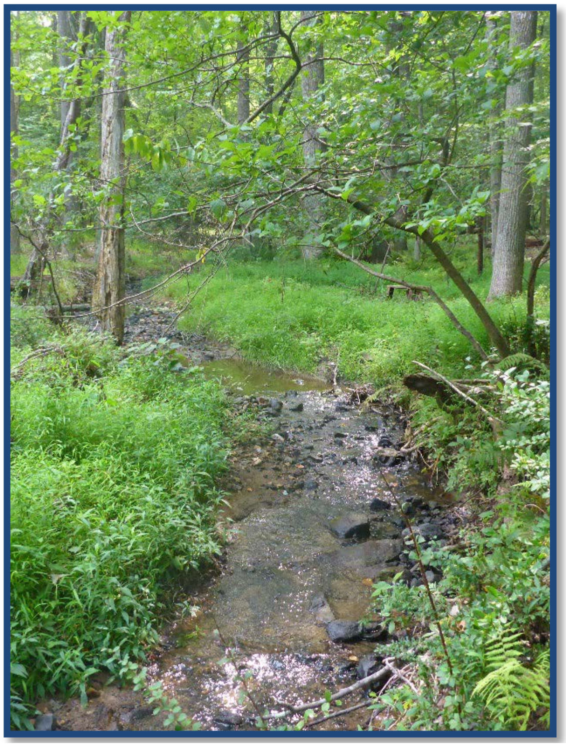
UPPER JONES FALLS

Small Watershed Action Plan: Final Report



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Department of Environmental
Protection and Sustainability

VOLUME 1

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Baltimore County Executive Kevin Kamenetz and the Baltimore County Council

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CHAPTER 1
Introduction

1.1 Purpose

This Small Watershed Action Plan (SWAP) is a strategy for the restoration and protection of the Upper Jones Fall watershed, referred to as Area G in this report. The report presents the plan for watershed restoration, describes management strategies for each of the four subwatersheds comprising Area G and identifies priority projects for implementation. A schedule for implementation through 2025 that aligns with the timeframe for the Maryland pollutant reduction targets for the Chesapeake Bay TMDL is presented in addition to planning level cost estimates where feasible. Financial and technical partners for plan implementation are suggested for the various recommendations. This SWAP is intended to assist Baltimore County Department of Environmental Protection and Sustainability (EPS) and partners to keep moving forward with the restoration and protection of Area G.

1.2 Background

A SWAP identifies strategies for bringing a small watershed into compliance with water quality criteria. Strategies include a combination of government capital projects, actions in partnership with local watershed associations, citizen awareness campaigns and volunteer activities. Effective implementation of watershed restoration strategies requires the coordination of all watershed partners and the participation of many stakeholders.

Over the past year, Area G partners have worked together, conducting field assessments, identifying restoration and protection opportunities, and engaging the community, in order to build a successful plan. A Steering Committee, consisting of watershed partners, was formed to develop the Area G SWAP. This includes Baltimore County personnel, Valleys Planning Council, Blue Water Baltimore, University of Maryland Sea Grant Extension, Soil Conservation District and other organizations and leaders from the local community. The Steering Committee met six times to provide input and guidance on the development of the SWAP document. Area G Steering Committee members are listed in Table 1-1.

Table 1-1: Area G Steering Committee Members

Name	Organization
Kathy Angstadt	Padonia Park
Amelia Atkins	Baltimore County, Department of Environmental Protection and Sustainability
Brian Bernstein	Trout Unlimited
Harold Burns	Falls Road Community Association
Elise Bulter	Robert E. Lee Park Nature Council
Carlton Sexton	Ruxton Riderwood Lake Roland Area Improvement Association
Jim Ensor	Soil Conservation District
Dick Gibbs	Community Leader
Neely Law	Center for Watershed Protection
Teresa Moore Liz Buxton (as of May 2015)	Valleys Planning Council
Brooks Paternotte	Irvine Nature Center
Eric Rockel	Greater Timonium Community Council
Stuart Stainman	Resident
Mark Staley	DNR Inland Fisheries
Steve Stewart	Baltimore County, Department of Environmental Protection and Sustainability
Michael Stott	Baltimore Country Club
Kim Pause Tucker	Stevenson University
Krisztian Varsa	UMD Sea Grant Extension
Alice Volpitta	Blue Water Baltimore
Bosley Wright	The Brotherhood of the Jungle Cock

In addition, two community meetings were held during the SWAP development to inform and receive input from the broader public. Community meetings are intended to raise citizen awareness and solicit feedback from residents in neighborhoods, leaders from the local community, institutions and business associations regarding watershed restoration strategies. A description of each meeting including date, approximate number of attendees and topics presented is provided below.

- **Community Meeting #1** (October 30, 2014; 15 attendees): This meeting included an introduction to the SWAP process and the Area G Steering Committee members. A description of watersheds, county goals, environmental requirements (see Section 1.3), and a SWAP framework was presented. The current conditions of Area G were presented based on a desktop analysis and the field assessments conducted. The draft vision and goals were presented and attendees were asked to identify the top three most important watershed goals.

- **Community Meeting #2** (September 29, 2015; 7 attendees): An overview of the SWAP developed for the Area G watershed was presented. This presentation included an overview of the SWAP process, watershed vision and goals, major watershed characterization, municipal and citizen strategies, pollutant removal analysis, subwatershed prioritization, and SWAP implementation.

1.3 Environmental Requirements

This SWAP was developed to satisfy environmental program requirements while also meeting citizen needs for a healthy environment, clean water, and an aesthetically pleasing community. The following environmental program requirements and regulations were considered during the development of this SWAP and are briefly described in the sections below.

- National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit assessment and planning requirements
- Local Total Maximum Daily Load (TMDL) reductions for sediment, bacteria, trash, and PCBs for Area G
- Chesapeake Bay TMDL reductions for nutrients (total nitrogen, total phosphorus) and sediment to meet water quality standards
- Maryland Fertilizer Use Act of 2011
- Maryland Department of Agriculture's Revised Nutrient Management Regulations

1.3.1 NPDES MS4 Permit

Many requirements of Baltimore County's NPDES permit (11-DP-3317(MD0068314)) will be addressed by this plan. One of these requirements is to systematically assess the water quality and develop restoration plans for all watersheds within the county. These assessments must include the following:

- Provide for public participation in the development and implementation of watershed restoration activities
- Determine current water quality conditions
- Include the results of a visual watershed inspection
- Identify and rank water quality problems
- Prioritize all structural and non-structural water quality improvement projects
- Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable wasteload allocations.

The county's existing NPDES permit also requires the county to address runoff from 20 percent of existing impervious cover not already treated and support regional trash reduction TMDL. Continued efforts by the County to implement Environmental Site Design (ESD) technologies for new and redevelopment projects to the Maximum Extent Practicable (MEP) along with inspection and enforcement of the Illicit Discharge and Elimination Program. The County will also be required to develop and implement plans to address stormwater waste load allocations (WLAs) established under EPA-approved total maximum daily load (TMDL) estimates. In terms of meeting the Chesapeake Bay TMDL nutrient and sediment reduction targets, the county developed a Phase II Watershed Implementation Plan (WIP) in 2012 (http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/FINAL_PhaseII_Report_Docs/Final_County_WIP_Narratives/Baltimore_County_WIPII_2012.pdf).

1.3.2 Local TMDLs

The Upper Jones Watershed contains 50.8% of the Jones Falls watershed drainage area. The Jones Falls watershed is listed as impaired in the Maryland 303(d) list of impaired waters for several pollutants of concern including: sedimentation and siltation (1996 listing), fecal coliform (2002 listing), water temperature (multiple listing for subwatershed), sulfates (2010 listing), chlorides (2010 listing), channelization (2012 listing), zinc (1996 listing), copper (1996 listing), lead (1996 listing), total phosphorous (1996 listing), and chlordane (1996 listing). Impairments specific to Lake Roland include: PCB in fish tissue (2002 listing), chlordane (2000 listing) and mercury in fish tissue. Four TMDLs have been completed for the Jones Falls watershed. These include sedimentation/siltation, fecal coliform, PCB in fish and chlordane. Table 1-2 provides a summary of the impairment listing and TMDL status.

Impairment listings reflect the inability to meet water quality standards for the designated uses. The Maryland Department of the Environment (MDE) designates the Jones Falls and all tributaries upstream of Lake Roland as Use Class III, Nontidal Cold Water (*COMAR* 26.08.02.08). The designated uses include water contact sports, leisure activities involving direct contact with surface water, fishing, growth and propagation of trout and other fish, aquatic life and wildlife, agricultural water supply, and industrial water supply, (*COMAR* 26.08.02.02).

Table 1-2: Water Quality Impairment Listing and Status

Impairment (Year Listed)	Water Type	TMDL Status	Applicable Designated Use
Sedimentation/siltation or Total Suspended Solids (TSS; 1996)	Non-Tidal 8-Digit Watershed	TMDL Approved (2011)	Aquatic Life and Wildlife
Fecal Coliform (2002)	Non-Tidal 8-Digit Watershed	TMDL Approved (2008)	Water Contact Sports
PCB in Fish Tissue (Lake Roland; 2002)	Impoundments	TMDL Approved (2014)	Fishing
Chlordane (Lake Roland; 2000)	Impoundments	TMDL Approved (2001) Relisted as Category 2 (2012)	Fishing
Water Temperature (021309041036, UTJones Falls)	Non-tidal Segment(s)	Category 5	Aquatic Life and Wildlife
Water Temperature (021309041036, UT N. Branch Jones Falls)	Non-tidal Segment(s)	Category 5	Aquatic Life and Wildlife
Water Temperature (021309041036, Slaughterhouse Branch)	Non-tidal Segment(s)	Category 5	Aquatic Life and Wildlife
Sulfates (2010)	Non-Tidal 8-Digit Watershed	Category 5	Aquatic Life and Wildlife
Chlorides (2010)	Non-Tidal 8-Digit Watershed	Category 5	Aquatic Life and Wildlife
Channelization (2012)	Non-Tidal 8-Digit Watershed	Category 4c[1]	Aquatic Life and Wildlife
Water Temperature (021309041036, Dipping Pond Run)	Non-tidal Segment(s)	Category 3[2]	Aquatic Life and Wildlife
Water Temperature	Non-tidal Segment(s)	Category 3[2]	Aquatic Life and Wildlife

[1] Category 4c listings are water bodies for which are impaired by a non-conventional pollutant

[2] Category 3 listings are water bodies for which there is insufficient data and information to determine if any water quality standard is being met

(021309041036, N. Branch Jones Falls)			
Zinc (1996)	Non-Tidal 8-Digit Watershed	Category 2	Aquatic Life and Wildlife
Copper (1996)	Subwatershed (021309041032)	Category 2	Aquatic Life and Wildlife
Copper (1996)	Subwatershed, Multiple Segments	Category 2	Aquatic Life and Wildlife
Mercury in Fish Tissue (Lake Roland)	Impoundments	Category 2	Fishing
Lead (1996)	Non-Tidal 8-Digit Watershed	Category 2	Aquatic Life and Wildlife
Total Phosphorus (1996)	Non-Tidal 8-Digit Watershed	Category 2	Aquatic Life and Wildlife
Chlordane (1996)	Impoundments	Category 2	Fishing

A TMDL was developed for sedimentation/siltation that was approved by MDE in 2011 for the non-tidal portions of the Jones Falls watershed. A copy is included in Appendix I. Sources of sediment in Upper Jones Falls include urban, agricultural, and stream erosion. While there is no numeric water quality standard for sediment, excessive sedimentation can negatively impact aquatic health and recreational uses. Biological communities in Jones Falls are likely impaired due to flow and sediment related stressors (MDE, 2011). An Index of Biotic Integrity (IBI) score of fair or good for the watershed would indicate a healthy aquatic community. In order to meet water quality goals, a target reduction of 21.9% was established for sediment.

The TMDL for fecal coliform bacteria was approved by MDE in 2008 and is included as Appendix I. Fecal bacteria are microscopic single-celled organisms (primarily fecal coliform and fecal streptococci) found in the wastes of warm-blooded animals. Excessive amounts of fecal bacteria in surface water used for recreation result in an increased risk of pathogen-induced illness to humans. Known sources of bacteria include pet, human, livestock, and wildlife categories. In order to meet water quality standards, bacteria levels measured at the monitoring station downstream of the Upper Jones Falls area, loadings must be reduced by more than 90% in all areas of the Jones Falls watershed (MDE, 2008). This level of reduction is not practical nor achievable and therefore, MDE recommended a staged approach to reduce sources of fecal coliform (MDE, 2008).

The TMDL for PCB in fish tissue for Lake Roland was approved by MDE in 2014. PCBs are chemicals that were used in manufacturing of electrical transformers, plastics, paints and lubricating oils that can persist for many years in lake and river sediments. The chemicals bioaccumulate or become persistent as they progress up the food chain to humans. Tissue concentration from clam surveys found that a sampling site on the Deep Run tributary within Area G had the highest mean PCB concentration in Jones Falls, indicating that this subwatershed may be the main source of PCB to Lake Roland. However, the PCB concentration in Lake Roland's fish tissue between 2000 and 2007 had declined from 79.88 ng/g to 43.48 ng/g, which is a 54% decrease in that time period. Thus further data collection is needed to determine if the levels are still exceeding the criteria. The TMDL for PCBs in Lake Roland is included as Appendix I.

A TMDL for chlordane in Lake Roland was approved by MDE in 2001 and delisted in Maryland's 2012 Integrated Report. The impairment was based fish tissue sample data in 1983 and 1984. New fish tissue data collected in 2007 found that fish tissue concentrations for chlordane were well below the fish tissue impairment of 242.8 parts per billion.

Local TMDLs also exist for the Baltimore Harbor and are unique because the area that must comply with the TMDLs typically includes the larger drainage area to the harbor. The Jones Falls discharges to the harbor and is often included in the area requiring load reductions when a TMDL is issued. Those Baltimore Harbor TMDLs that will have an impact on the Jones Falls include TMDLs for nitrogen and phosphorus, PCBs and trash. The percentage reduction required for nitrogen and phosphorus to the Baltimore Harbor Watershed is 15% reduction to urban stormwater loads. The Baltimore Harbor TMDL for PCBs states that a 91.5% reduction for all non-point source loads and NPDES regulated storm water loads, within the County portion of the TMDL area, is required to meet water quality standards for PCBs. The trash TMDL states that 100% of trash inputs to the Jones Falls must be removed in order to meet the TMDL for the affected area. Table 1-3 provides a summary of the local TMDL reduction requirements.

Table 1-3: Jones Falls Local TMDL Reductions

TMDL Area	Sediment	Bacteria	Nitrogen	Phosphorus	PCBs	Trash
Jones Falls[1]	21.9%	92.4%	15%	15%	91.5%	100%
Lake Roland[2]					29%	

[1]Local TMDLs are for the entire Jones Falls with the exception of bacteria which is for the portion of the Jones Falls within the Area G SWAP planning area. TMDLs for nitrogen, phosphorus, PCBs and Trash are from the Baltimore Harbor TMDL.

[2]Local TMDL is for the entire Lake Roland. There is no separate TMDL for the Area G SWAP planning area.

1.3.3 Chesapeake Bay TMDL

The Chesapeake Bay TMDL was finalized in 2010 by the EPA to restore the Chesapeake Bay by 2025. This TMDL allocates nutrient and sediment reductions for each bay state and for Maryland that includes a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment. The load reductions are based on estimates of existing nitrogen, phosphorus and sediment from a 2009 scenario of the Bay Watershed Model (http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html). These reductions were further broken down by county and major river basin.

At the state level, Phase 1 Watershed Implementation Plans (WIPs) were developed to determine how each state will help meet pollutant reductions. EPA charged the Bay watershed states and the District of Columbia with developing WIPs to provide adequate “reasonable assurance” that the jurisdictions can and will achieve the nutrient and sediment reductions necessary to implement the TMDL within their respective boundaries. Maryland’s Phase I WIP provided a series of proposed strategies that will collectively meet the 2017 target (70% of the total nutrient and sediment reductions needed to meet final 2025 goals). After more than a year of cooperative work, the Maryland Department of the Environment (MDE) and the Departments of Natural Resources, Agriculture, and Planning, submitted Maryland’s Final Phase I WIP to EPA in December 2010. Baltimore County’s Phase I plan required reductions equivalent to retrofit of 30% of pre-1985 developed land.

MDE worked with the other Maryland Bay agencies and many partners in local jurisdictions to develop Phase II WIPs with more detailed reduction targets and specific strategies to further ensure that the water quality goals of the Bay TMDL will be met (EPS, 2012). Baltimore County completed its Phase II WIP in July 2012, which was incorporated into the Maryland Phase II WIP that was finalized in October 2013. Phase II WIP reduction targets for the Baltimore County watershed urban areas are: 32.2% for nitrogen and 47.0% for phosphorus. Table 1-4 provides a summary of the Chesapeake Bay TMDL nutrient load reduction requirements.

Table 1-4: Chesapeake Bay TMDL Nutrient Load Reduction Requirements

	Required Nitrogen Reduction	Required Phosphorus Reduction
Urban Load	32.2%	47.0%
Agricultural Load	32.0%	21.4%

Baltimore County must reduce what is referred to as the “urban sector” to meet Chesapeake Bay mandates. The Urban Load reductions in the table above are for urban regulated stormwater. The agricultural allocation is shown in the table above because the agricultural community is also under mandate to reduce pollution from the “agricultural sector”. These pollution reduction efforts for agricultural properties are coordinated between the Maryland Department of Agriculture, Baltimore County Soil Conservation District (SCD), and local farmers. Agricultural load reductions are not part of the County’s urban stormwater reduction responsibilities. Baltimore County is only responsible for the Urban Load.

1.3.4 Maryland Fertilizer Use Act of 2011

The Fertilizer Use Act of 2011 is an environmental law that limits the amount and use of phosphorus and nitrogen in lawn fertilizer products. The major components of the law include content and labeling restrictions, use restrictions by commercial applicators and 'do-it yourself' applicators, certification requirements and a homeowner education program about best management practices. The law became fully effective on October 1, 2013.

1.3.5 Maryland Department of Agriculture's Revised Nutrient Management Regulations

The Maryland Department of Agriculture revised nutrient management regulations took effect on October 15, 2012 and will be phased in through March 1, 2020. The revised regulations call for updated nutrient management plans to address the new regulatory requirements, restrictions on organic nutrient use, and best management practices to restrict nitrogen applications.

1.4 USEPA Watershed Planning A-I Criteria

The Clean Water Act (CWA) was amended in 1987 and established the Section 319 Nonpoint Source Management Program, after recognizing the need for federal assistance with state and local nonpoint source efforts. Under this section, states, tribes, and territories can receive grant money for the development and implementation of programs aimed at reducing nonpoint source (NPS) pollution. NPS pollution comes from human activities, wildlife and atmospheric deposition, and is deposited on the ground to eventually be carried to receiving waters by stormwater runoff. Common NPS pollutants and sources include:

- Excess fertilizers, herbicides, and insecticides from agricultural and residential lands
- Oil, grease, and toxic chemicals from urban runoff
- Sediment from improperly managed construction sites, agricultural and forest lands, and eroding stream banks
- Bacteria and nutrients from livestock, wildlife, pet waste, and failing septic systems

CWA Section 319 grant funds can be requested to support nonpoint source related activities such as technical assistance, financial assistance, education, training, technology transfer, restoration projects, and monitoring to assess the success of specific nonpoint source implementation projects. Watershed plans to restore impaired water bodies and address nonpoint source pollution using Section 319 funds must meet USEPA's nine minimum elements, known as the “A through I criteria” for watershed planning. The “A through I criteria” are summarized below:

A. Identification of the causes and 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 nonpoint source (NPS) management measures
C. A description of the NPS management measures that will need to be implemented
D. An estimate of the amount 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
H. A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards
I. A monitoring component to determine whether the watershed plan is being implemented

This Area G SWAP meets the A through I criteria. Table 1-5 shows where these criteria are addressed throughout this document.

1.5 Partner Capabilities

In order to achieve effective watershed restoration, the capabilities of many organizations must be brought together and coordinated. Within Area G, key partner organizations include Baltimore County EPS, Baltimore County Soil Conservation District, Valleys Planning Council, and Blue Water Baltimore. Other organizations and local partners may assist with implementation on a project specific basis.

Table 1-5: U.S. EPA Watershed Planning "A-I" Criteria

Chapter of the Report	USEPA A-I Criteria								
	A	B	C	D	E	F	G	H	I
Chapter 1. Introduction					X				
Chapter 2. Vision, Goals and Objectives					X				
Chapter 3. Restoration Strategies		X	X		X				
Chapter 4. Subwatershed Management Strategies	X		X		X				
Chapter 5. Plan Evaluation				X		X	X	X	X
Appendix A. Area G Action Strategies			X	X	X	X	X		X
Appendix B. U.S. Environmental Protection Agency A Through I Criteria for Watershed Planning									
Appendix C. Cost Analysis and Potential Funding Sources				X					
Appendix D. Chesapeake Bay Program Pollutant Load Reduction Efficiencies		X							
Appendix E. Area G Watershed Characterization Report	X		X		X				
Appendix F. Stream Corridor Assessment Survey Data	X								
Appendix G. Uplands Survey Data	X								
Appendix H. Electronic Databases and Documents related to the SWAP	X								
Appendix I. Total Maximum Daily Loads for Area G	X								

1.5.1 Baltimore County Environmental Protection and Sustainability (EPS)

Baltimore County EPS has a waterway restoration program to implement restoration projects, including stream restoration, stormwater conversions and retrofits, and reforestation projects. Baltimore County has an extensive monitoring program that assesses the current ambient water quality, efficiency of various restoration projects in relation to pollutant removal and biological community improvement, and tracks trends over time. The County also has an illicit discharge and elimination program that monitors storm drain outfalls, tracks pollutant sources, and coordinates remediation.

The County operates street sweeping and inlet cleaning programs throughout the county that remove sediment, nitrogen, and phosphorus before they reach the waterways. These programs are tracked and estimates of the pollution removal are calculated.

1.5.2 Baltimore County Soil Conservation District

The Baltimore County Soil Conservation District works with federal, state, local agencies and the private sectors/residents to address the County's soil and water conservation needs. They are not a regulatory agencies, rather they promotes practical and effective soil, water and related natural resource programs to all citizens on a voluntary basis through leadership, education and cooperation. Staff provides technical assistance and help to identify funding sources to install best management practices that protect water quality such as the development of Nutrient Management Plans and Soil Conservation and Water Quality Plans.

1.5.3 Valleys Planning Council

The Valleys Planning Council (VPC) is a non-profit corporation whose mission is to conserve land and resources, preserve historic character and maintain the rural feel and land uses in the valleys. The VPC has a number of programs to protect natural landscapes features and agriculture in the County, specifically through easements and other land use controls.

1.5.4 Blue Water Baltimore

Blue Water Baltimore (BWB) is a non-profit organization formed in 2010 to represent the watersheds within Baltimore City and County. Their mission is to restore the quality of Baltimore's rivers, streams and harbor to foster a healthy environment, a strong economy, and thriving communities. BWB has a number of programs to engage residents and volunteers in projects to restore and protect local waterways that includes for example Adopt-a-Stream training, technical assistance, homeowner BMP project implementation (rain gardens and rain barrels), native plants promotion and planting among many others.

1.6 Area G Overview

The Area G watershed is subdivided into four subwatersheds that comprise the Upper Jones Falls Watershed (Figure 1-1). It is one of three planning areas in the Jones Falls watershed. Streams in the Upper Jones Falls watershed drain to the mainstem Jones Falls and Lake Roland, then eventually to the Baltimore Harbor. Area G is approximately 13,187 acres (20.6 mi^2), or 51.5% of the entire Jones Falls watershed (40 mi^2).

The Area G watershed is largely outside of the Urban Rural Demarcation Line (URDL) that ensures limited development in the watershed through restrictions on water and sewage infrastructure extensions. The lower part of the planning area is within the URDL. The land use in the watershed is dominated by low density residential (39.3%), forest (17.5%), and agriculture (12.7%). The watershed has a low impervious cover of 9%. The soils in the watershed consist of mostly hydrologic soil groups B (68.8%) and C (21.8%) with moderate to low infiltration rates. The total population for the watershed is 12,584 people based on the 2010 census, which translates into a low average population density of 1.0 people/acre. The watershed contains 97 stream miles. A little more than fourteen miles were assessed in the Deep Run and Dipping Pond Run subwatersheds during the development of the SWAP and are generally in good condition compared to more urbanized watersheds. However, there are areas of erosion and unstable channel conditions among the sites assessed. Streams in North Branch and Jones Falls main stem were evaluated in the Baltimore County's 1997 Jones Falls Water Quality Management Plan (WQMP) (Dames and Moore, 1997) and reevaluated for the SWAP from public right-of-way crossings as part of a 'windshield' survey. Further, this WQMP reinforces management approaches that include the creation or enhancement of riparian buffers and restoration of headwater stream systems in developing watersheds or watersheds without appropriate stormwater management.

The four subwatersheds that comprise the Area G watershed are intended to help target restoration, preservation and monitoring efforts. The Area G Watershed Characterization Report includes detailed analyses and descriptions of the current watershed conditions and potential water quality issues. This report is included as Appendix E of this plan. A summary of the key watershed characteristics for Area G based on the characterization report is provided in Table 1-6.

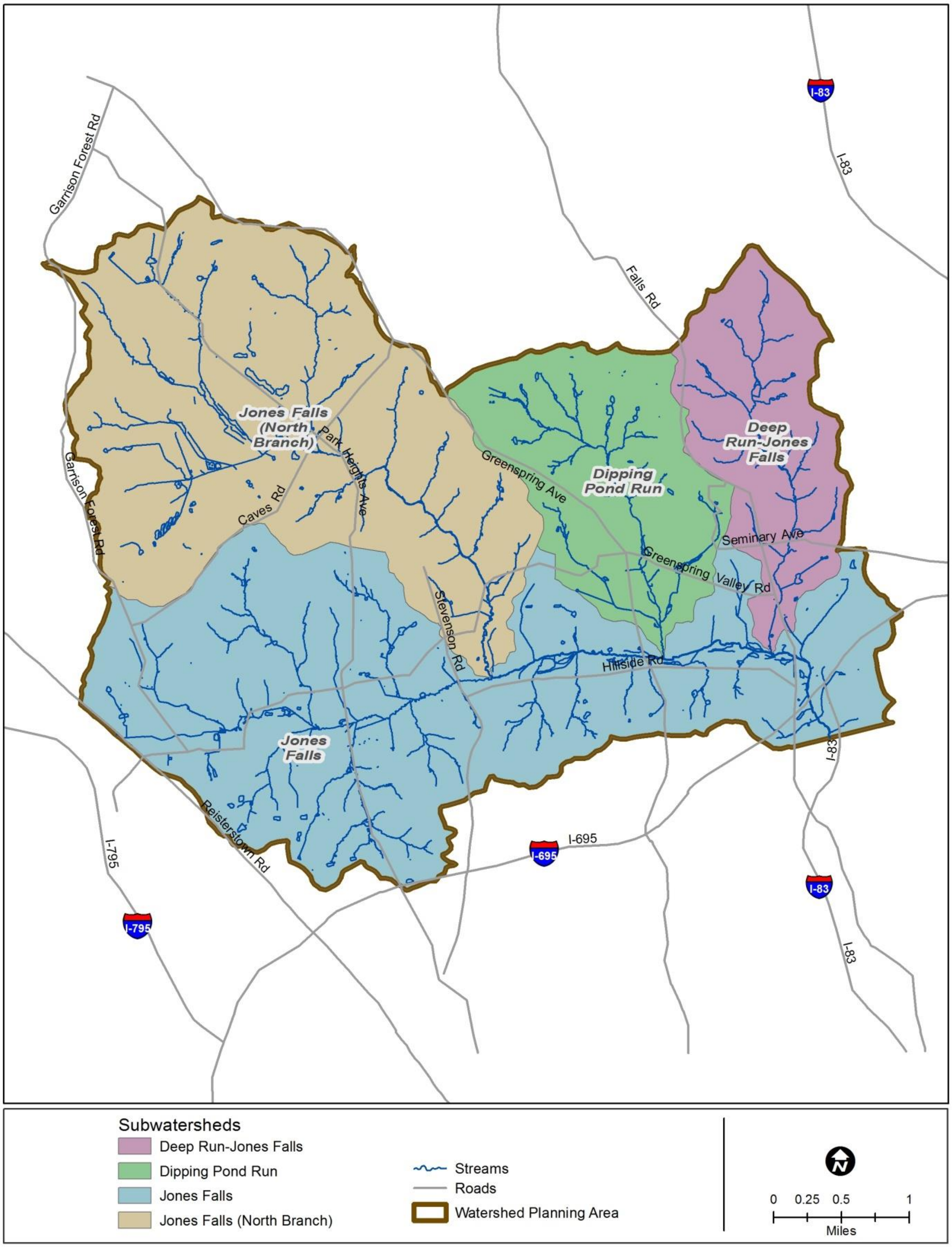

Figure 1-1: Area G SWAP Planning Area

Table 1-6: Area G Key Watershed Characteristics

Key Watershed Characteristics	Subwatershed				Total
	Deep Run	Dipping Pond	Jones Falls	Jones Falls (North Branch)	
Drainage Area (acres)	1,436.8 (2.2 mi^2)	1,758.4 (2.8 mi^2)	5,447.4 (8.5 mi^2)	4,544.8 (7.1 mi^2)	**13,187.4 (20.6 mi^2)**
Stream Miles	10.0	13.2	44.6	29.3	**97.0**
Total Population (2000 Census)	1,374	1,045	7,253	2,914	**12,586**
Land Use/Land Cover (%)					
Very Low Density Residential (Agricultural)	0.9	5.1	6.9	2.8	**4.6**
Very Low Density Residential (Forested)	9.2	5.4	7.0	5.1	**6.4**
Low Density Residential	44.7	35.6	36.8	42.1	**39.3**
Medium Density Residential	1.2	0.0	2.9	0.4	**1.5**
Commercial	6.0	0.0	1.9	0.3	**1.5**
Industrial	0.0	0.0	0.0	0.0	**0.0**
Institutional	2.0	2.6	6.4	1.0	**3.6**
Open Urban Land	12.7	10.2	4.1	9.4	**7.7**
Agriculture	6.5	16.2	12.8	19.9	**15.0**
Forest	14.6	24.1	15.2	18.9	**17.6**
Wetlands	0.0	0.0	0.1	0.0	**0.0**
Impervious Cover (%)	10.2	7.0	11.4	6.5	**9.0**
Hydrologic Soil Group (%)					
A (low runoff potential)	2.3	0.0	2.9	0.0	**1.4**
B	70.1	63.3	70.1	69.0	**68.8**

Key Watershed Characteristics	Subwatershed				Total
	Deep Run	Dipping Pond	Jones Falls	Jones Falls (North Branch)	
C	22.2	35.8	17.0	21.9	**21.8**
D (high runoff potential)	4.7	0.7	7.3	8.6	**6.6**

1.7 Report Organization

This report is organized into the following five major chapters:

Chapter 1 explains the purpose of this report including underlying environmental requirements and key watershed characteristics.

Chapter 2 presents the watershed vision, goals and objectives for restoring the Area G watershed.

Chapter 3 describes the types of watershed restoration practices planned for Area G and estimated pollutant load reductions.

Chapter 4 discusses prioritization of restoration of the six subwatersheds in the Area G watershed and summarizes subwatershed specific restoration and protection strategies.

Chapter 5 presents the implementation plan restoration and protection evaluation criteria and monitoring framework.

This volume (Volume 1) also includes the following appendices with additional, detailed information used to develop and support this SWAP:

- Appendix A: Area G Action Strategies
- Appendix B: U.S. Environmental Protection Agency A Through I Criteria for Watershed Planning
- Appendix C: Cost Analysis and Potential Funding Sources

- Appendix D: Chesapeake Bay Program Pollutant Load Reduction Efficiencies

A second volume (Volume II) includes the following appendices with supporting documentation related to the current conditions of the Area G watershed:

- Appendix E: Area G Watershed Characterization Report
- Appendix F: Stream Corridor Assessment Survey Data
- Appendix G: Uplands Survey Data
- Appendix H: Electronic Databases and Documents Related to the SWAP
- Appendix I: Total Maximum Daily Loads for Area G

CHAPTER 2
Vision, Goals and Objectives

2.1 Vision Statement

The Area G Steering Committee adopted the following vision statement that acted as a guide in the development of the SWAP:

We envision a resilient and healthy environment that protects the welfare of the entire Jones Falls watershed through public education, as well as conservation and restoration of natural resources.

2.2 Area G SWAP Goals and Objectives

The Steering Committee created a vision statement for Area G and identified nine goals to define the desired restoration and protection objectives. The goals were based on input from watershed residents at the first community meeting and revised with input from the Steering Committee. To achieve watershed goals, stakeholders then identified the type of restoration activities that are of interest. The watershed goals, organized by category, are provided below:

GOALS:

<u>Clean Water</u>

- Goal 1: Improve and maintain stream conditions that create swimmable waters in the Upper Jones Falls
- Goal 2: Reduce sediment input to the Upper Jones Falls to support healthy living resources in the stream (i.e., biological communities)
- Goal 3: Reduce nitrogen and phosphorus inputs to the Jones Falls watershed to meet the Baltimore County allocated load reduction for the Chesapeake Bay total maximum daily load (TMDL)

<u>Stream Protection</u>

- Goal 4: Reduce and control stormwater runoff to support Use Class III designation (non-tidal, cold water)
- Goal 5: Protect high quality streams to support cold water fisheries

<u>Forest and Habitat</u>

- Goal 6: Support conservation of contiguous forested areas
- Goal 7: Protect and restore 100-ft riparian buffers

Agricultural Practices

- Goal 8: Promote implementation of conservation practices on agricultural lands

Stewardship

- Goal 9: Engage the public in actions to support a healthy watershed

The following sections present a discussion of each of the nine goals for restoring and protecting the Area G watershed that are organized by category. For each goal, a series of objectives was developed to ensure that the plan will meet each goal. Measurable action items for each objective are included in Appendix A.

Clean Water

2.2.1 Goal 1: Improve and Maintain Stream Conditions that Create Swimmable Waters in the Upper Jones Falls

Fecal bacteria are microscopic single-celled organisms (primarily fecal coliform and fecal streptococci) found in the wastes of warm-blooded animals. Excessive amounts of fecal bacteria in recreational surface water are known to indicate an increased risk of pathogen-induced illness to humans. A Total Maximum Daily Load (TMDL) for fecal coliform was developed for the tributaries that drain to the Upper Jones Falls. The primary sources of fecal coliform identified in the TMDL are domestic animals (pets) and humans, with lesser contributions from livestock and wildlife (MDE, 2008). There is a need to reduce bacteria by 92.4% in the entire Jones Falls watershed to meet the TMDL requirement. Reductions in bacterial contamination in streams can be achieved through actions to meet the TMDL requirements in both the urban and rural sections of Area G.

Objectives:

1. Meet TMDL goal to reduce bacteria by 92.4% for streams in the SWAP planning area.

2.2.2 Goal 2: Reduce Sediment Input to the Upper Jones Falls to Support Healthy Living Resources in the Stream (i.e., Biological Communities)

As the land uses in the watershed become more urban, more stormwater runoff and associated pollutants enters a stream impairing water quality and living resources if excessive. If not effectively treated in the watershed, the amount and rate of runoff can also result in streambed and bank erosion. Exposed soil on agricultural land and construction sites are additional sources of sediment to streams in developed watersheds. MDE conducted a Biological Stressor Identification in the Jones Falls and found that biological communities are likely impaired due to flow/sediment related stressors associated with stream channel and bank erosion, resulting in a TMDL for sediment. Actions are needed in Area G to help achieve the sediment TMDL for the Jones Falls watershed. The implementation of best management practices (BMPs) and stream restoration are needed to reduce sources of non-point source pollution and any actions the reduce sediment input to the main stem should also help to reduce sediment inputs to Lake Roland.

Objectives:

1. Meet the TMDL goal to reduce sediment by 21.9% for the Jones Falls
2. Improve and maintain IBI score of fair or better

2.2.3 Goal 3: Reduce Nitrogen and Phosphorus Inputs to the Jones Falls Watershed to Meet the Baltimore County Allocated Load Reduction for the Chesapeake Bay Total Maximum Daily Load (TMDL)

In 2010, the US EPA developed a TMDL, or "pollution diet" that sets nitrogen, phosphorus and sediment load reductions to restore the Chesapeake Bay by 2025. The TMDL allocates load reductions to each of the six Bay States and District of Columbia with a goal to have practices in place by 2017 to meet 60% of the reductions. The implementation of BMPs are needed throughout the Jones Falls watershed on existing development as only 9.8% of the stormwater system drainage area is treated with stormwater BMPs.

Objectives:

1. Meet the Chesapeake Bay TMDL goal to reduce urban loads of nitrogen by 32.2% by 2025.
2. Meet the Chesapeake Bay TMDL goal to reduce urban loads of phosphorus by 47% by 2025
3. Support ambient water quality sampling efforts throughout the Jones Falls watershed. Identify and target areas to retrofit with stormwater management practices and stream protection.

Stream Protection

2.2.3 Goal 4: Reduce and Control Stormwater Runoff to Support Use Class III Designation (Non-Tidal, Cold Water)

The streams in Area G have an average rating as fair for both benthic macroinvertebrates and fish populations. While brown trout were collected in the watershed, reproducing native trout populations were not found. Area G currently has a low impervious cover of 9.0 percent which is an indicator of good stream health, but just below the threshold of impervious when impacts from urban development become more apparent (Schueler et al. 2009). Activities should be taken to protect these high quality streams, to include the continuing use of Environmental Site Design that conserves and protects natural resources during site development and actions that address the removal of biological stressors as identified in the Sediment TMDL.

Objectives:

1. Identify and target areas to retrofit with stormwater management projects and stream restoration
2. Limit impervious cover in new development through continued implementation of Environmental Site Design
3. Work with Bureau of Highways to review road de-icing practices to minimize use of road salt impact on local waterways

2.2.4 Goal 5: Protect High Quality Streams to Support Cold Water Fisheries

The strategy for this goal is to ensure that conditions to support trout streams are maintained. Landscape and stream conditions once supported a thriving native trout population and are now only represented by brown trout. However, cold water conditions still persist through springs, in Dipping Pond Run. Therefore continued efforts are needed to ensure development occurs in an environmentally sensitive fashion that maintains or restores habitat and stream conditions for cold water fisheries. A reduction in runoff and pollutant loads is achieved through the use of stormwater management facilities that include filtration/infiltration techniques in addition to the reduction of impervious cover and installation or enhancement of riparian buffers.

Objectives:

1. Identify high quality trout streams and document trout populations in the waters
2. Maintain and enhance current trout populations in the watershed
3. Identify high quality streams

4. Restore or sustain water temperatures in trout streams at 68° F

<u>Forest and Habitat</u>

2.2.5 Goal 6: Support Conservation of Contiguous Forested Areas

The conservation of trees and forests is a key prevention measure to protect and maintain waters quality and provide many other benefits to air quality and habitat for wildlife. The Upper Jones Falls watershed is 35.1% forested with the effects of development shown by the patchiness of forest cover. While half of the streams have a forested 100-ft buffer, continued efforts are needed to conserve remaining contiguous areas of forest. Trees and forests reduce stormwater runoff through evapotranspiration into the air and infiltration of rainwater into the soil. The presence of trees also helps to slow down and temporarily store runoff, which further promotes infiltration, and decreases flooding and erosion downstream. In addition, trees and forests reduce pollutants by transforming them into less harmful substances.

Objectives:

1. Identify and protect areas in groundwater 'recharge' areas for forest conservation
2. Support collaboration with watershed organizations and homeowners for projects to plant native species
3. Work with local, state and other organizations to manage forests to limit damage from invasive species, insects and deer
4. Improve and sustain native species and age diversity in forests

2.2.6 Goal 7: Protect and Restore 100-ft Riparian Buffers

Forested areas along stream channels benefit the physical, chemical, and biological conditions of streams by providing channel stability through root structures, processing of nutrients, shading of streams and food supplies. The buffer width required by the Baltimore County regulation can effectively protect streams. The majority of the 100-ft buffer in the Upper Jones Falls watershed is forested or grass/open space. Less than 2 percent of the land cover within the buffer is impervious.

Objectives:

1. Target restoration efforts in headwater areas
2. Continue to apply Baltimore County's forest buffer regulation to enhance and protect streams

Agricultural Practices

2.2.7 Goal 8: Promote the Implementation of Conservation Practices on Agricultural Lands

Agricultural practices (cropland, orchards, and pasture including horse farms) make up the third largest land use (15.1 percent) in Area G. This goal attempts to integrate the use of established, as well as new or innovative, conservation practices on all agricultural lands. There are a large number of proven agricultural practices that can be used by farmers to reduce pollutant runoff by reducing soil loss, trapping nutrients, and minimizing the amounts of nutrients and pesticides used on the land. The use of these practices will also help meet other watershed goals to maintain and restore stream conditions and aquatic biodiversity, and reduce pollution from stormwater runoff, including bacteria.

Objectives:

1. Work with Conservation Districts and University of Maryland Extension to inform agricultural land owners of conservation practices/ BMPs including, but not limited to, improving existing forest buffers on agricultural land.

Stewardship and Education

2.2.8 Goal 9: Engage the Public in Actions to Support a Healthy Watershed

Actions taken by private citizens and residents are an essential element to the success of the SWAP implementation. The mixed urban and rural character of the Upper Jones Watershed provide a wide-range of type of practices that homeowners and other citizens may voluntarily adopt. Resources need to be available to connect people with available technical, educational and funding opportunities that increase awareness of actions, which people can take in their neighborhoods and on their individual properties to enhance water quality and monitor stream conditions.

Objectives:

1. Develop partnerships with a variety of stakeholders at diverse geographic locations to adopt practices that reduce pollutant loads to streams and improve stream biology
2. Promote community education and increase involvement in stream clean-up activities

CHAPTER 3
Restoration Strategies

3.1 Introduction

This chapter presents an overview of the key restoration strategies and associated pollutant load reductions proposed for restoring the Upper Jones Falls watershed. A complete list of actions proposed for the watershed including goals and objectives targeted, timelines, performance measures, cost estimates, and responsible parties is included in Appendix A.

The key restoration strategies are the focus of this chapter ranging from capital projects such as stormwater retrofits and stream restoration, to green infrastructure such as buffer restoration and tree planting to source control through public education and outreach. Both urban stormwater and agricultural land uses are included in the plan. It is important that a combination and variety of restoration practices are implemented to engage citizens and meet watershed-based goals and objectives.

The Upper Jones Falls watershed restoration and preservation will occur as a partnership between the local government, watershed groups and citizens. All partners are critical to the success of the overall watershed restoration strategy. Local governments can implement large capital projects such as stormwater retrofits, stream restoration, changes in municipal operations, and large-scale public awareness. Watershed groups and citizens can implement locally based programs such as tree planting and downspout disconnection that require citizen participation, and increase awareness.

Therefore, key restoration strategies are divided into three categories: 3.2 Urban Municipal Strategies (Section 0), 3.3 Urban Citizen-Based Strategies (Section 0), and 3.4 Agricultural Best Management Practices (Section 0). It is important that all groups are active in restoration activities and that a variety of projects are implemented.

The watershed pollutant loading analysis performed to estimate current nutrient and sediment loads associated with land uses and other sources (e.g. septic systems) within the Upper Jones Falls watershed is discussed in Appendix E. A description of Best Management Practices (BMPs) is presented in Sections 3.2 through 3.4 that may be implemented by the County, citizens or the agricultural community to help the county comply with total maximum daily load (TMDL) requirements in the Jones Falls and Chesapeake Bay watersheds. Section 0 of this chapter discusses the 3.5 Pollutant Load Reduction Analysis to Meet the TMDLs for the existing and proposed Best Management Practice (BMP) strategies presented

3.2 Urban Municipal Strategies

The Baltimore County government works to restore local streams and improve water quality through capital improvement projects and municipal management activities (e.g., development review, street sweeping, illicit connection programs, etc.). This plays an important role in the SWAP implementation process. Key municipal strategies proposed for restoring Upper Jones Falls are discussed in the following sections.

3.2.1 Stormwater Management

Increased importance of water quality and water resource protection led to the development of the Maryland Stormwater Design Manual which provided BMP design standards for water quality and environmental incentives (MDE, 2000). The Maryland Stormwater Act of 2007 required that all new development adopt environmental site design (ESD) to the maximum extent practicable via nonstructural BMPs and/or other improved site design techniques. The intent of ESD BMPs is to distribute and reduce flow through multiple small BMPs throughout a development site and reduce stormwater runoff leaving that site. This will also reduce pollutant loads and sediment caused by erosive velocities. Further, MDE released guidance for National Pollutant Discharge Elimination Systems Stormwater Permits requiring the county to address runoff from 20 percent of existing impervious cover not already treated by stormwater management practices (MDE, 2014).

3.2.2 Stormwater Retrofits

Stormwater retrofits involve implementing BMPs in existing developed areas where SWM practices do not exist to help improve water quality. Stormwater retrofits improve water quality by capturing and treating runoff before it reaches the receiving water body. Potential sites for upland stormwater retrofits including the installation of bioretention at 13 commercial and institutional sites; and one at a neighborhood cul-de-sac, the conversion of grass ditches at four residential and institutional sites, regenerative stormwater conveyance (RSC) in one neighborhood, the installation of a runoff harvesting system at one institutional site, the installation of a sand filter at a hotspot and the replacement of paved area with permeable pavement in one institutional site.

Impervious surfaces including roads, parking lots, rooftops, and other paved surfaces prevent precipitation from naturally infiltrating into the ground. As a result, impervious surface runoff can result in erosion, flooding, habitat degradation, and increased pollutant loads in receiving water bodies. Subwatersheds with high amounts of impervious cover are more likely to have degraded stream systems and are larger contributors to water quality problems in a watershed than those that are less developed as discussed in Appendix E, Chapter 2.3.3. Removing impervious cover and converting to pervious or forested land will help promote infiltration of runoff and reduce pollutant loads from overland runoff.

There were no areas identified for impervious cover removal in Upper Jones Falls, because the percent of impervious area in the NSA or ISI sites was below the threshold of 10 percent. While not included in pollutant reduction calculations, awareness and outreach tools could be used to inform residents of the water quality impacts associated with large impervious parking lots, driveways or patios and the options available for conversion to, or incorporating more, permeable surfaces.

3.2.3 Stream Corridor Restoration

Stream restoration practices are used to enhance the appearance, stability, and aquatic function of urban stream corridors. Stream restoration practices range from routine stream cleanups and simple stream repairs such as vegetative bank stabilization and localized grade control to comprehensive repairs such as full channel redesign and realignment. Stream corridor assessments (SCAs) performed in the Upper Jones Falls watershed showed opportunities for stream repair and buffer reforestation. Stream segments identified during the SCAs with significant erosion and channel alteration were used to estimate pollutant load reductions which would result from stream repair efforts. Stabilizing the stream channel improves water quality by preventing soils, and the pollutants contained in them, from eroding from the bank and entering the waterway. Sediment from stream bank and channel erosion was also found to be one of the leading stressors contributing to biological impairment in the watershed which prompted the development of the sediment TMDL. Lengths of eroded and altered channel segments were recorded during the SCAs.

3.2.4 Reforestation/Tree Planting

Trees provide aesthetic value, and air and water quality benefits. They can provide shade and absorb nutrients through their root systems while also providing habitat for wildlife. Tree planting incentive programs mentioned previously can also help increase the success of planting efforts. Converting grassed and open areas in the upland portion of the watershed to forested areas through tree plantings can also reduce runoff and nutrient inputs to nearby water bodies and their erosion. Four open space areas were identified with approximately 60 acres available as potential areas for tree planting. Of these, three were privately owned and one was on publicly-owned land. The ISI assessment identified 18 institutional sites with a potential for 68 acres of tree planting.

3.3 Urban Citizen-Based Strategies

The participation of citizens in watershed restoration is an essential part of the SWAP process. When large numbers of individuals become involved in citizen-based water quality improvement initiatives, changes can be made to the aesthetic and chemical aspects of water bodies within the watershed that would otherwise not be possible. Citizen participation is critical to the implementation and long-term maintenance of restoration activities. Key citizen-based strategies proposed for restoring the Upper Jones Falls watershed are discussed in the following sections.

3.3.1 Reforestation

Trees strategically planted around a house can form windbreaks to reduce heating costs in the winter and can provide shade which reduces cooling costs in the summer. Incentive programs, such as Tree-Mendous Maryland (http://www.dnr.state.md.us/forests/treemendous), the State Highway Administration's Partnership Program for public property, and the Baltimore County Big Tree Sales for private residential properties (http://www.baltimorecountymd.gov/Agencies/environment/forestsandtrees/bigtrees.html), help increase successful planting efforts. Several areas throughout the watershed are targeted for tree planting reforestation opportunities.

Riparian Buffer

Stream riparian buffers are critical to maintaining healthy streams and rivers. Forested buffer areas along streams can improve water quality and prevent flooding since they filter pollutants, reduce surface runoff, stabilize stream banks, trap sediment, and provide habitat for various types of terrestrial and aquatic life including fish. Buffer encroachment from development was noted during stream surveys conducted throughout the watershed. Twenty-two out of the 60 neighborhoods were recommended for better stream buffer management due to encroachment. These sites can be improved through reforestation, therefore increasing the lot's tree canopy. These areas can be targeted for buffer awareness initiatives to encourage landowners to plant trees and/or create a no-mow area adjacent to streams. Urban open pervious (lawn) areas identified within the 100-foot stream buffer during the stream assessment and through a GIS analysis discussed in Appendix E are also good candidates for tree planting and are targeted for initial buffer reforestation efforts.

3.3.2 Urban Nutrient Management

Many common activities around homes can have a negative effect on water quality. Yards and lawns typically represent a significant portion of the pervious cover in an urban subwatershed and therefore, can be a major source of nutrients, pesticides, sediment, and runoff. Maintenance behaviors tend to be similar within individual neighborhoods and certain activities can impact subwatershed quality such as fertilizer, herbicide and pesticide use, lawn watering, landscaping, and trash/yard waste disposal. Urban nutrient management efforts related to lawn maintenance and Bayscaping can help reduce nutrient loads to nearby streams. Citizen awareness and behavior change is key to improved urban nutrient management.

Lawn Maintenance Education

Lawn maintenance activities that involve over-fertilization, improper use of herbicides and pesticides, and over-watering may result in polluted runoff to local streams. Lawns with a dense, uniform grass cover or signs designating poisonous lawn care indicate high lawn maintenance activities. Neighborhoods identified as having high lawn maintenance issues are targeted for awareness programs emphasizing responsible fertilizing techniques such as proper application rates and time of year for fertilization, soil testing for nutrient requirements and keeping fertilizers off impervious surfaces. Lawn maintenance education can be achieved through door-to-door canvassing, informational brochures/mailing, excerpts in community newsletters, or demonstrations at community meetings. Information on organic alternatives to chemical lawn treatments should also be included in these outreach efforts. During the Neighborhood Source Assessment, 47 neighborhoods were identified for a fertilizer reduction/education program.

Bayscaping

Reducing the amount of mowed lawn and increasing landscaping features with native vegetation provides water quality benefits through interception and filtration of stormwater runoff. Bayscaping refers to the use of plants native to the Chesapeake Bay watershed for landscaping. Because they are native to the region, these plants require less irrigation, fertilizer, herbicides and pesticides to maintain as compared to non-native or exotic plants. This means that there will be less stormwater pollution and lawn maintenance requirements. Bayscaping is also beneficial to wildlife. Similar to lawn maintenance education, Bayscaping awareness can be raised through informational brochures/mailings, excerpts in community newsletters, or demonstrations at community meetings. A combination of outreach/awareness techniques and financial incentives can be used to implement a Bayscaping program. Four neighborhoods were identified as potential candidates during the Neighborhood Source Assessment.

Maryland Fertilizer Use Act of 2011

This act, which bans phosphorus in most fertilizer products and provides a greater percentage of slow release nitrogen in fertilizer, took effect in October 2013. Fertilizer bags sold in hardware stores and nurseries now have better labeling, and large applicators will have to be certified in proper fertilizer application. The acres of pervious urban land that this act applies to were calculated using GIS.

3.4 Agricultural Best Management Practices

There are many agricultural practices used by farmers to reduce soil loss, trap nutrients, and minimize nutrient and pesticide use on the land. Key agricultural BMPs proposed for restoring the Upper Jones Falls watershed are discussed in the following sections. However, as stated in Section 1.3 of the SWAP Report, Baltimore County is under environmental mandate to reduce pollution entering the Chesapeake Bay. The implementation of agricultural practices will be coordinated between the Maryland Department of Agriculture, Baltimore County Soil Conservation District (SCD), and local farmers to address the agricultural load reductions.

3.4.1 Soil Conservation and Water Quality Plans

A Soil Conservation and Water Quality Plan (SCWQP) is a comprehensive plan that addresses natural resource management on agricultural lands. It describes BMPs which will be used to control erosion and sediment loss, and manage runoff. Based on data obtained from the Baltimore County Soil Conservation District, there are 11 SCWQPs in the Upper Jones Falls watershed. The Best Management Practice currently included in a SCWQP in Upper Jones Falls is discussed below.

Stream Protection with Fencing

Stream protection with fencing incorporates both alternative watering and installation of fencing along streams to exclude livestock. The fenced areas may be planted with trees or grass, but are typically not wide enough to provide the benefits of buffers. Stream fencing should be implemented so as to substantially limit livestock access to streams; however, it can allow for the use of limited hardened crossing areas if other options aren't possible to accommodate access to additional pastures or for livestock watering. By preventing or limiting access of livestock to streams, erosion from hooves and bacteria/nutrient contamination from cows in the stream is reduced. A total of 2.8 acres currently have Stream Protection with Fencing in place.

Conservation Tillage

The Soil Conservation District reports existing Residue and Tillage Management on agricultural lands. Conservation tillage is included in this practice as a creditable practice to meet the Chesapeake Bay TMDL. Conservation tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the surface soil. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface

3.4.2 Nutrient Management Plans

Nutrient management plan (NMP) implementation refers to a comprehensive plan that describes the optimal use of nutrient inputs for crop yield to minimize loss of excess nutrients to the environment. It is a requirement through the Maryland Water Quality Improvement Act of 1998 for farmers to meet specific requirements in their operations. A NMP details the type, rate, timing, and placement of nutrients for each crop. Soil, plant tissue, manure and/or sludge tests are used to assure optimal application rates. Plans are prepared by either University of Maryland Extension or certified private consultants, and are typically revised every year but may be written for up to three years to incorporate management, fertility and technology changes. There are 37.5 acres of agricultural land in the watershed with a NMP.

3.5 Pollutant Load Reduction Analysis to Meet the TMDLs

This section presents results of the watershed pollutant loading analysis performed to estimate current nutrient and sediment loads generated by the various non-point sources within the Upper Jones Falls watershed.

3.5.1 TMDL Pollutant Load Reduction Requirements

The runoff pollutant loading analysis for the watershed was based on land use area from the following source:

- Maryland Department of Planning's (MDP) 2007 Land Use/Land Cover (LU/LC) GIS layer

Pollutant loading rates were based on the following source:

- Pollutant loading rates were estimated by means of watershed-specific pollutant loading rates for nitrogen, phosphorus, and sediment based on the Chesapeake Bay Program

(CBP) July 2011 Watershed Model. The model derived segment-specific loading rates for urban and non-urban land uses.

Urban pervious and impervious nutrient loading rates were provided by Baltimore County and derived as watershed-specific pollutant loading rates based on the Maryland Assessment and Scenario Tool in October 2011. The pollutant loading analysis is described in detail in Chapter 3.3 of the Watershed Characterization Report (Appendix E). Table 3-1 presents the per-acre loadings for nitrogen, phosphorus and sediment used in this analysis. The urban loading rates are used for the reduction analysis discussed below.

Table 3-1: Land Use per Acre Nitrogen and Phosphorus Loadings (pounds/acre/year)

Land Use	Nitrogen Load per Acre	Phosphorus Load per Acre	Sediment Load per Acre	Area (acres)
Urban Pervious	11.55	0.30	132.26	6,910
Urban Impervious	17.36	1.51	968.40	695
Cropland	23.08	1.32	544.96	1,766
Pasture	7.97	0.74	128.65	669
Forest	2.77	0.04	29.65	3,147

The results of this reduction analysis are presented in Table 3-2 showing the average annual urban loads of nitrogen, phosphorus and sediment. The Chesapeake Bay TMDL requires 32.2% and 47.0% and reductions in nitrogen and phosphorus respectively from the County Phase I/II MS4 (urban) loads. Table 3-2 presents the pollutant removals needed to achieve these reduction goals.

Table 3-2: Land Use per Acre Nitrogen, Phosphorus and Sediment Loadings (pounds/acre/year)

Land Use	Nitrogen (lbs)	Phosphorus (lbs)	Sediment (lbs)	Nitrogen Reduction	Phosphorus Reduction	Sediment Reduction
			Urban Percent	**32.2%**	**47.0%**	**Not specified**
Urban	91,876	3,123	1,586,955	29,584	1,468	
			Agriculture Percent	**32.0%**	**21.4%**	**Not specified**
Agriculture	46,091	2,826	1,048,466	14,749	605	
Forest/Wetlands	8,717	126	93,309			
Water	0	0	0			
Septics	33,517.5	--	--			
Total	180,202	6,075	2,728,730			

For purposes of this SWAP, the reductions are applied to the urban load. Nutrient loads associated with all other land uses were not incorporated into these reduction estimates.

3.5.2 Pollutant Load Reduction Calculations

This section presents a quantitative analysis of pollutant removal capabilities of existing and proposed BMPs. Many of the calculations and estimates presented in the following subsections represent maximum potential pollutant removal capabilities. A summary of overall pollutant load reduction estimates is presented at the end of this section.

Most pollutant removal calculations are based on Chesapeake Bay Program models that credit nutrient reductions specific to individual scenarios as efficiencies or land use conversions. Stream restorations are credited using specific reduction amounts per stream length restored and other practices are credited simply as a direct removal. Table 3-3 shows the Chesapeake Bay Program removal efficiencies of some stormwater management practices and Appendix D presents the full suite of best management practices and the associated efficiencies.

Table 3-3: Pollutant Removal Rates

SWM Facility Type	TN Removal Efficiency (%)	TP Removal Efficiency (%)	TSS Removal Efficiency (%)
Detention	5%	10%	10%
Extended Detention	20%	20%	60%
Filtration	40%	60%	80%
Infiltration	80%	85%	95%
Proprietary	40%	60%	80%
Wet Ponds and Wetlands	20%	45%	60%
Bioretention (no underdrain)	70%	75%	80%
Grass Swale (Bioswale)	70%	75%	80%
Sand Filter	40%	60%	80%
Porous Pavement (no underdrain)	80%	80%	85%
Rainwater Harvesting	100%	100%	100%
Regenerative Stormwater Conveyance (Dry)	50%	60%	90%

Listed below are descriptions of how the reduction numbers displayed in Table 3-6, Table 3-7, and Table 3-8 are derived for specific BMPs.

Urban Stormwater Management (SWM)

Existing Urban SWM Practices. As described in detail in Section 2.3.6 of the *Watershed Characterization Report* (Appendix E), there are 147 existing SWM facilities in Upper Jones Falls including detention ponds, infiltration/filtration practices and extended detention ponds. The pollutant loading analysis included in Appendix E did not account for the existing SWM practices in the watershed. The pollutant load reduction from existing SWM practices are taken into account as part of this analysis. All of the Upper Jones Falls facilities have had their drainage areas digitized, and therefore actual pollutant loads from the drainage areas can be modeled. Removal efficiencies used for all facilities are those in Table 3-3.

Stormwater Retrofits. Proposed stormwater retrofits for the purposes of this SWAP refer to implementing BMPs to capture and treat runoff from impervious surfaces (i.e., streets, parking lots) which are currently untreated. Sites were noted for retrofit potential during the upland surveys included the following number of sites and impervious acreage treated:

Table 3-4: Stormwater Retrofit Treated Area

Stormwater Retrofit	Number of sites	Area in acres
Bioretention	14	10.2
Grass Swale	4	2.6
Sand Filter	1	1.3
Permeable Pavement	1	0.5
Rainwater Harvesting	1	0.1
RSC	1	2.0

Pollutant reductions for stormwater retrofits are calculated based on the pollutant load generated from the impervious area and removal efficiency shown in Table 3-3.

Stream Corridor Restoration. Several potential stream restoration sites totaling 6,867 linear feet were identified during the stream corridor assessments. Pollutant reductions for stream corridor restoration are calculated based on the load reduction factors provided by CBP (Appendix C) multiplied by the linear feet of identified significant erosion, and channel alteration sites.

Urban Stream Buffer Reforestation. Pollutant reductions for stream buffer reforestation are calculated based on a land use conversion from pervious urban to forest plus an additional reduction efficiency based on BMP performance guidance from CBP (Appendix C). 588 acres were assessed for reforestation. The pollutant load for forested land is subtracted from the current urban pervious load to obtain the land use change reduction. A reduction efficiency of 25% for nitrogen, 50% for phosphorus and 60% for sediment yields the reduction efficiency estimates. The reduction efficiency and land use change numbers are then summed to achieve the total nutrient reduction estimate.

Institutional Tree Plantings. Tree planting opportunities were identified at many institutional sites. Pollutant reductions for pervious area reforestation are calculated based on a land use conversion from pervious urban to forest. Acreage was estimated based on the land available and a planting density of 200 trees/acre.

Urban Nutrient Management – Maryland Fertilizer Use Act of 2011. The state of Maryland passed the Maryland Fertilizer Use Act of 2011 (the Act) that took effect in October 2013. Load reductions were modeled with The Chesapeake Bay Program Urban Nutrient Management Expert Panel Report recommendations:

- TN reductions of 9 percent for commercial applicators of fertilizer
- TN reductions of 4.5 percent for "do-it yourself" fertilizer applicators
- 25% reduction for TP for urban nutrient management.

In Area G, this reduction will apply to an estimated 839.56 acres of managed turf areas, assumed as a 50/50 split between commercial and DIY applications. Pollutant reductions are calculated based on the urban pervious pollutant load multiplied by the acres of managed turf, then the pollutant reduction efficiency.

Agricultural Best Management Practices

As described in Section 2.3 of the *Watershed Characterization Report* (Appendix E), 15.1% of Upper Jones Falls consists of agricultural land use that includes cropland, pasture, orchards, or agricultural buildings. There is considerable acreage in Upper Jones Falls currently being treated by three agricultural BMPs. The information on the extent of treatment and type of BMP was provided by the Soil Conservation District staff. Pollution load reductions mandated from the 'agricultural sector' based on future implementation of agricultural BMPs will be coordinated between the Maryland Department of Agriculture, Baltimore County SCD and local farmers.

3.5.3 Overall Pollutant Load Reductions

For nitrogen, phosphorus, and sediment respectively, Table 3-6 through Table 3-8 present summaries of the maximum potential pollutant load reductions, the methods used to credit each BMP, pollutant removal efficiencies, number of BMPs available for restoration, and projected load reductions. The projected implementation of BMP restoration projects shown is as follows:

Table 3-5: Reduction per Pollutant

Pollutant	Total Load (lb.yr)	Load Reduction (lb/yr)	Percent Reduction
TN	180,201.6	7,799.80	4.33%
TP	6,074.6	964.4	15.88%
TSS	2,728,729.5	356,931.60	13.08%

Additional reductions in the Upper Jones Falls watershed may be achieved as pollutant removal efficiencies for BMPs are changed from those currently defined by the CBP (Appendix B). Further, TP load reductions may also be achieved through additional stream restoration projects in the subwatersheds not assessed as part of this SWAP or in the 1997 Water Quality Management Plan for the Upper Jones Falls subwatershed.

The Chesapeake Bay Program is continuously reviewing the types and removal efficiencies for BMPs that may result in new BMPs or changes in pollutant load reductions that may be achieved with existing BMPs. The restoration practices identified in the SWAP should be revisited and adapted based on this information. For example, this analysis does not include public education/outreach efforts (e.g. pet waste pick-up, and septic system maintenance) which may be considered in the future.

Table 3-6: Current and Projected Nitrogen Reductions due to BMPs

	BMP	How Credited	TN Efficiency	U nits available	Projected Participation	Max. Potential TN Load Reduction (lbs/yr)	Projected TN Load Reduction (lbs/yr)	TN remaining (lbs/yr)
			Restoration Options					
	Urban Nitrogen to be Removed to meet the Bay TMDL 32.2% Reduction							29,584.0
Existing Urban	Detention	Efficiency	5%	469.5 ac	N/A	308.7	308.7	29,275.30
Existing Urban	Extended Detention	Efficiency	20%	734.7 ac	N/A	1,932.30	1932.3	27,343.00
Existing Urban	Filtration	Efficiency	40%	120.2 ac	N/A	632.2	632.2	26,710.80
Existing Urban	Infiltration	Efficiency	80%	69.5 ac	N/A	731.1	731.1	25,979.70
Existing Urban	Proprietary	Efficiency	40%	1.1 ac	N/A	5.8	5.8	25,973.90
Existing Urban	Wet Ponds and Wetlands	Efficiency	20%	49.6 ac	N/A	130.4	130.4	25,843.50
	Agriculture Nitrogen to be Removed to meet the Bay TMDL 32.0% Reduction							14,749.2
Existing Agricultural	Residue and Tillage Management	Load Reduction Rate	7 (lbs/ac/yr)	37.5 ac	N/A	2.6	2.6	40,590.10
Existing Agricultural	Soil Conservation WQP	Load Reduction Rate	0.93 (lbs/ac/yr)	666 ac	N/A	619.4	619.4	39,970.70
Existing Agricultural	Nutrient Management	Load Reduction Rate	3.11 (lbs/ac/yr)	37.5 ac	N/A	116.6	116.6	39,854.10
Existing Agricultural	Streamside Fence (10'-34')	Load Reduction Rate	6.79 (lbs/ac/yr)	2.8 ac	N/A	19	19	39,835.10
	Projected Total Pounds Nitrogen Removed:					4,498.1		
Proposed Urban	Bioretention (no underdrain)	Efficiency	70%	10.2 ac	100%	124	124	39,711.10
Proposed Urban	Grass Swale	Efficiency	70%	2.6 ac	100%	31.6	31.6	39,679.50
Proposed Urban	Sand Filter	Efficiency	40%	1.3 ac	100%	9	9	39,670.50
Proposed Urban	Porous Pavement	Efficiency	80%	0.5 ac	100%	7	7	39,663.50
Proposed Urban	Rainwater Harvesting	Efficiency	100%	0.1 ac	100%	1.7	1.7	39,661.80
Proposed Urban	Regenerative Stormwater Conveyance (Dry)	Efficiency	50%	2 ac	100%	17.4	17.4	39,644.40
Proposed Urban	Stream Corridor Restoration	Load Reduction Rate	0.075 (lbs/ft/yr)	6867 ft	100%	515	515	39,129.40
Proposed Urban	Stream Buffer Reforestation	LU Conversion + Efficiency	8.78 (lbs/ac/yr) - 25.0%	587.7 ac	25%	7,168.50	1,792.10	37,337.30
Proposed Urban	Institutional Tree Planting	LU Conversion	8.78 (lbs/ft/yr)	13600 trees	25%	597	149.3	37,188.00
Proposed Urban	Maryland Fertilizer Use Act of 2011	Efficiency	Residenti al: 4.50% - Non-Residenti al: 9.00%	839.56 ac	100%	654.6	654.6	36,533.40
	Total Load Reduction (lbs/yr) :						7,799.80	
	Total Existing Annual Load (lbs/yr) :						180,201.60	
	Reduction Achieved :						4.33%	
	Percent of TMDL Goal Achieved						17.59%	

Table 3-7: Current and Projected Phosphorus Reductions due to BMPs

	BMP	How Credited	TP Efficiency	U nits available	Projected Participation	Max. Potential TP Load Reduction (lbs/yr)	Projected TP Load Reduction (lbs/yr)	TP remaining (lbs/yr)
			Restoration Options					0
	Urban Phosphorus to be Removed to meet the Bay TMDL 47.0% Reduction							1,467.6
Existing Urban	Detention	Efficiency	10%	469.5 ac	N/A	30.5	30.5	1,437.10
Existing Urban	Extended Detention	Efficiency	20%	734.7 ac	N/A	95.5	95.5	1,341.60
Existing Urban	Filtration	Efficiency	60%	120.2 ac	N/A	46.9	46.9	1,294.70
Existing Urban	Infiltration	Efficiency	85%	69.5 ac	N/A	38.4	38.4	1,256.30
Existing Urban	Proprietary	Efficiency	60%	1.1 ac	N/A	0.4	0.4	1,255.90
Existing Urban	Wet Ponds and Wetlands	Efficiency	45%	49.6 ac	N/A	14.5	14.5	1,241.40
	Agriculture Phosphorus to be Removed to meet the Bay TMDL 21.4% Reduction							604.8
Existing Agricultural	Residue and Tillage Management	Load Reduction Rate	18 (lbs/ac/yr)	37.5 ac	N/A	6.8	6.8	1,839.40
Existing Agricultural	Soil Conservation WQP	Load Reduction Rate	0.14 (lbs/ac/yr)	666 ac	N/A	93.2	93.2	1,746.20
Existing Agricultural	Nutrient Management	Load Reduction Rate	0.3 (lbs/ac/yr)	37.5 ac	N/A	11.3	11.3	1,734.90
Existing Agricultural	Streamside Fence (10'-34')	Load Reduction Rate	0.91 (lbs/ac/yr)	2.8 ac	N/A	2.5	2.5	1,732.40
	Projected Total Pounds Phosphorus Removed:					340.0		
Proposed Urban	Bioretention (no underdrain)	Efficiency	75%	10.2 ac	100%	11.6	11.6	1,720.80
Proposed Urban	Grass Swale	Efficiency	75%	2.6 ac	100%	2.9	2.9	1,717.90
Proposed Urban	Sand Filter	Efficiency	60%	1.3 ac	100%	1.2	1.2	1,716.70
Proposed Urban	Porous Pavement	Efficiency	80%	0.5 ac	100%	0.6	0.6	1,716.10
Proposed Urban	Rainwater Harvesting	Efficiency	100%	0.1 ac	100%	0.2	0.2	1,715.90
Proposed Urban	Regenerative Stormwater Conveyance (Dry)	Efficiency	50%	2 ac	100%	1.5	1.5	1,714.40
Proposed Urban	Stream Corridor Restoration	Load Reduction Rate	0.068 (lbs/ft/yr)	6867 ft	100%	467	467	1,247.40
Proposed Urban	Stream Buffer Reforestation	LU Conversion + Efficiency	0.26 (lbs/ac/yr) - 50.0%	587.7 ac	25%	288	72	1,175.40
Proposed Urban	Institutional Tree Planting	LU Conversion	0.26 (lbs/ft/yr)	13600 trees	25%	17.7	4.4	1,171.00
Proposed Urban	Maryland Fertilizer Use Act of 2011	Efficiency	25%	839.56 ac	100%	63	63	1,108.00
	Total Load Reduction (lbs/yr) :						964.4	
	Total Existing Annual Load (lbs/yr) :						6,074.60	
	Reduction Achieved :						15.88%	
	Percent of TMDL Goal Achieved						46.54%	

Table 3-8: Current and Projected Sediment Reductions due to BMPs

	BMP	How Credited	TSS Efficiency	U nits available	Projected Participation	Max. Potential TSS Load Reduction (lbs/yr)	Projected TSS Load Reduction (lbs/yr)
			Restoration Options				
Existing Urban	Detention	Efficiency	10%	469.5 ac	N/A	30.5	30.5
	Extended Detention	Efficiency	60%	734.7 ac	N/A	286.6	286.6
	Filtration	Efficiency	80%	120.2 ac	N/A	62.5	62.5
	Infiltration	Efficiency	95%	69.5 ac	N/A	42.9	42.9
	Proprietary	Efficiency	80%	1.1 ac	N/A	0.6	0.6
	Wet Ponds and Wetlands	Efficiency	60%	49.6 ac	N/A	19.3	19.3
Existing Agricultural	Residue and Tillage Management	Load Reduction Rate	31 (lbs/ac/yr)	37.5 ac	N/A	11.6	11.6
	Soil Conservation WQP	Load Reduction Rate	0 (lbs/ac/yr)	666 ac	N/A	0	0
	Nutrient Management	Load Reduction Rate	0 (lbs/ac/yr)	37.5 ac	N/A	0	0
	Streamside Fence (10'-34')	Load Reduction Rate	0 (lbs/ac/yr)	2.8 ac	N/A	0	0
	Projected Total Pounds Sediment Removed:					**454.0**	
Proposed Urban	Bioretention (no underdrain)	Efficiency	80%	10.2 ac	100%	7,902.20	7,902.20
	Grass Swale	Efficiency	80%	2.6 ac	100%	2,014.20	2,014.20
	Sand Filter	Efficiency	80%	1.3 ac	100%	1,007.10	1,007.10
	Porous Pavement	Efficiency	85%	0.5 ac	100%	411.6	411.6
	Rainwater Harvesting	Efficiency	100%	0.1 ac	100%	96.8	96.8
	Regenerative Stormwater Conveyance (Dry)	Efficiency	50%	2 ac	100%	968.4	968.4
	Stream Corridor Restoration	Load Reduction Rate	45 (lbs/ft/yr)	6867 ft	100%	309,015.00	309,015.00
	Stream Buffer Reforestation	LU Conversion + Efficiency	102.6 (lbs/ac/yr) - 60.0%	587.7 ac	25%	133,271.60	33,317.90
	Institutional Tree Planting	LU Conversion	102.6 (lbs/ft/yr)	13600 trees	25%	6,977.50	1,744.40
	Maryland Fertilizer Use Act of 2011	Efficiency	0%	839.56 ac	100%	0	0
	Total Load Reduction (lbs/yr) :						356,931.60
	Total Existing Annual Load (lbs/yr) :						2,728,729.50
	Reduction Achieved :						13.08%

As shown by the tables above, the actions recommended by this SWAP will not be sufficient to meet the reductions required by the Bay TMDL. The existing urban and agricultural measures, along with proposed urban measures reduced nitrogen by 17.59% and phosphorus by 46.54% of the total TMDL target.

To address the additional nutrient load reductions needed to meet the urban sector load reductions, additional stormwater retrofit opportunities will need to be identified. Table 3-6 and Table 3-7 shows that an additional 21,784.2 lbs of nitrogen (29,584 lb/yr urban sector required reduction minus 7,799.8 lbs/yr from proposed urban BMPs) and 503.2 lbs of phosphorus (1,467.6 lb/yr urban sector required reduction minus 964.4 lbs/yr from proposed urban BMPs) will need to be reduced to meet the urban sector Bay TMDL requirements. Using loading rates from Table 3-1 and bioretention efficiencies from Table 3-3, the following equation was used to determine that 1,793 acres of impervious area, or the equivalent thereof, would need to be retrofitted to meet the goal.

Load reduced = Acres Treated x Loading Rate x Efficiency or
Acres Treated = Load Reduced / (Loading Rate x Efficiency)

TN: Ac = 21,784.2 lb/yr / (17.36 lb/ac/yr x 70%) = 1,793 ac
TP: Ac = 503.2 lb/yr / (1.51 lb/ac/yr x 75%) = 444 ac

CHAPTER 4
Subwatershed Management Strategies

4.1 Introduction

This chapter describes the criteria and methodology used to rank the four subwatersheds within the Area G watershed based on restoration and protection potential. Although, restoration and protection actions will likely have to occur throughout the entire Area G in order to meet environmental goals and requirements, the subwatershed priority ranking provides a tool for targeting restoration and protection actions identified in Chapter 3 by subwatershed. This chapter also provides a summary for each subwatershed's characteristics, management strategies and implementation priorities. The recommendations were based on the county's 1997 Water Quality Management Plan, upland assessment data, available water quality and biological monitoring data, and agricultural data in the watershed. The restoration practices identified in Chapter 3 are also included in watershed-specific management strategies where a specific location (e.g. subwatershed) for the practice is identified to include for example stormwater retrofits, tree planting and stream restoration. Other restoration practices that are dispersed throughout the watershed are included in Appendix A as a general restoration action (e.g. Bayscaping, urban riparian buffer).

4.2 Subwatershed Prioritization

A ranking methodology was developed to prioritize subwatersheds in terms of restoration and protection need and potential. In general, a subwatershed is prioritized for restoration where the subwatersheds are based on the data and analysis that characterize their environmental quality. As such, restoration and protection opportunities may target specific factors within the subwatershed. The following restoration and protection ranking criteria are:

Restoration Ranking Criteria

- Total Nitrogen and Total Phosphorus Loads
- Biological Indicators
- Impervious Surfaces
- Institutional Site Investigation
- Neighborhood Restoration Opportunity/Pollution Severity

Protection Ranking Criteria

- Total Nitrogen and Total Phosphorus Loads
- Biological Indicators
- Impervious Surfaces
- Stream Buffer Improvement
- Agricultural Land

Restoration Ranking Criteria	*Protection Ranking Criteria*
Indices • Neighborhood Lawn Fertilization Reduction/Awareness • Stream Buffer Improvement • Septic Systems	

An ordinal ranking scale of 1 to 4 was used to prioritize the subwatersheds based on the lowest to highest score for each criterion, with the exception of the Neighborhood Source Area (NSA) restoration score. This approach to ranking was taken given the narrow range, or small numerical differences amongst the subwatersheds for many of the criteria. If there was no data available for a subwatershed, a ‘no data’ qualifier was added in the table and taken into consideration for the prioritization score and ranking. For instances where more than one subwatershed had the same value for a specific criterion, the same ordinal score was assigned. Ordinal scores were assigned in descending order.

4.2.1 Total Nitrogen and Total Phosphorus Loads

Annual total nitrogen and total phosphorus loads (lbs/year) were estimated for each subwatershed using land use-based loading rates defined by the Maryland Department of Environment (MDE) and the Chesapeake Bay Program (CBP). The pollutant loading analysis for the Area G watershed is explained in further detail in Appendix E, Chapter 3. A subwatershed loading rate (lb/acre/yr) for each nutrient was calculated from the total watershed load (lb/yr) and then divided by the subwatershed area. The subwatershed with the highest pollutant loading rate was assigned the lowest protection score (1) and the highest restoration score (4). Conversely, the subwatershed with the lowest pollutant loading rate was assigned the lowest restoration score (1) and the highest protection score (4). The results are shown in Table 4-1 with total nitrogen loading rates ranging from 12.1 to 17.0 lb/acre/year and 0.4 to 0.5 lb/acres/year for total phosphorus.

Table 4-1: Total Nitrogen and Total Phosphorus Loading Rate Scores

Subwatershed	Total Nitrogen Loading Rate (lbs/acre/year)	Total Nitrogen Restoration Load Score	Total Nitrogen Protection Load Score	Total Phosphorus Loading Rate (lbs/acre/year)	Total Phosphorus Restoration Load Score	Total Phosphorus Protection Load Score
Deep Run	14.2	3	2	0.4	1	2
Dipping Pond	12.1	1	4	0.4	1	2
Jones Falls	17.0	4	1	0.5	2	1
Jones Falls (North Branch)	13.7	2	3	0.5	2	1

4.2.2 Biological Indicators

The Fish Index of Biotic Integrity (FIBI) and a benthic Index of Biotic Integrity (BIBI) were used to rank the subwatersheds for priority restoration and protection. The scores for each of these indicators were determined on sampling data collected from Baltimore County Department of Environmental Protection and Sustainability (EPS) and Maryland Department of Natural Resources (MD DNR) Fish Maryland Biological Stream Survey (MBSS). Chapter 3 in Appendix E provides a detailed discussion of the data.

For each subwatershed, average FIBI and BIBI scores were calculated using the data provided by EPS and MD DNR MBSS. FIBI and BIBI scores range from good (4.0 – 5.0) denoting minimally impacted conditions to very poor (1.0 – 1.9) indicating severe degradation. For restoration prioritization, lower biological indicator scores are assigned higher restoration scores (4) to denote greater restoration need. In contrast, lower scores were given to a subwatershed with a high biological indicator score (1). For protection prioritization, higher scores are provided for subwatersheds with a high biological indicator score and lower scores are provided for subwatersheds with a low biological indicator score. The results are shown in Table 4-2.

Table 4-2: Fish and Benthic Indices Restoration and Protection Scores

Subwatershed	FIBI Average Score	FIBI Restoration Score	FIBI Protection Score	BIBI Average Score	BIBI Restoration Score	BIBI Protection Score
Deep Run	n/d	--	--	3.25	3	2
Dipping Pond	1.58	4	2	3.82	1	4
Jones Falls	3.00	2	4	2.94	4	1
Jones Falls (North Branch)	2.96	3	3	3.43	2	3

4.2.3 Impervious Surfaces

The level of impervious cover of 9.0% in the Area G subwatershed suggests the watershed may be characterized as a ‘sensitive’ watershed. Sensitive watersheds have typically high quality streams with stable channels, good habitat conditions and good water quality according to the Impervious Cover Model described by Schueler et al (2009). The estimate of impervious cover for each subwatershed was based on data provided by Baltimore County that identifies roads, buildings and parking lots. Overall, all of the subwatersheds have very low impervious cover ranging from 6.5 to 11.4% (Table 4-3). However, research has found that Native Brook Trout and Brown Trout populations decline at two percent and four percent impervious cover, respectively (MD DNR 1999) and the stream corridor assessment shows areas of severe erosion within the assessed subwatersheds of Deep Run and Dipping Pond Run.

Table 4-3: Percent Impervious Surface Restoration and Protection Scores

Subwatershed	Total Area (acres)	Roads (acres)	Buildings (acres)	Total Impervious Area (acres)	% Impervious	% Impervious Restoration Score	% Impervious Protection Score
Deep Run	1,436.8	101.1	45.4	146.5	10.2	3	2
Dipping Pond	1,758.4	84.8	38.4	123.2	7.0	2	3
Jones Falls	5,447.4	417.6	203.6	621.2	11.4	4	1
Jones Falls (North Branch)	4,544.8	197.1	98.2	295.3	6.5	1	4

4.2.4 Neighborhood Restoration Opportunity/Pollution Severity Indices

A total of 60 neighborhoods were ranked and identified with the subwatershed in which the majority of its area was located. Chapter 4 in Appendix E rated each neighborhood with a Pollution Severity Index (PSI) of high, moderate, or low and a Restoration Opportunity Index (ROI) of high, moderate or low.

Restoration prioritization was rated based on the subwatersheds that had the most number of neighborhoods with high PSI and highest ROI. The highest score (4 points) was given to the subwatershed with one or more neighborhoods with both a high PSI and ROI and the most neighborhoods with a high PSI and moderate ROI score. The second highest score (3 points) was given to the subwatershed with the most neighborhoods with a moderate PSI and a moderate ROI. The third highest score (2 points) was given to the subwatershed with four or more neighborhoods with both a moderate PSI and a moderate ROI. The remaining subwatershed was assigned the lowest possible score (1 point). The results of the NSA restoration ranking scores are shown in Table 4-4.

Table 4-4: NSA PSI/ROI Restoration Scores

Subwatershed	Number of Neighborhoods for PSI/ROI Ratings								NSA PSI/ROI Restoration Score
	High/ High	High/ Moderate	High/ Low	Moderate /High	Moderate/ Moderate	Moderate /Low	Low/ Moderate	Low/ Low	
Deep Run	3	4	0	0	5	5	0	0	2
Dipping Pond	2	3	0	0	5	5	0	0	1
Jones Falls	6	20	0	4	12	15	5	11	4
Jones Falls (North Branch)	3	6	0	0	17	4	2	4	3

4.2.5 Neighborhood Lawn Fertilizer Reduction/Awareness

Residential lawns were assessed as part of the SWAP using visual survey methods described in Chapter 4 in Appendix E. A lawn was designated as high maintenance if it had dense, uniform grass cover or signs designating pesticide/fertilizer lawn care applications. These high maintenance lawns were indicators of nutrient pollution originating from lawn fertilizer. Neighborhoods where 20 percent or more of the homes appeared to employ high lawn maintenance practices were recommended for fertilizer reduction/education during the NSAs. This criterion was issued for subwatershed restoration prioritization because a reduction in nutrient loading may be achieved through urban nutrient management practices as credited by the Chesapeake Bay Program and the TMDL. In addition, this criterion is the major restoration practice that was identified during the neighborhood assessments. Protection prioritization was not rated for this criterion because neighborhood lawn fertilizer reduction/awareness activities do not provide protection potential.

The ranking for this criterion is based on the acres of high maintenance lawns within the subwatershed. The acreage of lawns is expressed as a percentage of the total subwatershed area in Table 4-5. Subwatersheds with the greatest percentage of high maintenance lawns received the greatest restoration potential score (e.g. 4). Overall, the percentages of subwatershed area addressed through lawn fertilizer reduction were all below 12 percent.

Table 4-5: Neighborhood Lawn Fertilizer Reduction/Awareness Restoration Scores

Subwatershed	% of Subwatershed Addressed	NSA Lawn Fertilizer Reduction Restoration Score
Deep Run	11.7%	4
Dipping Pond	6.1%	2
Jones Falls	6.6%	3
Jones Falls (North Branch)	4.5%	1

4.2.6 Institutional Site Investigation

A total of 25 institutional sites were assessed in Area G; 11 faith-based institutions (three of which also have schools), seven schools, three golf courses, two state road maintenance facilities, one meeting hall, and one college. Typically, institutional properties offer restoration opportunities to engage citizens in watershed stewardship and have large parcels of undeveloped land that may be considered for stormwater retrofits or tree planting, for example. The ranking of institutional sites was based on the total land area of these sites within a subwatershed. A higher restoration score was assigned with the more institutional land within a subwatershed. The highest score was given to Jones Falls as this subwatershed has 542.96 acres of institutional land area, whereas Dipping Pond had 159.49 acres of institutional land and received the lowest score of one. Protection prioritization was not rated for this criterion because the institutional site investigation doesn't provide protection potential. The results are summarized in Table 4-6.

Table 4-6: Institutional Site Restoration Scores

Subwatershed	ISI Acres	ISI Restoration Score
Deep Run	233.02	2
Dipping Pond	159.49	1
Jones Falls	542.96	4
Jones Falls (North Branch)	461.34	3

4.2.7 Stream Buffer Improvements

A stream buffer is defined as the 100 feet adjacent to either side of a stream channel. The condition of the stream buffer was classified into three categories based on its type of vegetative cover to include: forests, impervious and open pervious. Using Geographic Information Systems (GIS), impervious areas were determined by calculating the area of roads and buildings within the 100-foot stream buffer. The area of forest land cover within the stream buffer was determined using the forested GIS layer and removing any impervious area footprint. The remaining areas within the 100-foot stream buffer were classified as open pervious area. Open pervious areas (e.g., mowed lawns) represent the greatest potential for stream buffer reforestation. Therefore, the percentages of open pervious buffer area were used to prioritize restoration potential among subwatersheds. Subwatersheds with greater percentages of open pervious buffer areas denote the greatest potential for stream buffer improvement and were scored the highest for restoration prioritization. Subwatersheds with lower percentages of open pervious buffer areas have a higher percentage of forested buffer that are key areas for protection and are scored highest for protection prioritization. Jones Falls received the highest buffer restoration score, whereas Dipping Pond had the highest protection score. The absolute area available for reforestation ranged from 89.9 to 556.6 acres as shown in Table 4-7.

Table 4-7: Stream Buffer Improvement Score

	Forested		Impervious		Open Pervious		Stream Buffer Improvement Restoration Score	Stream Buffer Improvement Protection Score
Subwatershed	Acres	%	Acres	%	Acres	%		
Deep Run	159.4	60.4	9.9	3.8	89.9	34.1	2	3
Dipping Pond	204.8	66.8	8.5	2.8	94.6	30.8	1	4
Jones Falls	431.5	41.1	14.6	1.4	556.6	53.0	4	1
Jones Falls (North Branch)	462.6	58.3	1.5	0.2	313.0	39.5	3	2

4.2.8 Septic Systems

According to Baltimore County Bay Restoration Fund tracking, there are approximately 1,061 septic systems in the Area G watershed. Nutrient and pathogens can be a source of pollutants if septic systems are not functioning properly. Subwatersheds with a greater number of septic systems have the greatest potential to be a nutrient and pathogenic pollutant source and were assigned a high restoration score. The number of septic systems in each subwatershed and septic system restoration score are provided in Table 4-8.

Table 4-8: Septic System Restoration Scores

Subwatershed	Number of Septic Systems	Septic System Restoration Score
Deep Run	99	1
Dipping Pond	166	2
Jones Falls	454	4
Jones Falls (North Branch)	342	3

4.2.9 Agricultural Land

Agricultural land uses including agricultural facilities, cropland, orchards, and pasture occupy 15.1% of the land area in Area G. The ranking criterion for agricultural land is based on the amount of land in conservation easements. Conservation easements relevant to Area G agricultural land include properties under the following programs: Maryland Environmental Trust, Local Land Trusts, and Maryland Agricultural Land Preservation Foundation. Conservation easements protect significant natural resources on a property from development. A property owner maintains ownership of the land and may receive income, or estate and property tax benefits for the land area in a conservation easement. The acres of agricultural land without an easement and the protection score for each subwatershed is provided in Table 4-9.

Table 4-9: Agricultural Land Protection Scores

Subwatershed	Acres of Agriculture	Percent of Agriculture in easement	Percent of Agriculture not in easement	Agricultural Land Protection Score
Deep Run	93.20	51.97	48.03	2
Dipping Pond	298.45	40.49	59.51	3
Jones Falls	692.19	24.40	75.60	4
Jones Falls (North Branch)	904.69	80.18	19.82	1

4.2.10 Subwatershed Restoration and Protection Prioritization Summary

The four subwatersheds within Area G are ranked according to the total restoration and protection prioritization score (i.e., the sum of prioritization criterion scores). Subwatershed ranking results for restoration and protection are summarized in Table 4-10 and Table 4-11 respectively including criterion scores, total scores and rankings. Table 4-12 provides a summary of the restoration and protection prioritization for each subwatershed.

Restoration Prioritization

The four subwatersheds within Area G are ranked according to the total restoration prioritization scores. The total scores were adjusted to account for criteria not ranked for the subwatershed due to data availability. For example, if all of the ten criteria for restoration were ranked for a subwatershed, the total possible score was 40 points. In Deep Run, there were no data available to rank the Fish index of biological indicator and consequently, the total possible score for this subwatershed was 36. As a result, the ranking is based on the total possible score for each subwatershed. The subwatershed with the highest scores was assigned a high rank, the lowest scores a low rank, and the remaining two scores a moderate rank. Table 4-10 provides the scores for each criteria, total scores and ranking for restoration and protection, respectively. The Jones Falls (mainstem) scored the highest for restoration and is the best target for restoration. Deep Run and Jones Falls (North Branch) both were ranked as moderate priority subwatersheds. Dipping Pond Run scored the lowest for restoration overall.

Table 4-10: Subwatershed Restoration Ranking Results

Subwatershed	Total Nitrogen Load	Total Phosphorus Load	Fish IBI	Biological IBI	Impervious Surfaces	NSA PSI/ROI	NSA Lawn Fertilizer Reduction	ISI Site Investigation	Stream Buffer Improvement	Septic Systems	TOTAL SCORE	NORMALIZED SCORE	SUBWATERSHED RANK
Deep Run	3	1	n/d	3	3	2	4	2	2	1	21	**58**	**Moderate**
Dipping Pond	1	1	4	1	2	1	2	1	1	2	16	**40**	**Low**
Jones Falls	4	2	2	4	4	4	3	4	4	4	35	**88**	**High**
Jones Falls (North Branch)	2	2	3	2	1	3	1	3	3	3	23	**58**	**Moderate**

Protection Prioritization

Subwatersheds were placed into one of three protection priority categories, high, moderate and low, based on ranking results. The total scores were adjusted to account for criteria not ranked for the subwatershed due to data availability. For example, if all of the four criteria for protection were ranked for a subwatershed, the total possible score was 40 points. In Deep Run, there was no data available to rank the fish index of biological indicator and the total possible score for this subwatershed was 24 points. As a result, the ranking is based on the total possible score for each watershed. The highest scores was assigned a high rank, the lowest scores a low rank, and the remaining two scores a moderate rank. These results are summarized in Table 4-11 and Table 4-12 and illustrated in Figure 4-1. Dipping Pond Run subwatershed scored the highest and is the best targets for protecting water quality in the watershed. Deep Run and Jones Falls (North Branch) were both ranked as moderate priority subwatersheds. Jones Falls (mainstem) scored the lowest for protection overall.

Table 4-11: Subwatershed Protection Ranking Results

Subwatershed	Total Nitrogen Load	Total Phosphorus Load	Fish IBI	Biological IBI	Impervious Surfaces	Stream Buffer Improvement	Agricultural Land	TOTAL SCORE	NORMALIZED SCORE	SUBWATERSHED RANK
Deep Run	2	2	n/d	2	2	3	2	13	**54**	**Moderate**
Dipping Pond	4	2	2	4	3	4	3	22	**79**	**High**
Jones Falls	1	1	4	1	1	1	4	13	**46**	**Low**
Jones Falls (North Branch)	3	1	3	3	4	2	1	17	**61**	**Moderate**

Table 4-12: Subwatershed Restoration and Protection Prioritization

Subwatershed	Total Normalized Restoration Score	Restoration Prioritization Category	Total Normalized Protection Score	Protection Prioritization Category
Deep Run	**58**	**Moderate**	**54**	**Moderate**
Dipping Pond	**40**	**Low**	**79**	**High**
Jones Falls	**88**	**High**	**46**	**Low**
Jones Falls (North Branch)	**58**	**Moderate**	**61**	**Moderate**

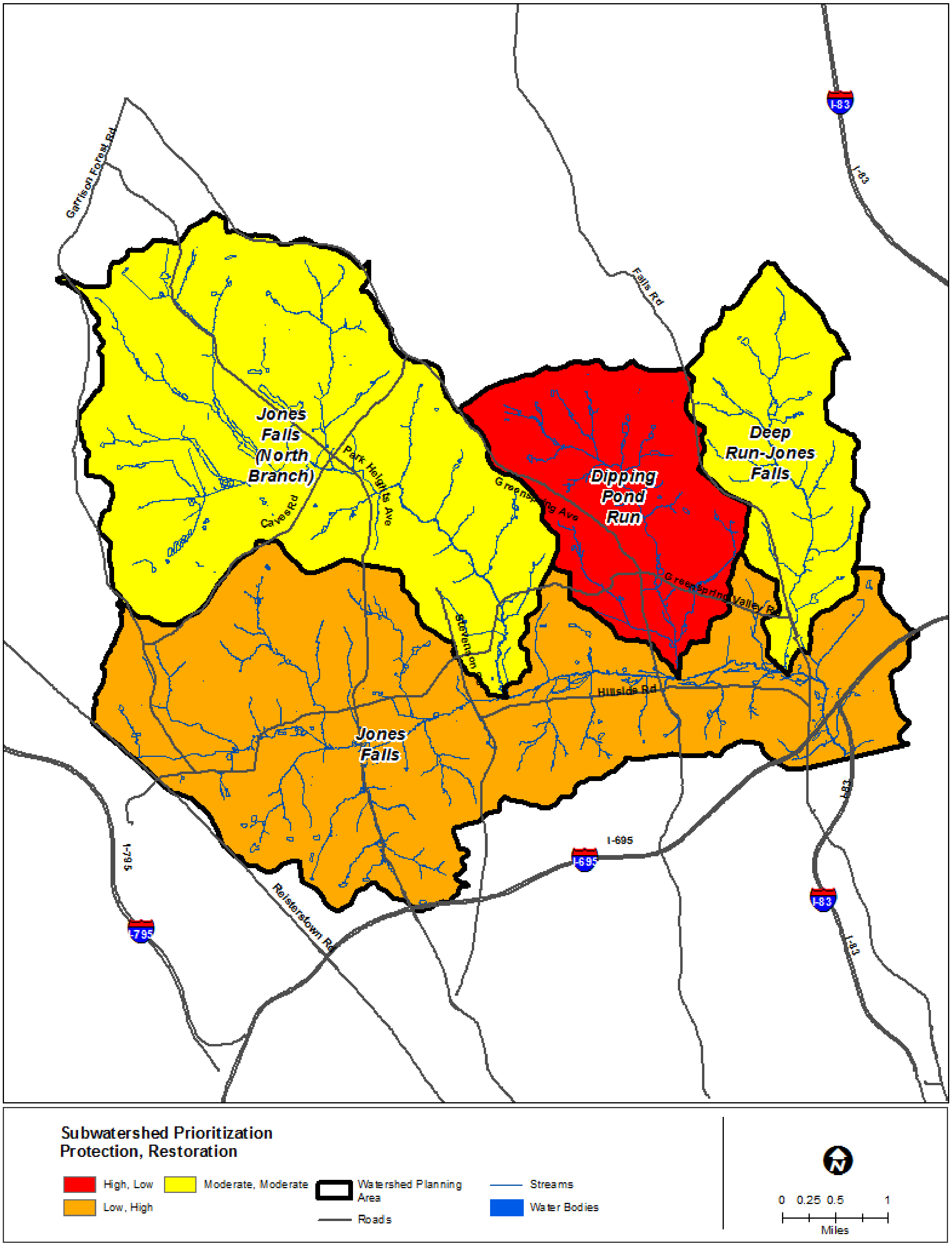

Figure 4-1: Subwatershed Protection and Restoration Priority Ranking

4.3 Subwatershed Restoration and Protection Strategies

Restoration and protection management strategies for each subwatershed are presented in the following subsections. The strategies are based on strategies presented in Chapter 3 and site specific actions. Appendix A presents measurable actions that correspond to each strategy and the goals and objectives described in Chapter 2. This section includes the results of the stream assessment and upland assessments (see Chapter 3 in Appendix E) and available agricultural data. For each subwatershed, key characteristics are presented that include drainage area, stream length, total population, land use/land cover, land in easement, impervious cover, hydrologic soil group, stormwater management (SWM) facilities and restoration and protection priority ranking. A summary of assessment results for neighborhoods, hotspots, institutions, stream corridors and stormwater conversions are provided for each subwatershed. Finally, a subwatershed management strategy including recommended citizen and municipal actions are presented at the end of each section.

4.3.1 Deep Run – Jones Falls

Deep Run is the smallest subwatershed within the Area G drainage area, having an area of just over two square miles (1,436.8 acres). The existing land use consists primarily of low density residential, forest, and open urban land uses. The majority of the development occurred from the 1950s through 2010, with a major boom in the 1980s. Over half (53.9%) of the land area is low/very low density residential and 6.5% percent is agriculture. Just over 100 acres, or seven percent, are in conservation easements with 48.4 acres of agricultural land in conservation easement in the watershed. Table 4-13 summarizes the key subwatershed characteristics of Deep Run.

Table 4-13: Deep Run Subwatershed Key Characteristics

Drainage Area	1,436.8 acres (2.2 mi^2)	
Stream Length	10 miles	
Total Population	1,373.7 (2010 Census) 1.0 people/acre	
Land Use/Land Cover	Very Low Density Residential (Agriculture):	0.9%
	Very Low Density Residential (Forested):	9.2%
	Low Density Residential:	44.7%
	Medium Density Residential:	1.2%
	High Density Residential:	2.3%

	Commercial:	6.0%
	Institutional:	2.0%
	Open Urban Land:	12.7%
	Agriculture (Cropland, Orchards, Pasture):	6.5%
	Forest:	14.6%
	Wetlands:	0.0%
Land in Easement	Total: 103 acres (7.2%) Agriculture: 48.53 acres (51.97%)	
Impervious Cover	10.2% of Subwatershed	
Hydrologic Soil Group	A soils (low runoff potential): B soils: C soils: D soils (high runoff potential):	2.3% 70.1% 22.2% 4.7%
SWM Facilities	29 Facilities 16.9% of urban land use treated	
Restoration/Protection Priority Rating	Moderate/Moderate	

Neighborhood Source Assessment

A total of 7 distinct neighborhoods were identified and assessed within the Deep Run subwatershed during the uplands assessment of Area G. Characteristics such as lot size, age, and type of development were used to delineate neighborhoods rather than subwatershed boundaries. Recommendations for addressing stormwater volume and pollutants within this subwatershed include rain gardens, rain barrels, downspout disconnection, fertilizer reduction, storm drain marking, and lot canopy improvements. The results of the Neighborhood Source Assessment (NSA) are presented in Table 4-14.

Table 4-14: Actions identified for neighborhoods in Deep Run

Site ID	Lot Size (acres)	Rain Garden/Rain Barrels/Downspout Disconnection	Storm Drain Marking	Bayscape	Fertilizer Reduction	Lot Canopy
NSA_G_101	>1	X			X	X
NSA_G_102	>1	X	X		X	
NSA_G_108A	<1/4	X	X		X	X
NSA_G_122	>1	X				X
NSA_G_123	1/2, 1, >1	X	X		X	
NSA_G_124	>1				X	
NSA_G_125	>1				X	

Six of the seven neighborhoods are identified for fertilizer reduction. Five neighborhoods were identified for rain gardens, rain barrels, and/or downspout disconnection. Three were identified for storm drain marking and three for lot canopy improvements. Figure 4-2 shows a neighborhood (NSA_G_101) that may be suitable for downspout disconnections, rain gardens, fertilizer reduction, and storm drain marking.

Figure 4-2: Neighborhood NSA_G_101, with potential rain garden site shown in Left photo

Hotspot Site Investigation

Nearly half of all the hotspot sites investigated in Area G were located in the Deep Run subwatershed. A total of eight sites – all commercial sites of different types – were assessed for the Hotspot Site Investigation (HSI) in the Deep Run subwatershed. Upon completion of the HSI, four were confirmed as hotspots (though none severe), three were characterized as potential hotspots, and one was not a hotspot. The sites assessed in the field included real estate offices, sports clubs, restaurants, a shopping center, and a gas station. Waste management, turf fertilization, and lack of stormwater management may pose a pollution concern at these sites. Specific remediation actions identified for the confirmed and potential hotspots are summarized in Table 4-15.

Table 4-15: Recommended Actions for Hotspots Identified in Deep Run

		Recommended Actions					
Site ID	**Type**	**Refer for Enforcement**	**Follow-Up Inspection**	**Test for Illicit Discharge**	**Education**	**On-site Retrofit**	**Review Pollution Plan**
HSI_G_103	Country Club		X		X		
HSI_G_107A	Tennis Club	X	X				
HSI_G_108	Chinese Restaurant & Adjacent Lot						
HSI_G_109	Real Estate Office						
HSI_G_110A	Shopping Center/ Mixed Use		X				
HSI_G_110B	Restaurant/ Mixed Use	X					
HSI_G_111	Gas Station	X	X	X			

The most prominent potential pollution source at the HSI sites was condition of the dumpster, lacking a lid and/or with trash next it. This can cause trash and contaminated liquids to get into stormwater runoff. Figure 4-3 shows an example of this type of situation.

Figure 4-3: Uncovered dumpsters in Deep Run subwatershed

Institutional Site Investigation

Three institutional sites in the Deep Run subwatershed were preselected for the field teams to conduct an Institutional Site Investigation (ISI) – a school, a church, and a golf course. A total of 1345 trees are recommended for planting at the school and 797 at the golf course to improve the stream buffer. The golf course is also a good candidate for storm drain marking. The church site has potential for storm drain marking and a stormwater retrofit of an existing dry pond. The actions identified for these institutional sites are summarized in Table 4-16.

Table 4-16: Identified Actions for the Institutional Sites in Deep Run

Site ID	Type	Identified Actions					
		Tree Planting	Stormwater Retrofit	Downspout Disconnection	Trash Mgmt.	Storm Drain Marking	Stream Buffer Improv.
ISI_G_111	School- HS, MS, Elementary	1345					
ISI_G_112	Church/Faith-Based	0	X			X	
ISI_G_113	Golf Course	797				X	X

Pervious Area Assessment

No additional pervious areas were assessed for this subwatershed.

Stream Corridor Assessment

During the 2014 stream corridor assessment (SCA), approximately 7 miles of stream were surveyed in the Deep Run subwatershed (78% of total stream miles in Deep Run). Areas of streambank erosion were the most commonly identified problem, followed by fish migration blockages and inadequate riparian buffer. The stabilization of streambanks can provide benefits to overall stream health by reducing nutrient and sediment loads and improving habitat for aquatic biota. Although the SCA highlights significant areas of erosion observed in 2014, the entire stream assessment data set should be considered when watershed management and implementation activities are being prioritized for the Deep Run subwatershed. Individual findings are discussed in Appendix E (Section 3.5) and complete SCA data tables are provided in Appendix F.

The significant erosion areas represent streams where moderate to severe erosion and unstable channel conditions are concentrated based on the SCA surveys. Including lower severity erosion sites that were interspersed with more significant erosion, approximately 29% of the total erosion length noted in Deep Run was located in five clusters (stream restoration areas I to M). The restoration areas are ranked according to the square feet of erosion calculated from the length of erosion times the average bank height of the channel at the problem location.

Table 4-17 shows the ranking of potential stream restoration areas identified in the Deep Run subwatershed. Figure 4-4 illustrates examples of severe and moderate severity erosion sites found in the Deep Run subwatershed during the SCA.

Table 4-17: Ranking of Potential Stream Restoration Area in Deep Run

Stream Restoration Area Ranking	Stream Restoration Area ID	Total Erosion Length (ft)	Erosion Area (sf)
1	J	914	3,737
2	L	571	1,791
3	K	298	1,652
4	M	376	1,377
5	I	176	702

Figure 4-4: Severe and moderate severity erosion sites identified in Deep Run

Stream restoration Area J ranked the highest when factoring the square feet of potential erosion calculated for the five areas. Area J represents one incising first-order tributary and nearby erosion on the mainstem of Deep Run. All erosion noted in this area was ranked either low severity or moderate (on a scale of minor, low severity, moderate, severe, very severe), but was noted as a potential restoration area due to an overall downcutting condition. Area L ranked second for potential erosion area. This section of the mainstem of Deep Run travels through a mowed utility right-of-way for approximately 1,500 feet and has several areas of low to moderate severity erosion on the outside of meander bends. The lack of deep roots in this area is likely contributing to the rate of bank erosion in Area L. Area K is associated with isolated areas of erosion downstream of outfalls at the heads of two streams. Area M has erosion at meander bends in conjunction with mowing to the top of the bank on one side of the stream. Area I ranked the lowest, but represents an opportunity to provide fish passage and remediate erosion at a dam below a large pond. These potential stream restoration areas should also consider the other problems identified and documented during the SCA surveys, such as pipe outfalls, fish migration barriers, and opportunities to enhance riparian buffers.

Subwatershed Management Strategy

Restoration and protection strategies are outlined below.

Engaging Citizens & Watershed Groups

1. Encourage citizens to reduce fertilizer use to maintain healthy turfgrass.
2. Promote new tree planting and maintain existing forests in the 100-ft stream buffers.
3. Inform citizens on the importance of septic system maintenance.
4. Engage property owners in downspout disconnection onto adjacent pervious surfaces or into retrofitted rain barrels or rain gardens.

Municipal Actions

3. Coordinate efforts with University of Maryland Extension outreach efforts to inform residents about proper fertilizer use and requirements of the 2013 Fertilizer Use Act
4. Identify opportunities to partner with local organizations to assist with outreach efforts and to focus on organizations with an existing rain barrel or rain garden program/initiative.
5. Evaluate stream restoration projects to stabilize stream channels for priority sites.
6. Investigate stormwater retrofit opportunities within headwater or first order tributaries to include two bioretention practices in ISI_G_101 and ISI_G_102, along with the installation of a cistern at ISI_G_102.
7. Work with property owners at institutional sites ISI_G_111 (school) and ISI_G_113 (golf course) to identify options for tree planting.
8. Provide homeowners with access to deer management and deer resistant landscaping information.

4.3.2 Dipping Pond Run

Dipping Pond Run subwatershed has an area of 1,758.4 acres, or just under three square miles (2.8 mi^2). The existing land use consists primarily of low density residential, forest, and agriculture land uses. Development peaked in the 1990s, with a previous surge in the 1950s. Nearly half (46.1%) of the land area is residential and 24% is forested. Over 330 acres, or nineteen percent, are within conservation easements with 40.49 acres of agricultural land in conservation easement in the watershed. Table 4-18 summarizes the key subwatershed characteristics of Dipping Pond Run.

Table 4-18: Dipping Pond Run Subwatershed Key Characteristics

Drainage Area	1,758.4 acres (2.8 mi^2)	
Stream Length	13.2 miles	
Total Population	1,045.1 (2010 Census) 0.6 people/acre	
Land Use/Land Cover	Very Low Density Residential (Agriculture):	5.1%
	Very Low Density Residential (Forested):	5.4%
	Low Density Residential:	35.6%
	Medium Density Residential:	0.0%
	Commercial:	0.0%
	Institutional:	2.6%
	Open Urban Land:	10.2%
	Agriculture (Cropland, Orchard, Pasture):	16.2%
	Forest:	24.1%
	Wetlands:	0.0%
Land in Easement	Total: 333.4 acres (19.0%) Agricultural: 121.02 acres (40.49%)	
Impervious Cover	7.0% per Subwatershed	
Hydrologic Soil Group	A soils (low runoff potential): B soils: C soils: D soils (high runoff potential):	0.0% 63.3% 35.8% 0.7%
SWM Facilities	10 Facilities 5.5% of urban land use treated	
Restoration/Protection Priority Rating	High/High	

Neighborhood Source Assessment

A total of six distinct neighborhoods were identified and assessed within the Dipping Pond Run subwatershed during the uplands assessment of Area G. Recommendations for addressing stormwater volume and pollutants within this subwatershed include fertilizer reduction, lot canopy improvements, rain gardens, downspout disconnection and storm drain marking. The results of the Neighborhood Source Assessment (NSA) are presented in Table 4-19.

Table 4-19: Actions identified for neighborhoods in Dipping Pond Run.

Site ID	Lot Size (acres)	Rain Garden/Rain Barrels/Downspout Disconnection	Storm Drain Marking	Bayscape	Fertilizer Reduction	Lot Canopy
NSA_G_203	>1	X	X		X	X
NSA_G_204	>1	X	X		X	
NSA_G_230	>1	X	X		X	X
NSA_G_231	1	X			X	X
NSA_G_255	>1				X	X
NSA_G_256	>1				X	X

Each of the six neighborhoods is identified for fertilizer reduction; five neighborhoods are identified for lot canopy improvements; four may be candidates for rain gardens and/or downspout disconnection; and three can benefit from storm drain marking. Figure 4-5 illustrates two typical yards in Dipping Pond Run, contrasting residential lots with turfgrass and forested land cover.

 

Figure 4-5: Roof drain connected to storm drain system (left photo); and fertilized turfgrass lawn (right photo) in Dipping Pond Run subwatershed neighborhood (NSA_G_03)

Hotspot Site Investigation

No hotspots were investigated in this subwatershed.

Institutional Site Investigation

Three institutional sites (two faith-based institutions and a school) were preselected in the Dipping Pond Run subwatershed for the field teams to conduct an ISI. Results of the investigations show that the two faith-based properties would benefit from tree planting. A total of 480 trees are recommended for planting at ISI_G_205 and 52 are recommended at ISI_G_208. One site is a candidate for downspout disconnection. The school (ISI_G_209) could be a site for a stormwater retrofit adjacent to a parking lot and one of the churches (ISI_G_208) could have a retrofit next to the driveway. The actions identified for these institutional sites are summarized in Table 4-20.

Table 4-20: Identified Actions for the Institutional Site in Dipping Pond Run

		Identified Actions					
Site ID	Type	Tree Planting	Stormwater Retrofit	Downspout Disconnection	Trash Mgmt.	Storm Drain Marking	Stream Buffer Improv.
ISI_G_205	Church/Faith-Based	480		X			
ISI_G_208	Church/Faith-Based	52	X				
ISI_G_209	School- HS, MS, Elementary	0	X				

Pervious Area Assessment

No additional pervious areas were assessed for this subwatershed.

Stream Corridor Assessment

During the 2014 stream corridor assessment, 7.5 miles of stream were surveyed in the Dipping Pond Run subwatershed (63% of total stream miles in Dipping Run). Areas of streambank erosion were the most commonly identified problem, followed by inadequate riparian buffers and unusual conditions. Several of the most severe unusual conditions were headcuts associated with erosion of the channel bed. The stabilization of streambed and banks can provide benefits to overall stream health by reducing nutrient and sediment loads and improving habitat for aquatic biota. Although the SCA highlights significant areas of erosion observed in 2014, the entire stream assessment data set should be considered when watershed management and implementation activities are being prioritized for the Dipping Pond Run subwatershed. Individual findings are discussed in Appendix E (Section 3.5) and complete SCA data tables are provided in Appendix F.

The significant erosion areas represent streams where moderate to severe erosion and unstable channel conditions are concentrated based on the assessments conducted during the SCA surveys. Including lower severity erosion sites that were interspersed with more significant erosion, approximately 49% of the total erosion length noted in Dipping Pond Run, consisting of the more severe cases, was located in eight clusters (stream restoration areas A to H). The restoration areas are ranked according to the square feet of erosion calculated from the length of erosion times the average bank height of the channel at the problem location.

Table 4-21 shows the ranking of potential stream restoration areas identified in the Dipping Pond Run subwatershed. Figure 4-6 illustrates examples of severe and moderate severity erosion sites found in the Dipping Pond Run subwatershed during the SCA.

Table 4-21: Ranking of Potential Stream Restoration Areas in Dipping Pond Run

Stream Restoration Area Ranking	Stream Restoration Area ID	Total Erosion Length (ft)	Erosion Area (sf)
1	G	998	3,547
2	B	729	3,444
3	H	720	2,705
4	C	497	2,258
5	A	513	2,095
6	F	492	2,053
7	E	425	1,909
8	D	158	761

Area G ranked the highest for potential stream restoration area in Dipping Pond Run. Along the mainstem and a tributary from the west, the stream banks had tall grasses with sparse trees. Both segments are incised and the mainstem appears to be actively widening. These reaches currently have moderate and low severity erosion and represent an opportunity for floodplain reconnection. Area B ranked second highest and is incised and actively widening, particularly downstream of the culvert at Woodland Drive. Several homeowners mow to the top of bank in Area B. The third ranked potential stream restoration area was Area H, located just upstream of the confluence with Jones Falls. This area has actively eroding meanders and is mostly forested with some areas of agriculture on the right bank. Areas C, A, F, and E represent additional reaches where meander bends are actively eroding, leaving tall, raw streambanks. Area D represents a localized potential project just downstream of two outfalls on the property of St. Paul's School. These potential stream restoration areas should also consider the other problems identified and documented during the SCA surveys, such as exposed pipes, fish migration barriers, and opportunities to enhance riparian buffers.

Figure 4-6: Severe and moderate severity erosion sites identified in dipping Pond Run

Subwatershed Management Strategy

Restoration and protection strategies are outlined below.

<u>Engaging Citizens & Watershed Groups</u>

1. Promote awareness of the benefits of proper lawn care in the neighborhoods
2. Increase homeowner awareness of tree planting opportunities with a focus on buffer management in regulated areas (easements) to increase native plants to include woody vegetation and removal of invasive vegetation.
3. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-19.
4. Inform citizens on the importance of septic system maintenance.
5. Engage property owners in downspout disconnection onto adjacent pervious surfaces or into retrofitted rain barrels or rain gardens.

Municipal Actions

6. Investigate stormwater retrofit opportunities within headwater or first order tributaries to include a step pool conveyance (regenerative stormwater conveyance) at ISI_G_09 near a large parking lot and a bioretention at ISI_G_202
7. Work with property owners at faith-based institutional sites ISI_G_205 and ISI_G_208 to identify options for tree planting
8. Work with natural resource and conservation agencies and agricultural land owners to enhance forested stream buffers
9. Investigate stream restoration potential at the three priority sites G and H (Greenspring Ave), and B (Woodland Drive).
10. Provide homeowners with access to deer management and deer resistant landscaping information.

4.3.3 Jones Falls

Jones Falls is the largest subwatershed within the Area G drainage area, having an area of 8.5 square miles. The existing land use consists primarily of low density residential, forest, and agriculture. Development increase dramatically in the 1950s and peaked in the 1990s. Over 58% of the land area is residential, while 15% and 12% is forest and agriculture, respectively. A total of 820 acres (15% of the subwatershed) are protected under conservation easements, with 170.14 acres of agricultural land in conservation easement in the watershed. Table 4-22 summarizes the key subwatershed characteristics of Jones Falls.

Table 4-22: Jones Falls Subwatershed Key Characteristics

Drainage Area	5,447.4 acres (8.5 mi^2)	
Stream Length	44.6 miles	
Total Population	7,252.5 (Census 2010) 1.3 people/acre	
Land Use/Land Cover	Very Low Density Residential (Agriculture):	6.9%
	Very Low Density Residential (Forested):	7.0%
	Low Density Residential:	36.8%
	Medium Density Residential	2.9%
	High Density Residential	4.7%
	Commercial:	1.9%
	Institutional	6.4%
	Open Urban Land:	4.1%
	Transportation	1.2%
	Agriculture (Cropland, Orchard, Pasture):	12.8%
	Forest:	15.2%
	Wetlands:	0.1%
Land in Easement	Total: 820.0 acres (15.1%) Agricultural: 170.14 (24.4%)	
Impervious Cover	11.4% per Subwatershed	
Hydrologic Soil Group	A soils (low runoff potential): B soils: C soils: D soils (high runoff potential):	2.9% 70.1% 17.0% 7.3%
SWM Facilities	67 Facilities 9.0% urban land treated	
Restoration/Protection Priority Rating	Low/Low	

Neighborhood Source Assessment

A total of 32 neighborhoods were identified and assessed within the Jones Falls subwatershed during the uplands assessment of Area G. Recommendations for addressing stormwater volume and pollutants within this subwatershed include storm drain marking, rain gardens, rain barrels, downspout disconnection, fertilizer reduction, lot canopy improvements, and a small amount of Bayscaping. The results of the Neighborhood Source Assessment (NSA) are presented in Table 4-23.

Table 4-23: Actions identified for neighborhoods in Jones Falls

Site ID	Lot Size (acres)	Rain Garden/Rain Barrels/Downspout Disconnection	Storm Drain Marking	Bayscape	Fertilizer Reduction	Lot Canopy
NSA_G_308B	<1/4	X	X		X	X
NSA_G_310	>1	X	X			
NSA_G_311A	>1		X		X	
NSA_G_313	>1	X			X	X
NSA_G_314	1/2	X	X			X
NSA_G_315	1	X			X	X
NSA_G_316	1		X	X	X	X
NSA_G_317	>1	X				X
NSA_G_318	1	X	X			
NSA_G_319	>1	X	X		X	
NSA_G_320	1/4	X	X		X	X
NSA_G_321	1/8	X	X		X	
NSA_G_326	1/2	X	X		X	
NSA_G_327	>1	X	X		X	X
NSA_G_328	1	X	X		X	
NSA_G_329	>1	X	X		X	X

NSA_G_338A	1/8	X	X		X	X
NSA_G_338B	1/3		X		X	X
NSA_G_338C	1/3	X	X		X	X
NSA_G_339	1/4	X	X		X	X
NSA_G_340	1/3		X		X	X
NSA_G_341	<1/4	X	X		X	X
NSA_G_342	1/2	X	X			X
NSA_G_345	>1				X	
NSA_G_346	>1					
NSA_G_347	1/4					X
NSA_G_348	>1	X			X	
NSA_G_349	>1		X		X	
NSA_G_351	>1					
NSA_G_352	>1					
NSA_G_353	>1				X	X
NSA_G_354	>1			X	X	X

There was a relatively even distribution of the different categories of restoration actions recommended in the Jones Falls subwatershed, except for Bayscaping which was only suggested for two neighborhoods. The most common action recommended is fertilizer reduction, recommended for 22 of the 32 neighborhoods. This is followed by storm drain stenciling which is suggested for 21 neighborhoods and then rain gardens/rain barrels/downspout disconnection which are recommended for 20 neighborhoods. Finally, 19 of the neighborhoods did not have much tree cover on individual lots and could benefit from tree canopy improvements. It should also be noted that about half of the neighborhoods exhibited some encroachment into the stream buffer from mowing and/or buildings. Figure 4-7 shows two yards in the Jones Falls subwatershed with proposed restoration actions.

 

Figure 4-7: High maintenance turfgrass lawn in NSA_G_320 (left photo); Opportunity for lot canopy improvements at NSA_G_354 (right photo)

Hotspot Site Investigation

A total of seven sites – six commercial and one municipal – were assessed for the Hotspot Site Investigation (HSI) in the Jones Falls subwatershed. Based on the HSI, three of those sites were considered to not be hotspots, two are potential hotspots, one was confirmed a hotspot and one is considered a *severe* hotspot. The sites assessed in the field were two car dealerships, a strip mall, and a fire station. One site was found to have an active wash water illicit discharge from car washing in the parking lot without any treatment. Other sources of potential pollution found at these sites included inadequate containment of fuel and waste and potential stormwater contamination. Specific remediation actions identified for the confirmed and potential hotspots are summarized in Table 4-24.

Table 4-24: Recommended Actions for Hotspots Identified in Jones Falls

Site ID	Type	Recommended Actions					
		Refer for Enforcement	Follow-Up Inspection	Test for Illicit Discharge	Education	On-site Retrofit	Review Pollution Plan
HSI_G_319	Strip Mall	X	X		X		
HSI_G_321	Car Dealership						
HSI_G_322	Car Dealership	X	X	X	X		
HSI_G_333	Fire Station						

Figure 4-8 shows examples of confirmed pollution sources at two of the hotspot sites in Jones Falls subwatershed.

Figure 4-8: Leak stains from trash compactor (left) and active wash water discharge (right) in Jones Falls subwatershed

Institutional Site Investigation

Sixteen institutional sites in the Jones Fall subwatershed were preselected for the field teams to conduct an Institutional Site Investigation (ISI). These sites include several schools and faith institutions, a maintenance facility, a meeting hall, and a golf course. Most of these institutional properties were recommended for tree planting. Over 11,000 trees total could be planted in areas that are currently un-forested on those sites, some of which include impacted stream buffers. About half of the sites have opportunities for stormwater retrofits; seven could use storm drain marking; and six need improvements to the stream buffers. Finally, four of the properties have excessive impervious cover that could be removed. The actions identified for the ISI are shown in Table 4-25.

Table 4-25: Identified Actions for Institutional Sites in Jones Falls

		Identified Actions					
Site ID	Type	Tree Planting	Stormwater Retrofit	Downspout Disconnection	Impervious Removal	Storm Drain Marking	Stream Buffer Improv.
ISI_G_314	School	23	X				
ISI_G_317	State Facility	353	X		X		X
ISI_G_318	Church/ Faith-Based	39					
ISI_G_319	Church/ Faith-Based	333	X				X
ISI_G_321	School	750				X	
ISI_G_322	School	301				X	
ISI_G_325	Church/ Faith-Based w/School	339	X		X	X	X

ISI_G_326	Church/ Faith-Based	1833			X		X
ISI_G_327	Golf Course	528	X				
ISI_G_328	School	163	X			X	X
ISI_G_330	Meeting Hall/ Historic House	1231			X		
ISI_G_331	Church/ Faith-Based	1003					
ISI_G_332A	College	3649				X	
ISI_G_332B	Church/ Faith-Based	844				X	
ISI_G_343	Maintenance Facility		X				X
ISI_G_345	School		X			X	

Pervious Area Assessment

Only one site was identified in the Jones Falls subwatershed for a Pervious Area Assessment (PAA). This site is a vacant parcel owned by the County (PAA_G_301), located on Sunset Knoll Court in a residential neighborhood. The parcel is comparatively small, but there may be opportunity to plant trees on the empty lot. There is no opportunity to expand the interior forest nor is there opportunity to close an exterior forest gap. Also, there is no need or opportunity for a stormwater retrofit at this site. Since restoration options are fairly limited at this site it is given a low priority score.

Stream Corridor Assessment

More than half of the streams in Area G were previously assessed in Baltimore County's 1997 Jones Falls Watershed Water Quality Management Plan (Dames & Moore, 1997). For this study in 2014, in the Jones Falls and North Branch subwatersheds, windshield surveys were conducted at road crossings and public right of way (ROW) to review stream assessment results reported in the 1997 WQMP. Data collection for this report focused on the potential for restoration projects or implementation of BMPs in the vicinity of these road crossings. Factors that were visually assessed and scored included bank stability and floodplain condition, feasibility criteria, and other benefits such as fish passage restoration and riparian buffer enhancement.

Seventeen road crossings were reevaluated and one additional crossing was evaluated in the Jones Falls mainstem subwatershed in August and September 2014. In the Jones Falls mainstem subwatershed, the top three problems were percent imperviousness, unforested riparian buffer, and unstable stream channel conditions. The stream reaches visible from the crossings generally exhibited good bank stability and were able to access their floodplain. The greatest potential for improvement was enhancement of the riparian buffer. Buffer plantings would reduce thermal impacts to the stream, slow stormwater runoff into the channel, and increase bank stability. Jones Falls supports a population of brown trout that can be threatened by rising water temperatures.

Subwatershed Management Strategy

Restoration and protection strategies are outlined below.

Engaging Citizens & Watershed Groups

1. Encourage citizens to reduce fertilizer use to maintain healthy turfgrass.Inform citizens on the importance of septic system maintenance.
2. Encourage citizens to adopt landscape practices to increase native vegetation and habitat, and decrease turfgrass to include Bayscapes.
3. Increase homeowner awareness with proper buffer management in regulated areas (easements) to maintain existing and reforest impacted stream buffers with native plants, to include woody vegetation and removal of invasive vegetation.
4. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-23.
5. Engage property owners in downspout disconnection onto adjacent pervious surfaces or into retrofitted rain barrels or rain gardens.

Municipal Actions

1. Coordinate efforts with University of Maryland Extension outreach efforts to inform residents about proper fertilizer use and requirements of the 2013 Fertilizer Use Act
2. Identify opportunities to partner with local organizations such as MD Extension or Blue Water Baltimore to assist with outreach efforts and to focus on organizations with an existing rain barrel or rain garden program/initiative.
3. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-23.
4. Identify opportunities to engage homeowners to plants trees to increase lot canopy improvement
5. Work with Conservation Districts to increase land in conservation easements for agricultural lands.
6. Conduct retrofit assessments at the following institutional sites to determine their implementation potential: ISI_G_314 (school); ISI_G_317 (state facility), ISI_G_319 (faith-based), IGI_G_325 (faith-based & school), ISI_G_327 (golf course), ISI_G_328, ISI_G_343 (maintenance facility), ISI_G_345 (school).

7. Evaluate opportunities for tree planting that coincide with need to improve stream buffer at five institutional sites to include: ISI_G_ 317, 319, 326, and 328.
8. Evaluate opportunity to extend restoration action at the top three ranked sites from the 2014 windshield survey of streams evaluated in the 1997 WQMP
    a. Crossing 1-12 from the 1997 Water Quality Management Plan to reduce erosion and improve riparian buffer.
    b. The Jones Falls mainstem downstream of crossing 1-2would benefit from pool creation and bank stability treatment to improve habitat and reduce erosion downstream. This site may be combined with restoration actions upstream to include wetland creation and riparian buffer enhancement
    c. A second-order tributary to Jones Falls crosses Hillside Road near Falls Road exhibits instability in the form of active incision and bank erosion downstream of the culvert. Upstream of Hillside Road, the channel is connected to its floodplain and appears stable. Maintained lawn between the left bank and a shared driveway may provide opportunity for riparian plantings.
9. Provide homeowners with access to deer management and deer resistant landscaping information.

4.3.4 North Branch of Jones Falls

The North Branch of Jones Falls has the second largest subwatershed in Area G, having an area of just over seven square miles (7.1 mi^2). Like the other subwatersheds in Area G, a large proportion of the land cover in this subwatershed is residential – 50.4%. Like the rest of the area, development started to accelerate in the 1950s and peaked in the 1990s. The next largest category of land cover is agriculture which comprises nearly 20% of the subwatershed. Forest cover is also a fairly significant portion (18.8%) of the land cover in North Branch. Table 4-26 summarizes the key subwatershed characteristics of North Branch.

Table 4-26: North Branch Subwatershed Key Characteristics

Drainage Area	4,544.8 acres (7.1 mi^2)	
Stream Length	29.3 miles	
Total Population	2,913.7 (Census 2010) 0.6 people/acre	
Land Use/Land Cover	Very Low Density Residential (Agriculture):	2.8%
	Very Low Density Residential (Forested):	5.1%
	Low Density Residential:	42.1%
	Medium Density Residential	0.4%
	Commercial:	0.3%
	Institutional:	1.0%
	Industrial:	0.2%
	Open Urban Land:	9.4%
	Agriculture (Cropland, Orchard):	19.9%
	Forest:	18.8%
	Water and Wetlands:	0.0%
Land in Easement	Total: 1,728.6 acres (38.0%) Agricultural: 724.14 acres (80.12%)	
Impervious Cover	6.5% per Subwatershed	
Hydrologic Soil Group	A soils (low runoff potential): B soils: C soils: D soils (high runoff potential):	0.9% 69.0% 21.9% 8.6%
SWM Facilities	41 Facilities 7.8% of urban land use treated	
Restoration/Protection Priority Rating	Moderate/Moderate	

Neighborhood Source Assessment

A total of 15 distinct neighborhoods were selected and assessed within the North Branch subwatershed. Recommendations for addressing stormwater volume and pollutants within this subwatershed include fertilizer reduction, storm drain marking, rain gardens, downspout disconnection, lot canopy improvements, and one site for Bayscaping. The results of the Neighborhood Source Assessment (NSA) are presented in Table 4-27.

Table 4-27: Actions Identified for Neighborhoods in North Branch

Site ID	Lot Size (acres)	Rain Garden/Downspout Disconnection	Storm Drain Marking	Bayscape	Fertilizer Reduction	Lot Canopy
NSA_G_405	>1	X	X		X	
NSA_G_406A	>1	X	X		X	
NSA_G_406B	>1	X	X		X	
NSA_G_407	>1	X			X	
NSA_G_409	>1		X			
NSA_G_411B	>1	X			X	
NSA_G_412	>1	X			X	X
NSA_G_432	1	X	X		X	X
NSA_G_433	1, >1				X	
NSA_G_434	>1	X	X		X	
NSA_G_435	1	X	X		X	X
NSA_G_436	>1	X	X		X	
NSA_G_437	>1	X			X	
NSA_G_443	>1	X				X
NSA_G_444	>1	X		X		

There are many opportunities for rain gardens and downspout disconnection in this subwatershed – 13 out of 15 of the neighborhoods have opportunities for this type of restoration activity. The large majority of neighborhoods in North Branch show signs of lawn fertilization, so twelve of the neighborhoods appear to have an opportunity for reduction of fertilizer use. About half of the neighborhoods have storm drains that should be marked. Because many of the neighborhoods in this part of Area G are well wooded, only four of the neighborhoods were identified for lot canopy improvements and only one is recommended for Bayscaping. Very few neighborhoods showed any sign of encroachment into the stream buffer area either. Figure 4-9 illustrates two typical yards in the North Branch subwatershed.

Figure 4-9: Forest-like conditions of neighborhoods in North Branch (NSA_G_405 and NSA_G_437)

Hotspot Site Investigation

Only one site was assessed with the HSI in the North Branch subwatershed. This site, HSI_G_402, is an automotive repair facility. This site has potential issues with waste management and storage of hazardous materials that could lead to stormwater pollution. However, no active pollution was apparent during the assessment so this site is considered a *potential* hotspot. Secondary containment around fuel tanks, anti-freeze tanks, and other containers would better ensure that such pollution does not occur in the future. Figure 4-10 shows images of some of the outdoor material storage at this site.

Figure 4-10: Outdoor material storage without secondary containment as HSI_G_402

Institutional Site Investigation

A golf course and two faith-based schools are the two sites that were assessed in the North Branch subwatershed during the ISI. Potential restoration actions at the golf course (ISI_G_404) include stream buffer improvements and storm drain marking. Both schools also have opportunities for storm drain marking and have potential for stormwater retrofits. In addition, the school at ISI_G_403 has an open space that appears to be unused that could be planted with approximately 120 trees. The other school (ISI_G_435) has some loose trash behind the school that should be dealt with to avoid it washing away. The actions identified for these ISIs are shown in Table 4-28.

Table 4-28: Identified Actions for Institutional Sites in North Branch

Site ID	Type	Identified Actions					
		Tree Planting	Stormwater Retrofit	Downspout Disconnection	Trash Mgmt.	Storm Drain Marking	Stream Buffer Improv.
ISI_G_403	Church/ Faith-Based/ School	120	X			X	
ISI_G_404	Golf Course					X	X
ISI_G_435	Church/ Faith-Based/ School		X		X	X	

Pervious Area Assessment

Three sites in North Branch subwatershed were selected for Pervious Area Assessments to look for potential re-forestation opportunities. The three properties are all private parcels and are described below.

Walnut Avenue, PAA_G_401: This parcel has a large area of open space with no buffer along the stream. There appears to be potential for 366 linear feet of stream buffer planting. It appears that there is sufficient space for this planting (about 20 acres), but the actual potential for planting is unknown. There is no potential here to expand interior forest, but there is an exterior forest gap.

Garrison Forest Road, PAA_G_402: This area is protected by conservation easements. There are areas along the stream that appear to be open from the aerial view, but the true opportunity for planting is unknown. There appears to be 1,248 linear feet of stream (27 acres total) with the opportunity for planting. There also appears to be potential to expand the interior forest and close an exterior forest gap. This site has high restoration potential.

Greenspring Valley, PAA_G_403: Streams and tributaries span the entire area of this property. Many of these streams have insufficient buffers. There appears to be potential for 3,718 Linear Feet of tree planting (about 13 acres total). There is no opportunity for expanding the interior forest and there is no opportunity for closing an exterior forest gap.

Stream Corridor Assessment

For the “windshield survey” in North Branch subwatershed, nine stream road crossings that were originally evaluated in the 1997 study were re-evaluated and one additional crossing was evaluated. Streams in the North Branch subwatershed were generally found to be in good condition with little erosion visible from road crossings. Most sites in this subwatershed rated in the mid-range for habitat value, which indicates conditions that would benefit from stream restoration utilizing structures to increase flow diversity and other in-stream habitat enhancements.

Subwatershed Management Strategy

Restoration and protection strategies are outlined below.

Engaging Citizens & Watershed Groups

1. Encourage citizens to reduce fertilizer use to maintain healthy turfgrass.
2. Increase homeowner awareness with proper buffer management in regulated areas (easements) to maintain existing and reforest impacted stream buffers with native plants, to include woody vegetation and removal of invasive vegetation.
3. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-27.
4. Engage property owners in downspout disconnection onto adjacent pervious surfaces or into retrofitted rain barrels or rain gardens.

Municipal Actions

1. Coordinate efforts with University of Maryland Extension outreach efforts to inform residents about proper fertilizer use and requirements of the 2013 Fertilizer Use Act
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-27.
3. Work with land owners to expand forest buffer at PAA_G_402 (Garrison Forest School) and ISI_G_404 (golf course)
4. Evaluate opportunities to install bioretention facilities at two faith-based institutions/school, ISI_G_403 and 435
5. Identify opportunities to partner with local organizations such as MD Extension or Blue Water Baltimore to assist with outreach efforts and to focus on organizations with an existing rain barrel or rain garden program/initiative.
6. Provide homeowners with access to deer management and deer resistant landscaping information.
7. Further study to evaluate the 3-ft headcut and restoration opportunity at Crossing 1 located in a gas line ROW that was accessed from the Garrison Forest Veterans Cemetery.

CHAPTER 5
Plan Evaluation

5.1 Introduction

The Upper Jones Falls Watershed Action Plan (SWAP) is based on an implementation schedule with an anticipated endpoint of 2025. This time frame is necessary to implement restoration measures and meet the Chesapeake Bay Total Maximum Daily Loads (TMDL). The ability to implement this plan within the specified timeframe is dependent upon the availability of staff and sufficient funding. The Upper Jones Falls SWAP Implementation Committee (an outgrowth of the Steering Committee) will meet twice per year to assess progress in meeting watershed goals and objectives to discuss funding options. In addition, any completed projects will be recorded in the county's annual National Pollutant Discharge Elimination System (NPDES) report. An adaptive management approach will be used to meet watershed goals and objectives based on SWAP evaluation data. The Upper Jones Falls SWAP Implementation Committee will initiate a revision of the plan within six months if additional TMDLs are developed and approved or when a water quality issue arises.

Progress and success of the Upper Jones Falls SWAP will be evaluated during implementation based on the following: interim measureable milestones, pollutant load reduction criteria, implementation tracking, and monitoring. These evaluation components are described in the following sections.

5.2 Interim Measurable Milestones

Overall performance measures have been developed for each action listed in Appendix A and will be used to gage the progress and success of proposed restoration strategies. The progress and success of actions in Appendix A will be evaluated every year. Actions strategies may be modified and/or new actions may be proposed based on this annual evaluation. New actions proposed will also be evaluated on a semiannual basis and modified as necessary to meet watershed goals and objectives.

5.3 Pollutant Load Reduction Criteria

Current pollutant load reduction scenarios and calculations for proposed actions are presented in Chapter 3. The effectiveness estimates for best management practices (BMPs) that are implemented and reported by the Chesapeake Bay partners, as well as those planned for future implementation, were obtained from the Documentation for Scenario Builder Version 2.4, which was revised January 2013 (U.S. EPA, 2013). These estimates are the most recent at the time of SWAP development. The BMP effectiveness estimates are extracted from Tables 8-4 and 8-5 from this documentation. In addition, recommendations from the Chesapeake Bay Program BMP Expert Panels which provide updated efficiencies for Urban Nutrient Management and urban stream restoration were used in this SWAP. The revised BMP effectiveness estimates from two other Expert Panel reports, Urban Stormwater Retrofit Expert Panel and New State Stormwater Performance Standards, were not applied given the detailed information on individual BMPs needed to estimate the value, and therefore values in Tables 8-4 and 8-5 were used. These references are available in Appendix D.

5.4 Implementation Tracking

Implementation of restoration actions for the Upper Jones Falls SWAP will be overseen by the Implementation Committee. The committee will assess progress with individual actions related to the amount complete and the ease of implementation. Overall progress with meeting pollutant reductions will also be assessed. Adaptive management will allow the committee to discuss changes to the action schedule depending on the success of individual actions and the overall progress with the plan. If additional water quality issues arise, the Upper Jones Falls SWAP Implementation Committee will initiate revisions of the plan.

5.5 Monitoring

Baltimore County currently conducts water quality monitoring programs within the Upper Jones Falls watershed. Additional monitoring is anticipated to assess the effectiveness of restoration projects and progress in meeting TMDL reductions.

5.5.1 Existing Monitoring

Baltimore County conducts chemical, biological, bacterial, and illicit connection monitoring within the Upper Jones Falls watershed. These are described in detail in Chapter 3.4 of the Watershed Characterization Report (Appendix E) and listed below:

Trend Monitoring – 40 monitoring sites throughout the county, 1 of which is located within the Lower Jones Falls watershed, provide information on ambient chemical conditions and assess trends in chemical concentrations and loads (EPS, 2014).

Biological Monitoring – Conducted since 2003 following the Maryland Biological Stream Survey (MBSS) probabilistic monitoring methods to assess ecological health in local streams, assess the effectiveness of stream restoration projects, and provide data on the best streams in the county to serve as bench marks for other stream assessments (EPS, 2014).

Illicit Discharge Detection and Elimination Program – Routine outfalls screening and prioritization system to track and reduce illicit connections and discharges.

5.5.2 SWAP Implementation Monitoring

SWAP implementation monitoring activities will focus on project specific monitoring and targeted subwatershed monitoring. Project specific monitoring will be identified as restoration progresses. It will not be possible to monitor all restoration projects due to the number of actions proposed. Project specific monitoring will target activities with limited data regarding removal efficiencies such as bayscaping education. Subwatershed monitoring will measure overall improvement in water quality as a result of multiple restoration activities within a subwatershed. This will also be developed as restoration progresses. Monitoring activities will be coordinated among SWAP participants through participation in the Upper Jones Falls SWAP Implementation Committee.