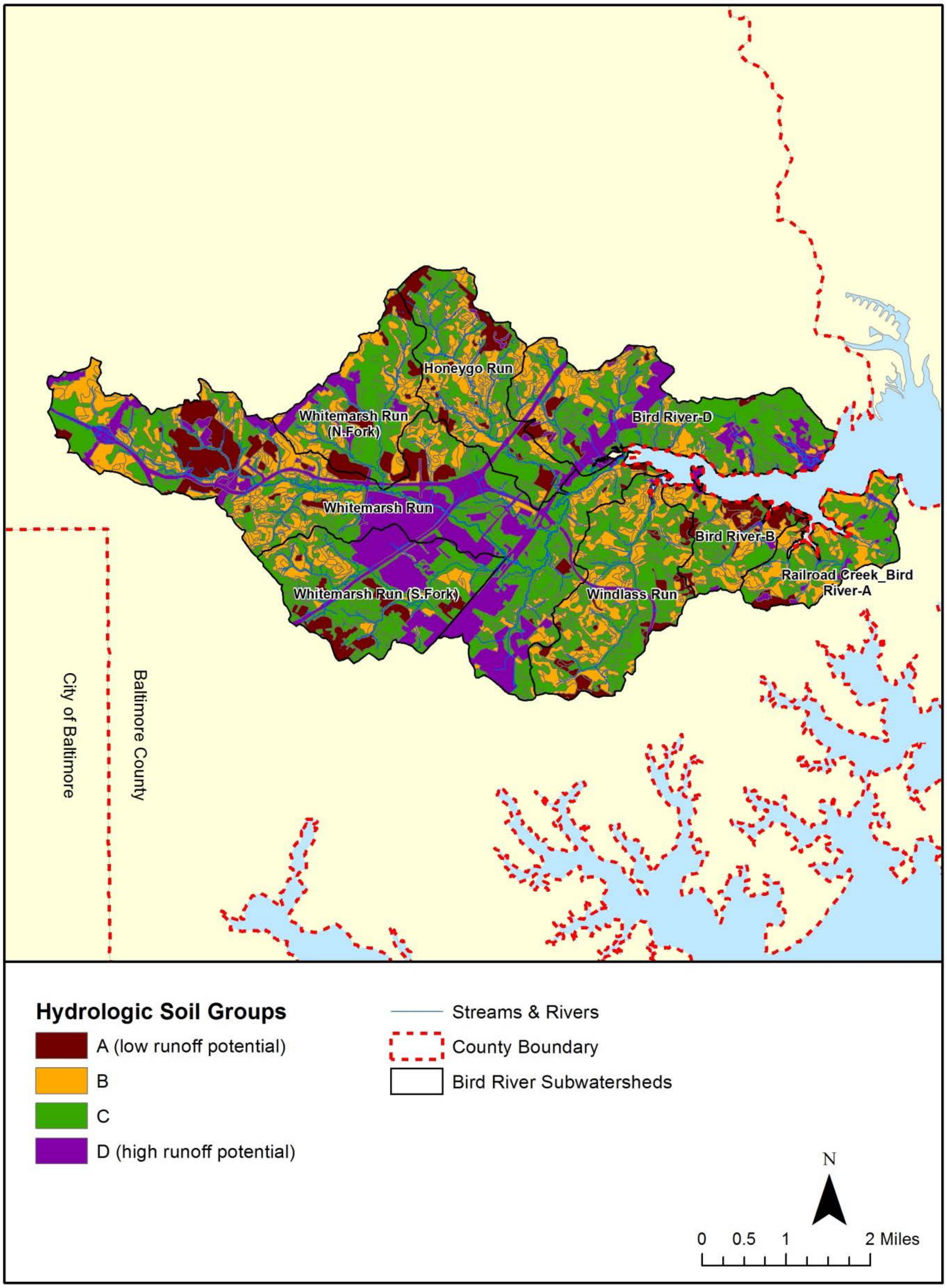

Figure 5-3: Bird River Watershed Hydrologic Soil Groups (2014)

5.2.2 Erodibility

Erodibility is the susceptibility of soil to erosion. It is quantified by the K factor, which is part of the Universal Soil Loss Equation (USLE) developed by USDA's Agricultural Research Service to estimate rate of erosion and soil loss for a particular site. Low K factor values indicate low erodibility or high resistance to detachment and high K factors represent high erodibility potential. Erodibility is based on the physical and chemical properties of the soil, which determine how strongly soil particles cohere with one another. For example, clay soils are cohesive or resistant to detachment and have low K values on the order of 0.05 to 0.15 (Ouyang 2002).

Soil erodibility was divided into the following three categories, based on the soils data obtained from Baltimore County's Office of Information Technology (OIT) for Bird River:

- Low Erodibility (K factor < 0.24);
- Medium Erodibility ($0.24 \leq$ K factor ≤ 0.32); and
- High Erodibility (K factor > 0.32).

Figure 5-4 shows the distribution of soil erodibility in the Bird River watershed based on these categories and a summary by subwatershed is shown in Table 5-3. Subwatersheds with the largest fractions of highly erodible soils present the greatest potential for addressing soil conservation issues via best management practices (BMPs) such as minimizing bare soil and keeping topsoil in place. Soil erodibility data are also useful in combination with other information such as location of cropland, slope steepness, and distance to streams to determine where retirement of highly erodible land, another BMP, is appropriate. High K factor values can also serve as a warning for urban activities planned near streams such as road construction or utility placements.

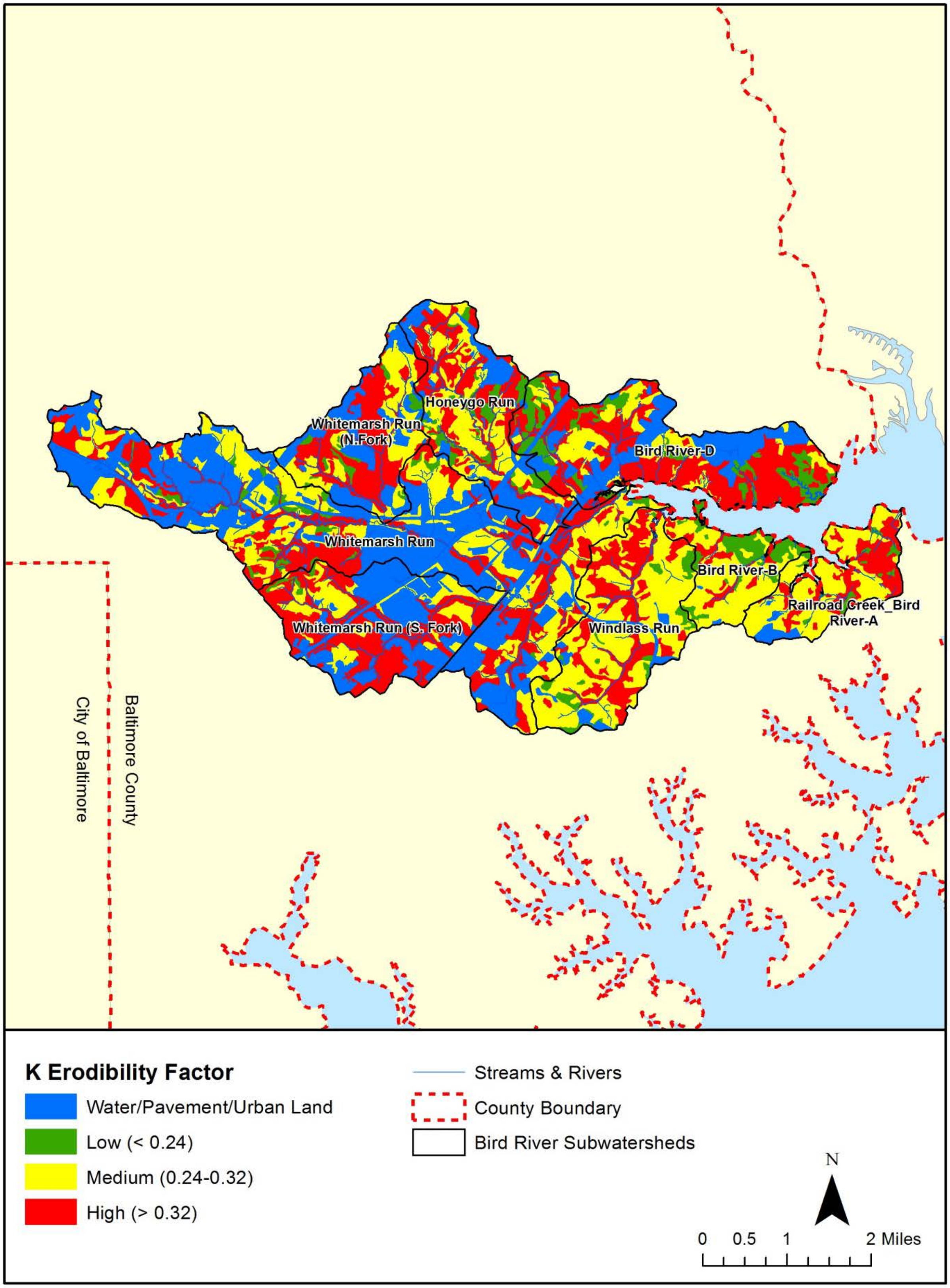

Figure 5-4: Bird River Watershed Soil Erodibility (based on K factor) (2014)

Table 5-3: Bird River Subwatershed Soil Erodibility Categorization (2014)

Subwatershed	Water/ Pavement/ Urban Land Cover (%)	Soil Erodibility Category (K Factor) (% of Subwatershed)		
		Low (< 0.24)	Medium (0.24-0.32)	High (> 0.32)
Bird River-B	0.67	26.32	59.94	13.07
Bird River-D	25.21	14.82	16.29	43.69
Honeygo Run	22.11	8.76	32.55	36.58
Railroad Creek_Bird River-A	5.64	5.10	58.89	30.37
Whitemarsh Run	43.12	3.00	28.22	25.66
Whitemarsh Run (N. Fork)	27.97	5.10	26.34	40.59
Whitemarsh Run (S. Fork)	37.19	1.15	18.56	43.11
Windlass Run	5.55	6.40	58.49	29.55
Total	**20.93**	**8.83**	**37.41**	**32.83**

As shown in Figure 5-4 and Table 5-3, medium and high erodibility categories represent over 70 percent of the soil erodibility distribution in the Bird River watershed. This indicates that most of the watershed's soils are prone to Mod. or high erosion. Significant portions (> 40%) of the Bird River-D, Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork) subwatersheds consist of highly erodible soils. These subwatersheds should rank as a priority for maintaining protective land cover such as forested area. Water/Pavement/Urban Land are not assessed for the erodibility K factor because of the skew in the data this would cause (e.g. pavement does not erode as lose soils do).

5.3 Tidal Waters

The tidal waters of Bird River encompass approximately 828 acres. This area is primarily open tidal water, though a small portion is made up of embayments (e.g., coves, bays. The tidal waters of Bird River are oligohaline which denotes low salinity/brackish waters (0.5 to 5 parts per thousand [ppt]). The Bird River watershed contains approximately 16 miles of coastline. Three of the eight subwatersheds are landlocked and have no coastline.

5.4 Zoning and Landuse

5.4.1 Zoning Classifications

The zoning for the Bird River watershed at the time of the most recent watershed assessment is shown in Figure 5-5. A summary of zoning category acreages and proportions within the Bird River watershed is included in Table 5-4. As shown in the table, a variety of zoning categories are represented in the watershed however, the dominant categories are residential ('DR' categories) and light manufacturing ('ML' categories). Most of the land directly adjacent to the tidal Bird River is zoned as Resource Conservation- Critical Area or Agricultural, as shown in Figure 5-5. Commercial and industrial zoning dominate the central portion of the watershed, while the remaining areas of the watershed, including most of the lands surrounding stream headwaters, are zoned residential.

Table 5-4: County Zoning in Bird River Watershed (2014)

Zoning Description	Zoning Codes	Acres	% of Watershed Area
Business Local	BL,BLR	278	1.7
Business Major	BM	418	2.5
Business Roadside	BR	321	2.0
Community Business	CB	14	0.1
Low Density Residential	DR 1	4,383	26.6
Medium Density Residential	DR 5.5	3,751	22.8
High Density Residential	DR 10.5	1,160	7.0
Residential Apartment - Mid-rise	RAE 1	50	0.3
Manufacturing Heavy	MH	440	2.7
Manufacturing Light	ML	2,213	13.5
Manufacturing Light Restricted	MLR	272	1.7
Office Park	O 3	11	0.1
Office/Residential - High Density	OR 1	-	0.0
Office/Residential - Medium Density	OR 2	30	0.2
Office and Technology	OT	-	0.0
Resource Conservation - Agricultural	RC 2	1,447	8.8
Resource Conservation - Deferral of Pl. and Devel.	RC 3	399	2.4
Resource Conservation - Rural Residential	RC 5	43	0.3
Resource Conservation - Rural Cons. & Reside.	RC 6	43	0.3
Resource Conservation - Critical Area	RC 20, RC 50	1,131	6.9
Residential Office	RO	48	0.3
Total		**16,451**	**100.0**

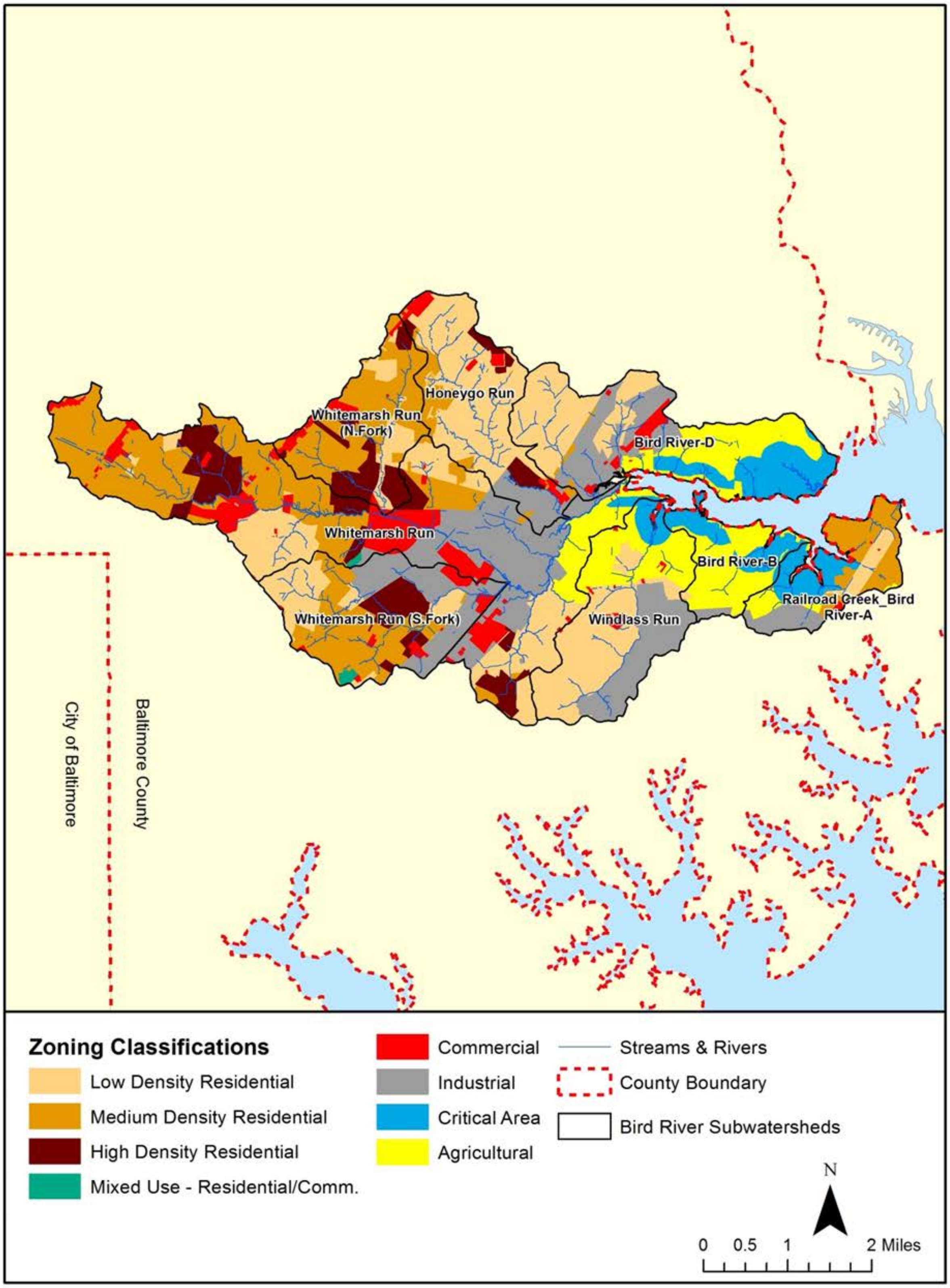

Figure 5-5: Bird River Watershed Zoning (2014)

5.4.2 Land Use

Land use can have pronounced impacts on water quality and habitat. Different land uses generate different types and amounts of pollutants. In considering some pollutants, land cover may be more pertinent for pollutant load analysis, however for toxics such as PCBs, land use would be perhaps more pertinent to assess, as there are implications of potential PCB sources associated with certain land uses.

Maryland Department of Planning (MDP) develops statewide land use/land cover GIS layers to provide a general overview of predominant land cover/usage (interpreted from aerial photography and satellite imagery) and to monitor development activities throughout the state. The most recent update available and used for this characterization report is the 2010 MDP land use/land cover scheme. A map and pie chart of land use/land cover according to MDP's 2010 scheme is shown in Figure 5-6. A summary of land use/land cover percentages by subwatershed is included in Table 5-5.

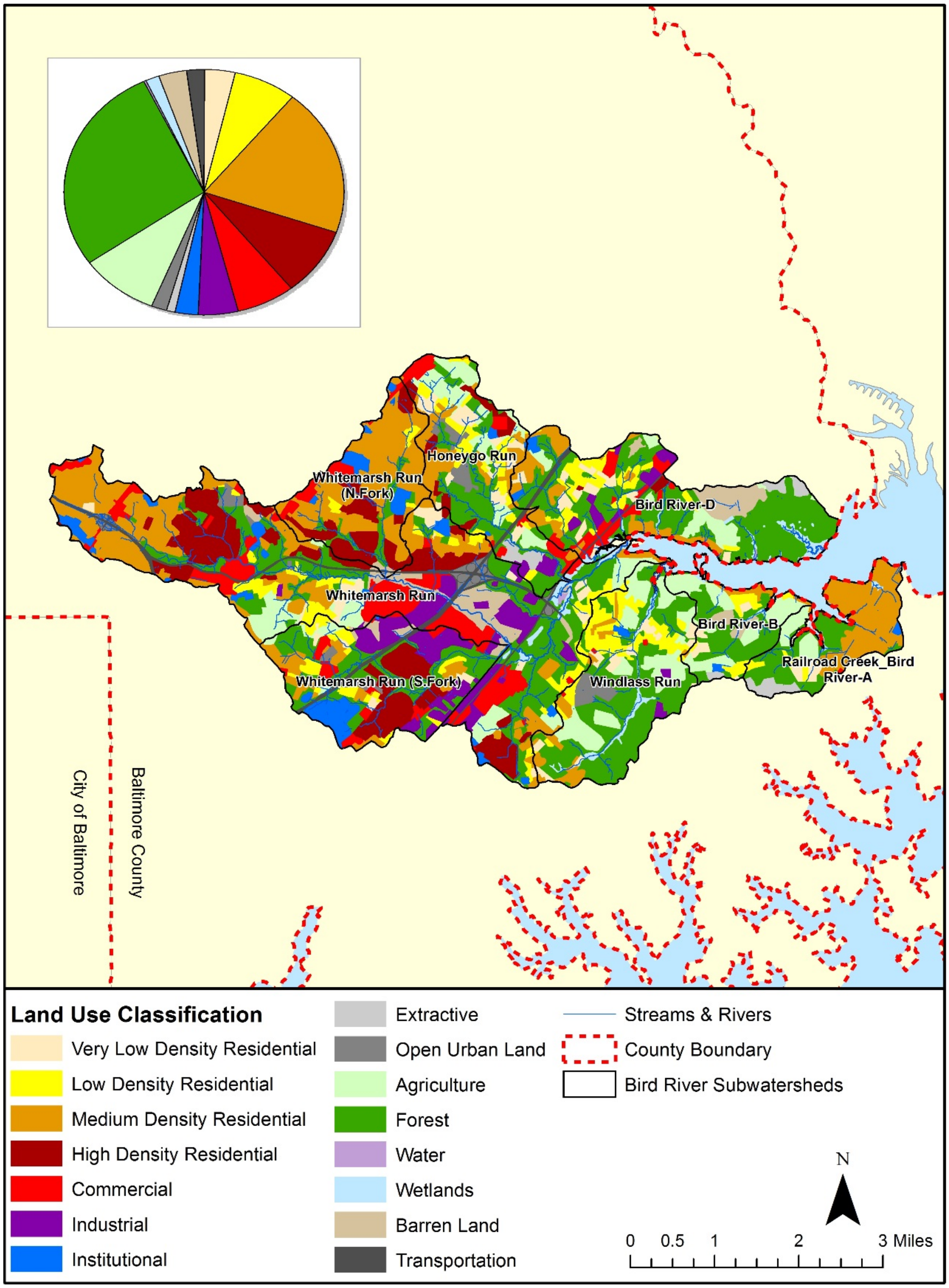

Figure 5-6: Map and Pie Chart of Bird River Watershed Land Use/Land Cover (2010)

Table 5-5: Bird River Land Use/Land Cover Classification (%; 2010)

Land Use	Subwatershed: Bird River-B	Bird River-D	Honeygo Run	Railroad Creek_Bird River-A	Whitemarsh Run	Whitemarsh Run (N. Fork)	Whitemarsh Run (S. Fork)	Windlass Run	Total
Very Low Density Residential	4.5	4.6	8.3	3.5	2.7	0.0	1.7	4.7	3.7
Low Density Residential	8.6	7.7	10.9	3.8	4.9	2.4	7.4	14.5	7.5
Medium Density Residential	5.3	10.6	14.3	48.8	21.2	53.4	10.0	6.4	21.2
High Density Residential	0.0	0.7	6.3	0.2	13.1	22.0	17.7	0.0	7.5
Commercial	0.0	6.1	6.4	0.3	11.9	6.5	6.4	0.3	4.7
Industrial	0.0	3.6	2.6	0.0	5.8	0.0	16.0	1.1	3.6
Institutional	1.1	1.0	0.8	0.8	2.7	6.9	6.9	0.6	2.6
Extractive	1.4	1.7	3.2	5.7	0.0	0.0	0.0	0.0	1.5
Open Urban Land	0.0	0.0	4.3	0.0	2.0	0.0	2.1	4.1	1.6
Cropland	31.8	5.7	15.7	9.2	5.9	0.1	2.3	20.2	11.4
Orchards/Vineyards/Horticulture	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeding Operations	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	37.4	43.8	5.3	25.9	16.4	7.6	22.0	39.3	24.7
Evergreen Forest	0.0	0.6	2.0	0.0	0.0	0.0	0.0	0.0	0.3
Mixed Forest	0.0	0.0	18.7	0.0	3.3	0.0	2.8	5.6	3.8
Brush	6.1	0.0	0.0	0.0	2.9	0.9	2.0	0.0	1.5
Bare Ground	0.0	7.4	0.0	0.0	1.8	0.0	0.0	0.0	1.1
Water	0.2	0.6	0.0	0.3	0.2	0.0	0.0	0.1	0.2
Wetlands	3.8	3.7	0.1	1.4	1.4	0.0	0.0	3.2	1.7
Transportation	0.0	1.8	1.2	0.0	4.0	0.2	2.5	0.0	1.2

The Bird River watershed encompasses approximately 16,408 acres (25.6 square miles) of land. By this dataset, the primary land uses in the watershed are Deciduous Forest (25%) and Medium Density Residential (21%), which occur in large patches that are spread throughout the watershed. The largest area of commercial and industrial land uses is concentrated around White Marsh Mall and the Avenue at White Marsh near the center of the watershed. When all residential and commercial land uses are combined, urban development covers close to 50% of the watershed.

5.4.3 Construction History

PCBs were used in building construction materials, and were produced in the United States from 1929 to until they were banned in 1979. Structures built or renovated during this PCB era might release PCBs into the environment due to weathering, repairs, renovations, or demolition. Construction dates, structure size, and parcel size information is available from the Maryland Department of Assessments and Taxation through Baltimore County's landuse geodatabase.

Parcels were grouped by construction date into PCB era (1929 to 1979), Pre-PCB era (before 1929), and Post-PCB era (after 1979). The map in Figure 5-6 shows the patchy distribution of structures by era. Many areas are dominated by PCB era structures (red dots), but there are several areas dominated by Post-PCB era structures (blue dots), and a few areas dominated by Pre-PCB era structures (yellow dots). A large portion of the structures developed during the PCB era were medium density residential – based on comparison with the land use data presented in the previous section. Much of this development is clustered near the Harford Rd interchange with I-695, in the headwaters of the Whitemarsh Run subwatershed. Additional clusters appear in the North Fork Whitemarsh Run subwatershed to the North of Whitemarsh Blvd and East of the Belair Rd corridor.

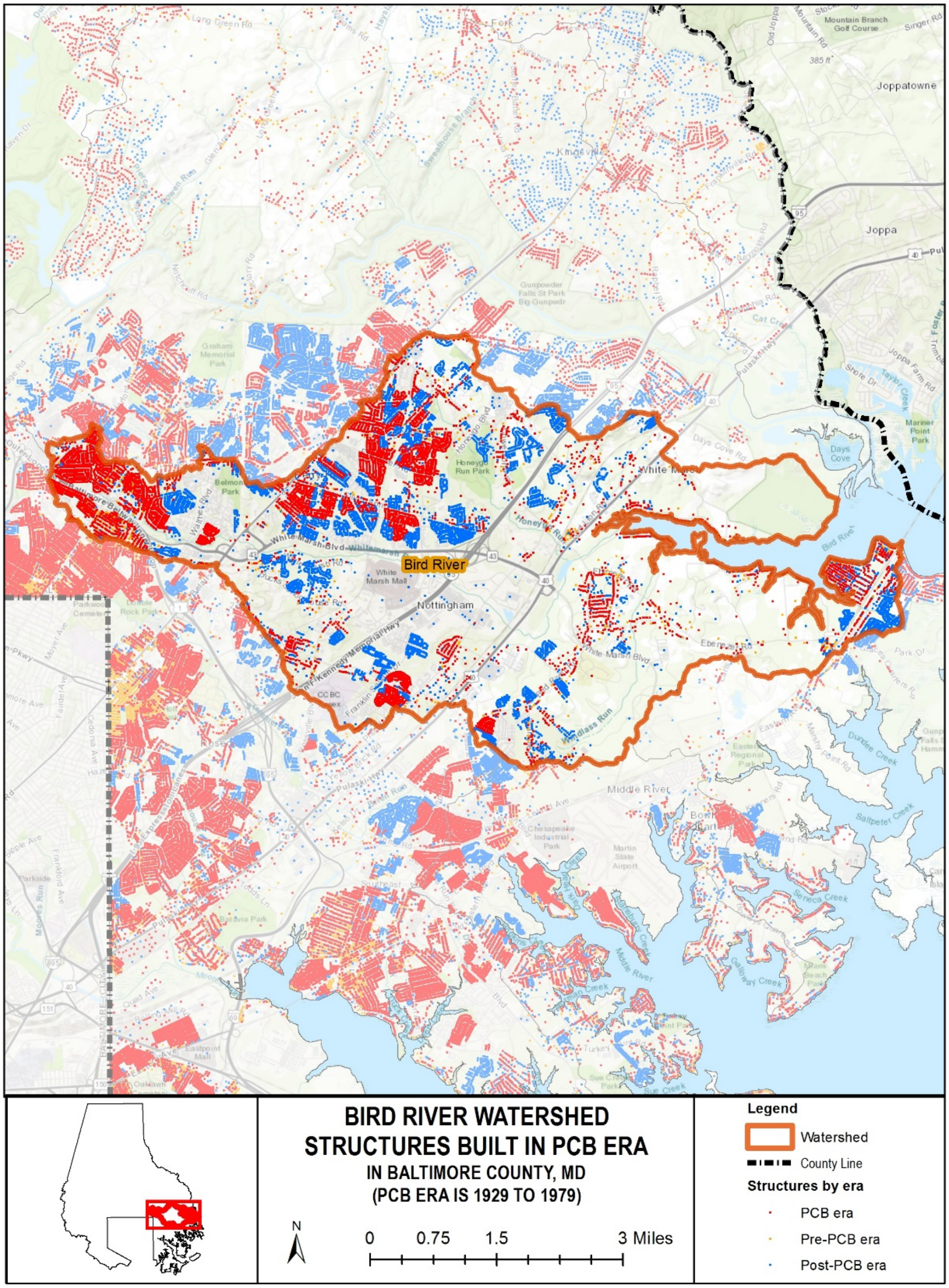

Figure 5-7: Map of Structures by PCB Era in Bird River Watershed in Baltimore County

For additional detail regarding the characterization of the Bird River Watershed, please refer to the Bird River Watershed Characterization Report developed as Volume 2 of the Small Watershed Action Plan (SWAP) completed in April 2014.

The purpose of this section is to summarize and analyze the existing monitoring data regarding Polychlorinated Biphenyls (PCBs) within the Bird River watershed. Baltimore County does not currently have a PCB monitoring program in place, and while Baltimore County does have past data from a program which monitored PCB concentrations in dredged sediments, concentrations appeared below minimum detection limits for the method used. Maryland Department of the Environment (MDE) has conducted PCB monitoring for the purposes of developing the Total Maximum Daily Load (TMDL) for PCBs in Gunpowder River and Bird River. The data provided in the TMDL related to total PCB (tPCB) concentrations is shown in this section; since Baltimore County's requirement to reduce PCB inputs is for Bird River, we have omitted the monitoring data from Gunpowder River in this section. The data may also be found in the TMDL document main report in Appendix G. Additional MDE water quality data may be downloaded from https://www.waterqualitydata.us/.

Figure 6-1 below shows the locations where monitoring data was collected by MDE during TMDL development. The points shown on the map are labeled with a station ID which corresponds to a particular data point further detailed in Table 6-1 through Table 6-3.

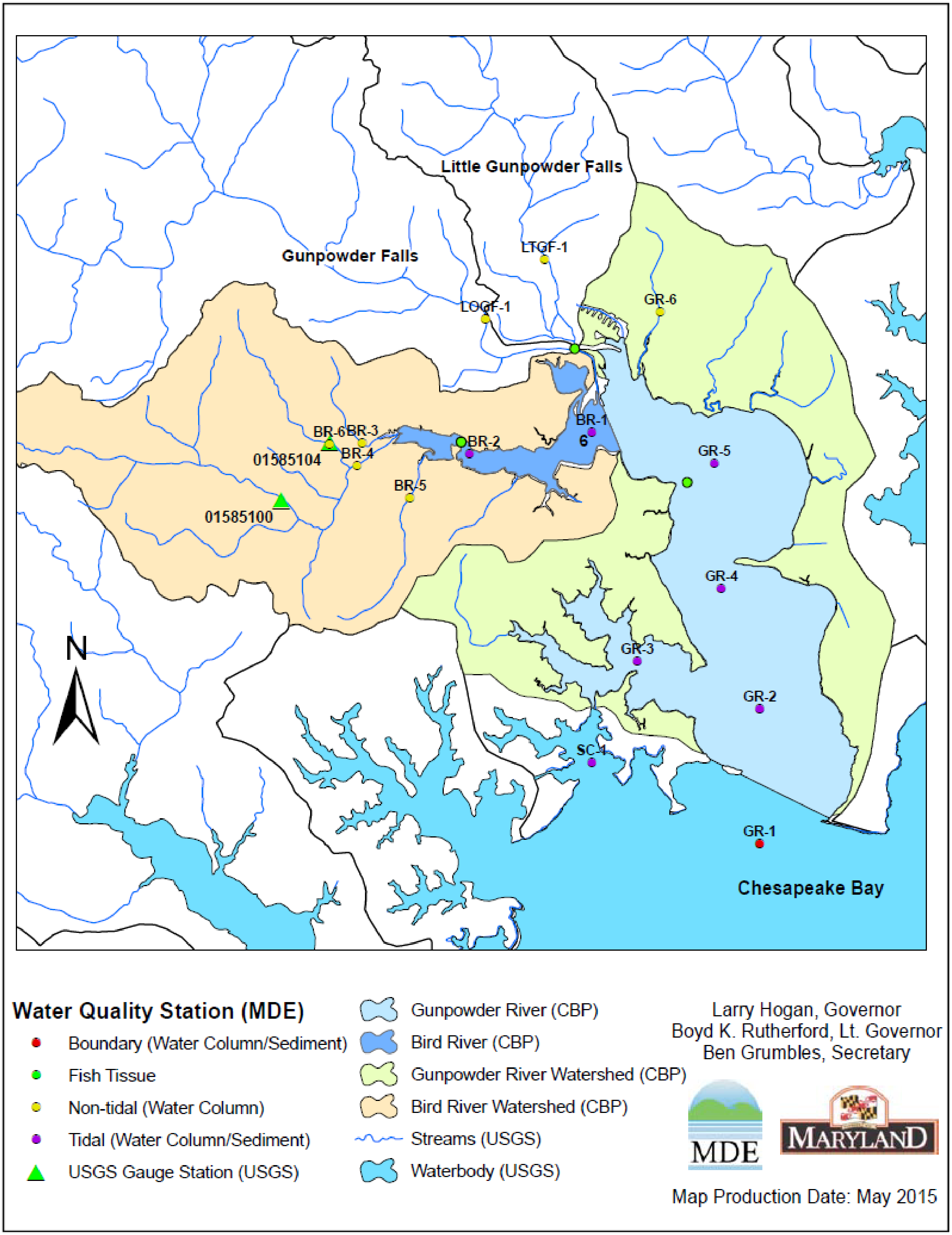

Figure 6-1:PCB Water Quality Monitoring Stations in Bird River and Gunpowder River

(Adapted from MDE, 2016)

Table 6-1: Sediment tPCB Concentrations in Bird River

Station	Date	Station Type	Concentration (ng/g)
BR-1	5/15/2012	Tidal	22.4096
BR-1	10/11/2012	Tidal	9.6915
BR-2	5/15/2012	Tidal	11.2813
BR-2	10/11/2012	Tidal	38.3998

(Adapted from MDE, 2016)

This data demonstrate mean higher concentrations of PCBs in sediment further from the confluence with the Gunpowder River. Because of PCBs having an affinity to sorb to sediments it is possible that this data reflects the settling of contaminated sediments near the mouths of non-tidal streams as they enter the embayment.

Table 6-2: Fish Tissue tPCB Concentrations in Bird River

Sample	Date	Species	Fish/ composite (#)	Mean length (cm)	Mean weight (g)	Lipid (%)	Concentration (ng/g)
BIRD_A	5/16/2012	Channel Catfish	5	48.5	1325.4	5.53	476.3
BIRD_B	5/16/2012	Channel Catfish	5	51.8	759.8	6.48	289.6
BIRD_C	5/16/2012	Brown Bullhead	5	27.5	273.6	0.99	57.9
BIRD_D	5/16/2012	White Perch	5	21.0	146.2	3.78	355.0
BIRD_E	5/16/2012	White Perch	5	19.4	118.6	3.35	235.5
BIRD_F	5/16/2012	Carp	5	27.9	496.0	3.58	101.2
BIRD_G DUP	5/21/2013	Channel Catfish	5	45.1	981.8	4.39	252.7
BIRD_G	5/21/2013	Channel Catfish	5	45.1	981.8	4.39	307.8
BIRD_H	5/21/2013	Channel Catfish	5	50.8	1479.4	2.93	417.4

(Adapted from MDE, 2016)

Different species may see varying average tPCB concentrations in their tissue, depending on life history, prey choice, and other factors. For example, fish that are top predators may have higher concentrations of PCBs through processes of bioaccumulation/biomagnification, and likewise species that prefer benthic waters (bottom fish) may see elevated concentrations through direct contact with contaminated sediments.

Table 6-3: Water Column tPCB Concentrations in Bird River

Station	Date	Station Type	tPCB Conc. (ng/L)	Mean Conc. by Station (ng/L)	Mean Conc. by Station Type (ng/L)
BR-1	5/17/2012	Tidal	0.958	0.398	0.607
BR-1	7/17/2012	Tidal	0.033		
BR-1	10/10/2012	Tidal	0.585		
BR-1	1/10/2013	Tidal	0.017		
BR-2	5/17/2012	Tidal	1.686	0.816	
BR-2	7/17/2012	Tidal	0.909		
BR-2	10/10/2012	Tidal	0.541		
BR-2	1/10/2013	Tidal	0.129		
BR-3	5/8/2012	Non-tidal	0.048	0.267	0.248
BR-3	7/11/2012	Non-tidal	0.06		
BR-3	10/17/2012	Non-tidal	0.759		
BR-3	1/15/2013	Non-tidal	0.199		
BR-4	5/8/2012	Non-tidal	0.046	0.232	
BR-4	7/11/2012	Non-tidal	0.604		
BR-4	10/17/2012	Non-tidal	0.035		
BR-4	1/15/2013	Non-tidal	0.242		
BR-5	5/8/2012	Non-tidal	0.494	0.276	
BR-5	10/17/2012	Non-tidal	0.334		
BR-5	1/15/2013	Non-tidal	0		
BR-6	5/8/2012	Non-tidal	0.075	0.226	
BR-6	7/11/2012	Non-tidal	0.142		
BR-6	10/17/2012	Non-tidal	0.008		
BR-6	1/15/2013	Non-tidal	0.68		

(Adapted from MDE, 2016)

The mean tPCB concentration in water column from tidal samples was higher than the mean of non-tidal samples. This could be in part due to moving water in non-tidal areas constantly flushing into the embayment. Tidal areas will generally flush less quickly than non-tidal streams, allowing for greater concentrations to accumulate as residence times are greater in these areas. The data collected from each sampling station in the non-tidal areas shows little variability, while samples from the tidal station closer to the confluence with the Gunpowder River show considerably higher tPCB concentrations. This disparity in concentration could be due to the influence of the PCB load in the tidal Gunpowder River, or perhaps the water column closer to non-tidal inputs being more diluted by the lower concentration PCB loads coming from those streams. Also of note is the presence of the Eastern Sanitary Landfill located on the North bank of the Bird River tidal subsegment. Additional monitoring in the area of this facility may be beneficial to determining if there is an influence to tPCB concentrations in Bird River.

Baltimore County has already developed plans that aim to manage certain pollutants in parts of the Bird River watershed. A 1995 study of Bird River was one of the County's first comprehensive watershed plans. In 2014 a more holistic Small Watershed Action Plan (SWAP) was completed for the Bird River watershed. Compared with previous rounds of watershed planning, the SWAP program was designed to be more accessible and inclusive. Not only does the plan include various possibilities for capital expenditures, but also is largely focused on identifying citizen-based activities that can be implemented on a very local level by homeowners and local non-profits.

7.1 Small Watershed Action Plan

Baltimore County's SWAP program focuses on assessments which conform to EPA guidance on developing watershed plans. This guidance, known as the "a through i" criteria lays out nine elements which may help a jurisdiction conduct a successful and meaningful watershed plan. SWAP development is guided by an active steering committee which meets many times throughout the process, helping to define the vision, goals, and specific objectives of each SWAP as they may be most relevant to the area in question. To see EPA's nine elements to be included in watershed plans, visit: https://www3.epa.gov/region9/water/nonpoint/9elements-WtrshdPlan-EpaHndbk.pdf

7.1.1 Bird River SWAP

The SWAP, completed in June 2014, assessed the watershed as separate subwatersheds to determine potential actions for implementation on very local scales. The Bird River steering committee adopted the following vision statement and goals that served as a guide in the development of the SWAP:

> *Our vision for the Bird River is a watershed with healthy, swimmable and navigable waters, with streams that contribute less sediment, nutrients, trash and sewage to the river and the Chesapeake Bay.*

- Goal 1: Improve and maintain water quality in streams and tidal area
- Goal 2: Enhance the connection between the communities and the watershed
- Goal 3: Restore and maintain aquatic biodiversity
- Goal 4: Reduce trash in the watershed

While the SWAP does address PCBs in Bird River, it may still need updating to reflect the new technologies and maintain relevance with this TMDL IP. To review the complete SWAP please visit the Baltimore County SWAP webpage: http://www.baltimorecountymd.gov/swap.

This section provides an overview of pollutant reduction measures and their predicted effectiveness. This overview is meant to serve as a guide to aid in selecting the most efficient possible Best Management Practices (BMPs) that may be implemented to meet the pollutant reduction goals required by the TMDL. This review utilizes conservative estimates of BMP efficiency for planning purposes, as exact types of BMPs (e.g. structural BMPs) will not be chosen until appropriate on-site analysis is complete. It is possible that only some of the listed actions in this section will be selected for inclusion in Section 9 of this Implementation Plan.

In the past PCBs were found in many products and today may still be produced as a byproduct from various industrial processes. Through improper disposal these contaminated materials with PCBs can contaminate the soil and water. There are many ways to potentially remove PCBs from the environment. However the general efficiency is unknown and most mechanical BMPs (ie. Dredging, in-situ thermal) tend to be very expensive. Due to PCB's ability to cling to sediment particles, the BMPs that will be established will attempt to reduce the amount of sediment entering the waterway.

Building Demolition and Remodeling

The purpose of identifying the storage or use of PCBs is to eliminate materials containing PCBs. In order to do this building inspectors must be trained to identify PCB containing equipment and materials. Currently there is no way to identify buildings that contain PCB materials or equipment, other than site inspection. (SFEI. 2010)

Street Sweeping

The process of Removing PCBs associated with particles that are dispersed onto impervious surfaces, before the particles can enter the storm drain system. (SFEI. 2010)

Stormdrain and Stormwater Management Sediment Removal

The Removal of PCBs associated with particles that are deposited in stormdrains and stormwater management facilities. (SFEI. 2010)

Soil Remediation

The process of Identifying known PCB contamination sites by querying regulatory databases, measure concentration of PCBs in soil, then remove and replace the soil. (SFEI. 2010)

Source Control

This process includes identifying any storage or use of PCBs and eliminating the PCB containing materials. There is a need to train building and industrial inspectors to identify PCB containing equipment and materials to accomplish this. (SFEI. 2010)

Sediment Settling

The process of using treatment controls which are engineered devices or environments that can be installed or built in place to enhance the capture of an undesirable constituent such as sediment, PCBs, or Hg. (SFEI. 2010)

Capture and Reuse

In the case of PCBs, primary locations of reuse and/or treatment are mainly located near the tidal marsh areas of the Bay margin. (SFEI. 2010)

Biostimulation

The process of biostimulation involves the addition of a primer to galvanize targeted dechlorinating populations in PCB-contaminated soils. (NNEMS. August 2004)

Bioaugmentation

The process of bioaugmentation involves enriching a contaminated site with organisms capable of degrading the targeted compound. (NNEMS. August 2004)

Aerobic Biodegradation

The process involves degradation of the PCBs via the *bph (*biphenyl pathway) pathway (NNEMS. August 2004).

Reductive Dechlorination by Nanoscale Zero-Valent Iron

Current research is exploring the ability of using nanoscale zero-valent iron particles to reduce and de-chlorinate PCBs. (NNEMS. August 2004)

In-Situ Thermal Desorption

The process of using ISTD technology includes direct application of heat supplied by electrical heater elements to raise the temp of soil in-situ to destroy the organic contaminant with thermal blankets or thermal wells. (TTES RTES. 1998)

Amendment of Contaminated Sediments with Adsorbent

Spreading a layer of activated carbon or other adsorbent over areas of contaminated sediments has shown promise in binding PCBs in-situ, making them no longer bioavailable (Beckingham and Gosh, 2011). Varying methods of application and adsorbent delivery are being assessed.

Table 8-1: Reduction Efficiencies for PCBs

Best Management Practice	Efficiency
Building Demolition & Remodeling	Unknown
Street Sweeping	Unknown
Stormdrain & Stormwater Mgmt. Sediment Removal	Unknown
Soil Remediation	To be calculated per project.
Source Control	Unknown
Sediment Settling	50% of PCBs settle out in 20 min or less
Capture & Reuse	Unknown
Biostimulation	Nearly complete C dechlorination
Bioaugmentation	Unknown
Aerobic Biodegradation	Unknown

Reductive Dechlorination by Nanoscale Zero-Valent Iron	Unknown
In-Situ Thermal Desorption	100%
Amendment of contaminated sediments with adsorbents	69%-99%

Discussion of Uncertainty

Literature reviews have been mostly inconclusive based on the removal efficiency per BMP. In order to retrieve more sufficient information for removal rates further testing must be done. Only a select few of the BMPs listed showed sufficient data. For example the effectiveness of sediment settling, Biostimulation, and In-Situ Thermal Desorption were found to significantly improve the sediment samples post treatment.

In this section you will find a list of actions that together become one scenario as to how the county could reach the pollutant load target. While EPS has developed this scenario, progress will be assessed on an annual basis through results of implementation actions and monitoring data. It is intended that the Implementation Plan (IP) will be reviewed on a five-year cycle for potential revisions. The County takes an adaptive management approach to all watershed planning efforts.

Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood (U.S. Department of the Interior 2009). The tools that Baltimore County will use in adaptive management are the tracking of implementation progress, identification of barriers that prevent targeted actions from occurring, and an enhanced monitoring program to measure progress in both reductions and meeting water quality standards. While this will be an on-going process, there will be a formal review of the strategy at five year intervals to determine if changes are needed or if the strategies are on track.

For this section, we will bring together information from earlier sections of this Implementation Plan to determine actions that will reduce pollutant inputs to acceptable regulatory levels. We will consider the existing data on pollution input levels (Section 6), existing restoration plans (Section 7), and the efficiencies of known Best Management Practices (BMPs) for pollution reductions (Section 8). By examining our existing data on pollution loads we can know how much of a reduction is needed to reach water quality goals, and what needs to be done to reach those goals.

The manufacture and sale of PCBs has been banned in the United States since 1979, however the ban did not extend to the use of PCB containing products that may still be in operation today. PCBs are very stable chemicals, meaning they do not readily break down in the environment, and may remain toxic for extended periods of time. These two factors are likely large contributors of PCBs to the environment over time. The baseline PCB input to the Bird River watershed is 65.7 grams per year, while the Gunpowder River has seen a baseline loading rate of 273.6 grams per year. Baltimore County assumes it will claim responsibility for addressing the 6.4 grams per year being input by the County's NPDES regulated stormwater in the Bird River as stated in the TMDL document. The TMDL document calls for a maximum annual load of 1.92 grams of PCB inputs from the County's stormwater to Bird River; a reduction of 4.48 grams per year, or 70%, from the baseline.

PCBs are not pollutants that are expected to be found over widespread areas (with the exception of PCBs that are deposited atmospherically), but are expected to be found in small areas of higher concentrations, which we will refer to as spot sources. An example of a spot source may be one of the multiple locations of blown power transformers, which may have at one time leaked PCBs into a small area. Locating higher concentrations of PCBs through the use of monitoring studies and field assessments will be a high priority in the effort to stop PCBs from entering the waterways from their spot sources.

The actions discussed in this section are to be implemented in addition to currently in-progress or completed programs and restoration actions, some of which may have been discussed in Section 7 of this Implementation Plan. Because the production of PCBs has been banned over 35 years ago, the focuses of this implementation plan will be on managing PCBs currently in use. This does not preclude sediment remediation in the receiving waters if that action is determined to be the best approach to meeting the water quality standards for fish tissue PCB concentrations.

9.1 Actions

The actions below are divided into programmatic actions, management actions, and restoration actions. Programmatic actions are actions that do not directly result in load reductions, but create the necessary conditions for load reduction. Management actions are those where there is regular management of county property, such as, street sweeping. Restoration actions include measures such as the development of new control measures aimed to reduce pollutant loads as well as retrofits of existing stormwater management facilities. With the uncertainty surrounding the intended locations of many potential actions outlined in the Bird River SWAP, it was decided to include the relevant actions in our implementation plan, but to omit the quantity and specific locations of these actions. To see the full list of actions proposed by the SWAP, please visit the County's SWAP webpage: http://www.baltimorecountymd.gov/swap or the County's webpage for Bird River.

Programmatic and Restoration Actions

Actions within this category might include public education and outreach activities, monitoring, or supporting specific legislation. These actions will move Baltimore County closer to achieving TMDL targets; however, there is currently no way to attribute a predictable pollutant load reduction to programmatic actions. Some programmatic actions, such as investigation and monitoring, are necessary to implement management and restoration actions or make those actions more efficient. Other programmatic actions, such as education and outreach actions, are predicted to increase the load reduction over time through behavioral change and/or BMP implementation by individual citizens, such as encouraging proper disposal of household hazardous waste. The exact load reduction is not predictable because the participation rate for individual home owners either currently taking appropriate actions, or changing actions to be appropriate, as a result of public education, is not yet known. Educated citizens may support load reductions in other ways such as educating other citizens about watershed management actions, supporting legislation that improves watershed management, and other actions that do not have associated load reductions but support the necessary condition for pollutant reduction.

Restoration actions include the development of new control measures aimed to reduce pollutant loads as well as retrofits of existing stormwater management facilities. It may include reforestation actions as well as any stormwater control measures that do not require regular management on county property. Restoration actions will have predictable load reductions, which will be used to calculate the contribution of each action toward meeting the overall load reduction required by the TMDL.

Table 9-1 outlines the programmatic and restoration actions to be implemented in support of meeting the TMDL.

Table 9-1: Implementation Actions with Performance Standards and Schedule

Action	Time Frame	Performance Standard	Responsible Parties
Programmatic Actions			
Bird River SWAP Implementation Committee to meet on a semi-annual basis to discuss implementation progress and assess any changes needed to meet goals	20 years	40 meetings (2 per year)	EPS and Implementation Committee partners

Action	Time Frame	Performance Standard	Responsible Parties
Hold Household Hazardous Waste Collection Events	On-going	# of events held	EPS, DPW
Work with MDE to develop a load reduction calculation that will link PCBs with sediment loadings	On-going	Calculation developed	EPS, MDE
Explore feasibility of adsorbent application in affected areas of embayment to bind PCBs.	1 year	Feasibility assessed	EPS
Monitoring Actions			
Work with MDE to develop a local, or enhancement of the State's, fish tissue monitoring program to determine current levels of PCBs in fish tissue	2 years	Fish tissue analysis program in place	EPS, MDE
Work with MDE to develop an enhanced monitoring program for determining subwatersheds that have potential sources of PCBs.	2 years	Bioaccumulation/ passive water quality monitoring program	EPS, MDE
Conduct field surveys, in subwatersheds found to have higher contaminant concentrations, prioritized by contamination level detected based on future monitoring program.	18-20 years	Contamination sources of PCBs located.	EPS
Work with County Department of Public Works to determine ability to sample street sweeper debris, storm drain cleanout debris, and SWM pond cleanouts for PCB content	2 years	Street sweeping debris included in monitoring plan	EPS
Reporting Actions			
Continue to update status of restoration projects and BMPs in the Annual MS4 Report	Annually	MS4 Report submitted to MDE and posted on county website	EPS
Implement the Continuing Public Outreach Plan	On-going	Number of actions per year	EPS
Hold Biennial State of Our Watersheds Conference in even years	Biennially	Conference Held	EPS
Adaptive Management assessment of the Implementation Plan	5 year interval	Assessment complete	EPS
Restoration Actions			
Develop and implement remediation plans for any sites identified through the subwatershed surveys as contributing PCBs pollutants	18-20 years	Remediation plans developed and implementation initiated	EPS, MDE
Develop remediation plan as needed for benthic sediments as inputs are reduced to appropriate levels to warrant addressing existing constituents in embayment	20 years	Plan developed as needed	EPS

Management Actions

Management actions are those where there is regular management of county property, such as, street sweeping. It does not include the development of new control measures, such as, retrofitting highway yards. Management actions usually have predictable load reductions, which can be used to calculate the contribution of each action toward meeting the overall load reduction required by the TMDL.

Baltimore County's street sweeping program and storm drain cleanouts will likely aid in reductions to atmospherically deposited PCBs on the streets. Additionally, Baltimore County will continue to support stormwater management measures to reduce the probability of sediment-bound PCBs from re-entering the water column as a result of high storm flow.

9.1.1 Sediment Reducing Actions

The actions relevant to this section are the same management and restoration actions that can be found in other County TMDL Implementation Plans for sediment. These actions are specifically those that reduce sediment as well as nutrients. Most BMPs that reduce sediment result in nutrient reductions and so these pollutants are closely tied together, and again closely tied with PCBs as they move in conjunction with sediment. Scientific evidence indicates that sediment reducing BMPs will also result in PCB reductions, however, efficiencies relating sediment reduction to PCB reduction are not yet know. PCBs adsorb to sediment, therefore we expect that sediment reducing BMPs will also reduce PCB loads. However, limited knowledge of the interactions between PCBs, sediments in stormwater, and these BMPs prevent reliable estimation of PCB reductions. This uncertainty is due in part to the nature of the relationship between sediment and PCB concentration. Initial literature searches have indicated that the relationship, if it exists, is quite variable and may not be a good predictor of PCB load reductions. The United States Geological Survey (USGS) on PCBs in stream sediment found that the frequency of detection of PCBs above the lower detection limit of 50 microgram/kg was only 18.8% (Wong, et.al., 2000). Baltimore County will work with MDE to develop a load reduction calculation for PCBs that will link sediment reductions to PCB reductions. Also note that lag times for reducing PCBs by means of the actions listed below are unknown. Although we assume that reductions will result from these actions, it is not known how long it will take for the actions to have any measurable effect on the PCB levels in Baltimore County embayments nor is it known what those reductions may be.

9.1.2 Sediment Remediation

PCBs have traditionally been remediated by specialized sediment incineration and by land filling (Mikszewski, 2004). Both methods require dredging of river sediments and can result in other potentially negative environmental effects. Other emerging technologies point toward possibilities for in-situ remediation of contaminated sediments. Application of activated carbon to contaminated benthic sediments to reduce the bioavailability of the existing contaminant has shown to be somewhat effective, albeit potentially costly (Patmont et al., 2015). Other PCB removal methods may be less damaging, but many are still experimental as it is extremely challenging to remediate large areas of PCB contaminated aquatic sediment. This plan will make full use of adaptive management principles to employ the best available technologies to Baltimore County for remediation as needed.

For a further review of available literature on PCB reducing BMPs see A BMP Tool Box for Reducing PCBs and Mercury in Municipal Stormwater: sections 4 &5 and also see Emerging Technologies for the In Situ Remediation of PCB-Contaminated Soils and Sediments: Bioremediation and Nanoscale Zero-Valent Iron, 2004.

The assessment of implementation progress is based on two aspects; progress in meeting programmatic, management, and restoration actions; and progress in meeting water quality standards and any interim water quality benchmarks. The assessment of progress in meeting the restoration actions; includes setting up methods of data tracking, validation of projects, and pollutant load reductions associated with the actions (10.1) and will be consistent across all TMDL Implementation Plans. The assessment of progress in meeting water quality standards and interim milestones (10.2) is the data analysis associated with the monitoring plan specific to each TMDL Implementation Plan.

10.1 Implementation Progress: Data Tracking, Validation, Load Reduction Calculation, and Reporting

The Baltimore County Department of Environmental Protection and Sustainability – Watershed Management and Monitoring Section is currently preparing a document entitled Baltimore County Method for Pollutant Load Calculations, Pollutant Load Reduction Calculations, and Impervious Area Treated. While this document will not address PCBs at first, future editions may, once sufficient data has been collected and processed. This document will detail the data sources, data analysis (including pollutant load calculations, and pollutant load reductions calculations), validation of the practices, and reporting of progress made. It was determined that a document was needed to document how Baltimore County calculated pollutant loads and pollutant load reductions from the implementation of various best management practices, as guidance from the State continues to evolve. The document also needs modification based on the published literature and to include any additional findings that result from our monitoring programs. The document will be updated annually to account for any changes that may have occurred during the previous year. Due to the fact that implementation is being achieved through the actions of many county agencies, it was also determined that the means of data acquisition, any data manipulation, and the means of data analysis needs to be documented on an annual basis to provide consistency in the data acquisition and analysis and to document any changes in the process over time. The overall result is intended to provide transparency for the general public and users of reports on progress generated as a result of the analysis.

The Maryland Department of the Environment (MDE) has provided a guidance document for NPDES – MS4 permits entitled: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. The draft document was released in June 2011, followed by a final release in August 2014. The document is intended to provide consistency among the MS4 jurisdictions in calculating baselines and reporting implementation progress. This document however, does not provide guidance on bacteria, chlordane, mercury, or PCB reduction efficiencies. MDE also provides guidance through its web site, with a webpage entitled Maryland TMDL Data Center. This site provides guidance on the development of the TMDL Implementation Plans and is updated on a regular basis.

10.1.1 Reporting

Reporting will be done through the annual NPDES – MS4 Permit Report. This is technically due on the anniversary date of the permit renewal. The report will detail progress made in meeting each of the local TMDLs and the Chesapeake Bay TMDL. The analysis will include progress in meeting the two-year milestone programmatic and restoration actions, along with the calculated load reduction. It will also present the results of the monitoring conducted the previous year. See below for TDML specific monitoring.

In January of each year, a progress report (mostly extracted from the MS4 report) will be prepared and posted on the web.

10.2 Implementation Progress: Water Quality Monitoring

The rationale for the development of the PCB TMDL for this watershed was the detection of PCB in sediments and certain fish tissues at levels that required the issuance of a consumption advisory in this area. Since fish tissue samples serve as the key source of data for PCB, Baltimore County will develop new monitoring programs to track PCB levels in fish tissue of the tidal portion of Bird River and to track bioavailability of PCB in the tributaries.

10.2.1 Fish Tissue Monitoring

The State has been monitoring fish tissue, in some capacity, since the 1970s and PCB was initially suggested as an impairment from the result of monitoring the tidal portion of Bird River and Gunpowder River in 2012. Two or more fish species, representing bottom feeders and higher trophic level predators, were targeted for collection at each monitoring location. Baltimore County will develop a program to monitor fish tissue in the tidal portion of Bird River on a three year cycle in conjunction with any State fish tissue monitoring. Baltimore County will work closely with the State to ensure a complete survey of fish tissue across the trophic levels is obtained for each cycle.

10.2.2 Bioavailability Monitoring

Caged bivalves (i.e. Asiatic Clam, Corbicula fluminea) have been used as study organisms to screen for bioavailable toxin sources. Bivalves are frequently used in biological monitoring studies because of their widespread distribution and abundance in study areas, sedentary habits, hardiness, and ability to bioaccumulate pollutants without excessive mortality. They also give results which are representative of average long-term conditions since the clams filter-feed over an extended period of time. Given recent questions as to the consistency of results from this method, Baltimore County may pursue different passive water quality sampling methods for PCBs in streams. Passive water sampling used in conjunction with possible sediment monitoring in tidal areas will give a better picture of the presence of bioavailable PCBs throughout the watershed which could be contributing to elevated levels of PCBs in fish tissue.

10.2.3 Chemical Trend Monitoring

The County continues to monitor water chemistry trends throughout its jurisdiction, and will consider the addition of monitoring stations and analytical methods as needed to build the County's database on PCB concentrations in the environment.

10.2.4 Other MS4 Related Monitoring

Baltimore County will continue to provide its street sweeping, storm drain cleaning, and stormwater management pond cleanout operations. These are important programs to incorporate PCB monitoring into, determining any potential load reductions that may result in keeping these potentially contaminated sediments from the streams and embayments.

In order to engage the public in the TMDL implementation process this continuing public outreach plan will be implemented upon approval of this TMDL Implementation Plan. The continuing public outreach plan is applicable to all TMDL Implementation Plans that are currently being developed and those developed in the future, as well as the Trash and Litter Reduction Strategy. This continuing public outreach plan is meant to engage county agencies, environmental groups, the business community, and the general public.

11.1 County Agencies

County agencies will be engaged through two regularly scheduled NPDES Management Committee meetings per year and other agencies meetings as necessary to move implementation forward.

11.1.1 NPDES Management Committee

The NPDES Management Committee is composed of representative agencies that are involved in meeting the NPDES – MS4 Permit requirements. This committee has met irregularly in the past, generally to review information on permit requirements and other upcoming regulatory requirements, such as, the General Industrial Stormwater Discharge Permit. In the future this committee will meet twice per year and will discuss not only the NPDES – MS4 Permit requirements, but also the TMDL Implementation Plans and progress being made in meeting the implementation strategy. In order to address all components of the TMDL Implementation Plans the committee membership will be expanded to include any county agency that has some responsibility for TMDL implementation. Examples being, the County Police Department and the Department of Environmental Protection and Sustainability – Groundwater Management Section. Prior to the development of the TMDL Implementation Plans and the Trash and Litter Reduction Strategy, these agencies were not specifically engaged in NPDES – MS4 Permit activities.

The first yearly meeting will be held in January of each year. The focus of this meeting will be to review the implementation plan 2-year milestones for each plan; provide a forum for discussion of the ability to meet the implementation actions; and determine any revisions necessary to meet the interim implementation milestones set in the plan. This meeting is also the forum for discussion of data tracking and reporting to ensure that the implementation actions are properly credited.

The second yearly meeting will be held in July of each year and will provide the forum for determining data submittal for the yearly progress report on the implementation actions and the resulting load reductions. The monitoring data from the previous calendar year will be presented and contrasted with the interim water quality milestones that are detailed in each implementation plan.

11.1.2 Other Agency Meetings

In order to move forward with implementation, agency meetings regarding specific implementation actions are anticipated. These will be scheduled as needed, and tracked by meeting date, attendance, TMDL Implementation Plans discussed, and topic. Meeting minutes will be reported in the Annual NPDES – MS4 Report submitted to Maryland Department of the Environment. This report is also posted on the County website for public access.

11.2 Environmental Groups

Baltimore County is currently engaged with local watershed associations through its funding of *Watershed Association Restoration Planning and Implementation Grants*, and through inclusion of watershed association members on the Steering Committees of the Small Watershed Action Plans. Formerly, this engagement and support was coordinated through the *Baltimore Watershed Agreement*. As part of that engagement, periodic Watershed Advisory Group (WAG) meetings were held. As part of this continuing public outreach plan, WAG participation will be formalized with two meetings per year.

The first meeting will be held in March of each year and focus on the local and Chesapeake Bay TMDL implementation actions and implementation progress, including an analysis of the pollutant load reduction calculations from the previous fiscal year. The watershed associations are currently engaged in citizen-based restoration activities and report their implementation progress to the county for inclusion in the Annual NPDES – MS4 Report. This meeting will provide a forum for discussion of the progress being made, coordination between the watershed associations, and any changes to the *Watershed Association Restoration Planning and Implementation Grant* being considered for the next grant period.

The second meeting will be held in November of each year and will focus on the water quality monitoring results from the previous calendar year. The results presented will compare trends and measures against the TMDL Implementation Plans water quality benchmarks and water quality standards.

11.3 Business Community

The business community will be engaged through various business forums, targeted outreach and education efforts on specific topics, and hosting workshops on specific topics as necessary.

11.3.1 Business Forums

Business forums, such as the Hunt Valley Business Forum with greater than 200 business members, provide opportunities to present the TMDL Implementation Plans and the Trash and Litter Reduction Strategy, and discuss the role of business in helping improve water quality. These forums will be convened as the opportunities arise. Summaries of these meetings will be reported in the annual NPDES – MS4 Report and will include the name of the forum (or other business organization), approximate number in attendance, the topic presented, and audience responses.

11.3.2 Targeted Business Outreach and Education

The Small Watershed Action Plan (SWAP) process includes an upland assessment of potential pollution hotspots. Often, these potential hotspots are commercial or industrial sites. The information derived from this assessment will be used to target outreach and education to businesses specific to the issue(s) at the location identified in each SWAP. These actions will be tracked and reported in the annual NPDES – MS4 Report.

11.3.3 Business Workshops

There are certain issues that may be pervasive through a segment of the business community that can most effectively be addressed through hosting workshop education on the specific topic. These issues will be identified as SWAP implementation moves forward, but one potential topic for a business workshop is related to the recently renewed *General Discharge Permit for Stormwater Associated with Industrial Activities.* A workshop designed in conjunction with

Maryland Department of the Environment would not only result in improved water quality, but it would also benefit the business community through increased understanding of the requirements of the permit.

11.4 General Public

The general public will be engaged through a number of mechanisms, including:

- WIP Team meetings
- Targeted outreach and education efforts on specific topics
- Steering Committee meetings and stakeholder meetings in the development of Small Watershed Action Plans
- Meetings of the Implementation Committee for completed Small Watershed Action Plans
- Displays at various events
- Annual progress reports posted on the county website and placed in our libraries
- A biennial State of Our Watersheds conference

11.4.1 Watershed Implementation Plan (WIP) Team Meetings

Baltimore County has assembled a Watershed Implementation Plan (WIP) team to serve as a sounding board for the development of the WIP to address the Chesapeake Bay TMDL. Members of the team include representatives from various county agencies, business community representatives (particularly the environmental engineering community), watershed associations, representatives from the agricultural community, and Baltimore County citizens.

The county will schedule at least one meeting annually to present implementation progress and to address specific topics related to the TMDL Implementation Plans and the Trash and Litter Reduction Strategy. Meetings will be scheduled as issues arise. It is anticipated that the WIP team will provide initial review of newly developed outreach and education materials, in order to provide feedback from a variety of perspectives.

11.4.2 Targeted Outreach and Education

The Small Watershed Action Plan development process includes upland assessments of neighborhoods to identify pollution sources and restoration opportunities. This information will be used to prioritize and target outreach and education efforts specific to the issue(s) in neighborhoods with the intent to affect behavioral change and/or increase citizen based restoration actions. These actions will be tracked and reported in the annual NPDES – MS4 Report.

11.4.3 Small Watershed Action Plans (SWAPs)

Baltimore County has been developing Small Watershed Action Plans since 2008. There are 22 planning areas in the county, with 13 completed plans, 5 plans in development, and 4 areas pending. These planning areas cover the entire county. The planning process includes the development of a steering committee, the composition of which is determined by the issues, and land ownership within the planning area. At a minimum membership consists of agency representatives, watershed associations, and citizen representatives. The process also includes a number of stakeholder meetings, open to all planning area residents and businesses, which provide information on the plan and solicit input. Once the SWAP is complete, the steering committee becomes the implementation committee. As designed the implementation committee is to meet twice per year, however, most implementation committees have not met this goal.

The plans have addressed to varying degrees the TMDLs that are applicable within the planning area. Some of the TMDLs have been developed subsequent to the specific SWAP development or did not address the full range of TMDLs that were applicable to the planning area. The TMDL Implementation Plans are built on incorporation of the actions from each SWAP within the applicable TMDL area. In some cases, additional actions have been identified in order to meet water quality standards.

11.4.3.1 Small Watershed Action Plans in Development and Future Plans

For SWAPs currently under development, and for plans developed in the future, the steering committee and stakeholder meetings will be used for outreach regarding the TMDL Implementation Plans and the progress being made in achieving water quality standards. The meeting participants will be informed on where they can access the TMDL Implementation Plans, the Trash and Litter Reduction Strategy and any Progress Reports that have been developed.

Applicable TMDL Implementation Plan actions will be incorporated into the SWAP based on the assessment of applicable restoration actions within the SWAP planning area. Since the SWAPs incorporate field assessments of streams and uplands, they provide more detailed information on applicable restoration actions, both on quantity and location. The accelerated schedule for developing TMDL Implementation Plans precluded conducting field work to build the plans.

11.4.3.2 Small Watershed Action Plans Already Developed

For those SWAPs already developed, the implementation committee meetings will be scheduled twice per year. The first meeting will be held in winter and will present the implementation progress not only of the SWAP, but also any applicable TMDL Implementation Plan progress. The progress analysis will be based on fiscal year. This meeting will also provide the opportunity to discuss any changes in the SWAP or the TMDL Implementation Plan based on an analysis of what actions have been successful and what actions have been more difficult to implement.

The second implementation committee meeting will be held in fall of each year and will present the monitoring data in relation to progress being made in relation to interim milestones and water quality standards.

11.4.4 Educational Displays at Events

Educational displays and handouts will continue to be used at applicable events as they occur. The particular display and handout materials will be determined by the location and focus of the event. The location and focus of the event, number of citizens engaging staff at the display, and the number of handouts taken by citizens will be tracked for annual reporting in the NPDES – MS4 Report.

11.4.5 TMDL Implementation Plan, Trash and Litter Reduction Strategy, and Progress Report Availability

The TMDL Implementation Plans and the Trash and Litter Reduction Strategy will be posted on the Baltimore County website with hard copies placed in county libraries. The hard copies in the libraries will be specific to the watershed in which the library is located. Progress reports will be posted on the County website and placed in libraries. A set of hard copy plans will be kept at the Baltimore County Department of Environmental Protection and Sustainability

11.4.6 Biennial State of Our Watersheds Conference

Baltimore County, in conjunction with Baltimore City, has held *State of Our Watershed* conferences in the past to present information to county and city citizens on water quality issues applicable to the watersheds in these jurisdictions. Future conferences will be held in early March of even numbered years. Information on implementation progress for local TMDLs and the Bay TMDL will be presented, along with other topics of interest. These conferences will be organized with the assistance of the Watershed Advisory Group (WAG), and the surrounding local jurisdictions (Baltimore City, Howard County, Carroll County, Harford County, and York County, PA) will be invited to participate in the organization and presentation of the conference.

The timing of even years is related to the 2-year milestone process set up by the Maryland Chesapeake Bay TMDL Watershed Implementation Plan (WIP) whereby in January of even calendar years, progress in meeting the previous 2-year milestone programmatic and restoration implementation is reported and the next 2-year programmatic and restoration implementation milestones are proposed by the local jurisdictions. The timing of the conference not only permits reporting on the progress made in meeting the previous 2-year milestones but also what is planned for the next two years.

11.5 Adaptive Management

As Baltimore County moves forward to meet its pollutant reduction goals, there will be consideration of the elements of public outreach as they pertain to this Implementation Plan. During implementation, a more specific, and tailor-made outreach plan will be developed to address the various pollutants and watersheds impacted by them. A sampling of the types of outreach elements Baltimore County currently intends to employ is presented in Table 11-1.

Table 11-1: Continuing Public Outreach Plan Summary

Plan Component	Plan Element
Agencies	NPDES Management Committee
	Other Agency meetings
Environmental Groups	Watershed Advisory Group (WAG) meetings
Business Community	Business Forums
	Targeted Business Outreach and Education
	Topical Workshop
General Public	WIP Team meetings
	Targeted Outreach and Education
	SWAP – Steering Committee meetings
	SWAP – Stakeholder meetings
	SWAP – Implementation Committee meetings
	Educational Displays at Events
	Document availability (various)
	Biennial Conference

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