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Prologue

The *Middle Potomac Watersheds Management Plan* presents a strategy for mitigating the impacts of development and improving or preserving the water resources and natural habitat in the Bull Neck Run, Scotts Run, Dead Run, Turkey Run, and Pimmit Run watersheds, collectively known as the Middle Potomac Watersheds. The plan has three goals: human protection, habitat protection, and stewardship. It outlines recommended structural and nonstructural actions in each of the five watersheds which will help achieve the plan goals.

The plan follows the same format as other watershed management plans adopted recently by Fairfax County, such as Difficult Run and Cameron Run. These watershed management plans are the first comprehensive plans for stormwater that the county has conducted since the 1970s. This is also the county's first attempt to examine water quality and stream management issues in addition to addressing flooding.

This is a watershed master plan, not a design plan, attempting to look at the big picture in the watersheds for the next 25 years. The objective is to assess the state of the watersheds by collecting a baseline data set and identifying and developing an inventory of existing problem areas. The plan also suggests potential solutions and policy changes and prioritizes a group of projects that will help improve the watersheds' conditions. The Middle Potomac Watersheds drain highly urbanized areas, making the restoration of streams to pre-development conditions virtually impossible. Furthermore, most of the watersheds have limited open space, so the type of projects that can be implemented in them is also limited. This plan will, however, help halt the degradation of the streams and loss of habitat and, with the implementation of the recommendations, the conditions of the streams will improve.

The plan is only the first step in the process of improving watershed conditions and is designed to be a living document that will be updated over the life of the plan. Stormwater management technologies are continuingly evolving, therefore implementation will occur on a five to ten year basis. This will allow time for monitoring and assessment of the effectiveness of selected technologies as well as allowing time to assess unanticipated changes to the watersheds that may affect planned projects.

Every year, projects from Fairfax County's adopted watershed management plans will be put into the Stormwater Management annual work plan. The work plan is developed to balance work done in each of the watersheds and districts, and to spread resources among infrastructure maintenance, dam safety, flooding issues, water quality, watershed restoration, and plan implementation. Projects in the plan will also be evaluated for their ability to meet other county initiatives, such as the Chesapeake 2000 agreement and the new Cool Counties initiative.

Executive Summary

The *Middle Potomac Watersheds Management Plan* presents a strategy for improving and preserving the water resources and natural habitat in the Bull Neck Run, Scotts Run, Dead Run, Turkey Run and Pimmit Run Watersheds, collectively known as the Middle Potomac Watersheds. The plan was initiated by Fairfax County as part of an initiative to create watershed management plans for all county watersheds with input from watershed residents and from a watershed advisory committee. Much of the watersheds were developed before stormwater controls were required, allowing runoff from impervious surfaces such as roofs, roadways and sidewalks to flow directly into the streams in large quantities, often causing downstream flooding and stream deterioration, including instream erosion. The condition of the watersheds has been damaged further by recent infill development and other sources of increased imperviousness, such as road widening projects. The actions outlined in the plan will begin to reduce the amount of runoff, improve water quality in the streams, restore stream habitat, and help the county meet its Chesapeake 2000 and Cool Counties goals. The Middle Potomac Watersheds drain highly urbanized areas, making the restoration of streams to pre-development conditions virtually impossible. This plan will, however, help halt the degradation of the streams and loss of habitat and, with the implementation of the recommendations, the conditions of the streams should improve.

The approach to developing the plan included the following actions:

- Analyzed information from stream assessments, previous watershed studies, watershed residents and current modeling to determine key watershed issues
- Worked with watershed stakeholders to identify goals, objectives, and actions to address the watershed issues
- Developed proposed improvements to the watershed, including costs and priorities

The plan lays out a sequence of projects to be implemented to improve stream conditions in the watersheds. Projects in the headwaters of the watersheds will be implemented first because their water quantity reductions will make downstream projects, such as stream restoration, more feasible. Projects that are easy to implement, such as obstruction removal and buffer restoration projects, will also be implemented first. Additional information such as subwatershed condition rankings, geographic location, parcel ownership, and existing water quantity or water quality controls were also considered in determining the appropriate sequencing of projects, as described in Section 3.4 in Chapter 3.

As the plan is implemented, it will need to be updated to address the dynamic nature of watershed conditions and land use. This will ensure that progress toward the plan goals and objectives is achieved. This plan is only the first step in the process and is designed to be a living document that will be updated as becomes necessary over the life of the plan. Stormwater management technologies are continuingly evolving, therefore implementation will occur on a five to ten year basis. This will allow time for monitoring and assessment of the effectiveness of selected technologies as well as allowing time to assess unanticipated changes to the watershed that may affect planned projects. The plan will not be able to solve all of the problems in the watersheds, but will guide the county in the right direction.

Background

The Middle Potomac Watersheds cover an area of approximately 26 square miles located in the northeast portion of the county. Most of the Middle Potomac Watersheds are entirely within Fairfax County, but approximately 17 percent, or 2.1 square miles, of the Pimmit Run watershed is in Arlington County. The watershed group contains some of the most diverse watersheds in Fairfax County. Tysons Corner, one of the largest commercial centers on the East Coast, is located in the headwaters of Scotts Run and Pimmit Run Watersheds. McLean Community Business Center is located in the headwaters of Dead Run. Large natural areas including approximately 2,130 acres of park land (13 percent of the watershed land area) are located along the Potomac River and stream valleys. The *Middle Potomac Watersheds Management Plan* provides a strategy for mitigating the impacts of development, such as increased runoff, degraded water quality, and loss of stream habitat.

The history of the county's watershed management began in the 1940s with the conversion of agricultural land use to residential and commercial land uses. During this time, stormwater infrastructure was constructed to quickly carry runoff away from the developed areas to the creeks and streams that serve as the principal drainage system for the county. Starting in 1972, onsite Stormwater Management (SWM) facilities were required for new development to minimize the effects of increased runoff from development. As shown in Table 2.12 in Chapter 2, approximately 15 percent of the main watershed area is controlled by SWM facilities. In the early 1980s, water quality Best Management Practices (BMPs) were required for new development in the southern areas of the county that drained to the Occoquan drinking water reservoir. Stormwater BMPs were required for all new development in the county starting in July 1993. Because so much of the Middle Potomac Watersheds area was developed before stormwater controls were required, stormwater runoff has had considerable impacts on the streams in these watersheds.

In the late 1970s, the county developed master drainage plans for all of the watersheds in the county, including the Middle Potomac Watersheds. These plans identified projects to solve problems that included flooding, erosion, sedimentation, and other environmental impacts and issues projected through the year 2000. As proposed by residents, the county initiated a stream restoration and protection study and completed the *Fairfax County Stream Protection Strategy* (www.fairfax.va.us/gov/DPWES/environmental/SPS_Main.htm) in January 2001. This baseline study evaluated the condition of county streams and prioritized the watersheds for protection strategies. The stream protection program is ongoing, with continuous biological monitoring and assessment of stream condition. The residents of Fairfax County have also played an important role in the management of the county's watersheds, and they will continue to do so in the future.

Building on the recommendations from the *Stream Protection Strategy* baseline study, the county initiated a process to develop watershed management plans for all 30 watersheds in the county. The development of the watershed management plans builds on a detailed stream physical assessment of over 800 miles of stream and includes community involvement; modeling of the runoff and stream flows; and the development of goals, objectives, and strategies for addressing watershed issues.

Purpose

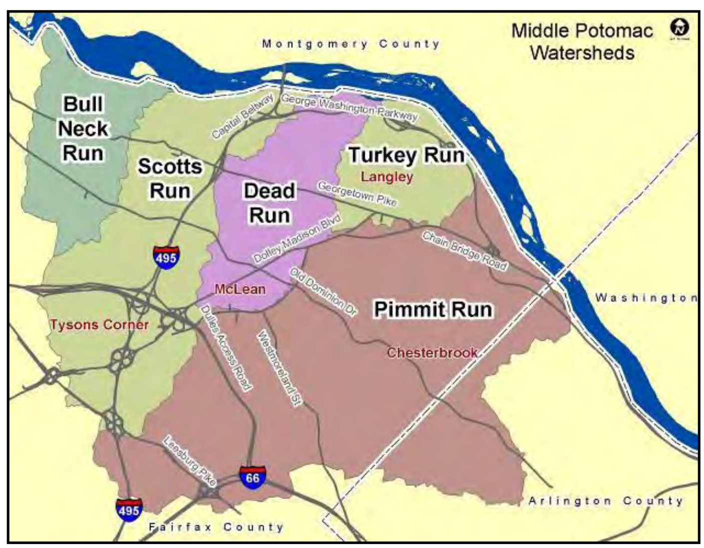
The primary reasons the *Middle Potomac Watersheds Management Plan* was developed can be summarized as follows:

1. To restore and protect the county's streams, of which 80 percent are categorized as being in "fair" to "very poor" condition
2. To help meet state and federal water quality standards by identifying strategies to prevent and remove pollution
3. To support Virginia's commitment to the Chesapeake 2000 Agreement to clean up the Chesapeake Bay
4. To replace the currently outdated watershed management plans and incorporate the use of new technologies
5. To take a comprehensive approach in addressing multiple regulations, commitments, and community needs

With input from the Middle Potomac Watersheds Steering Committee and other members of the community, this watershed management plan addresses these needs with a strategy for restoring and protecting the watersheds.

Existing Watershed Condition

For the purpose of this watershed plan, the Middle Potomac Watersheds were divided into nine subwatersheds: Bull Neck Run, Upper Scotts Run, Lower Scotts Run, Dead Run, Turkey Run, Upper Pimmit Run, Middle Pimmit Run, Lower Pimmit Run and Little Pimmit Run. These subwatersheds were further subdivided into 86 smaller basins, called subbasins, for further analysis. These subbasins are shown in Chapter 2 on Map 2.4.



The predominant existing land use in the Middle Potomac Watersheds is medium-density, single-family residential which covers approximately 26 percent of the area in the Middle Potomac Watersheds. The next most common land use in the watersheds is low-density residential, which comprises 17 percent of the overall land area. Currently 94 percent of the developable land within the five watersheds has been developed. The current impervious area in the watersheds is approximately 4,068 acres, or 24 percent of the total area, which includes the portions of the watersheds in Arlington

County.

The Virginia Department of Environmental Quality's (DEQ's) 2006 305(b)/303(d) Water Quality Assessment Integrated Report states that the recreation use goal for Pimmit Run is not supported due to exceedances of the fecal coliform bacteria water quality standard recorded at two DEQ water quality monitoring stations located on this stream. In addition to the bacterial impairment, DEQ's 2006 Integrated Report states that Pimmit Run is also impaired for fish consumption due to polychlorinated biphenyls (PCBs), chlordane, and heptachlor epoxide. The aquatic life use in Pimmit Run is fully supported with observed effects due to exceedances of the sediment screening value at the downstream portion of the stream. The 2004 DEQ Integrated Report listed Scotts Run as a Water of Concern based on citizen monitoring stations that revealed medium probability of adverse conditions for aquatic life.

The Fairfax County Health Department's *2002 Stream Water Quality Report* concluded that the overall water quality of the watersheds in the Middle Potomac Watershed Group is considered fair for fecal coliform and good for the other chemical and physical parameters that were sampled. The physical and chemical parameters that were measured included fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous and heavy metals.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Pimmit Run and its tributaries, Scotts Run, and Dead Run received "very poor" composite site condition ratings, whereas Bull Neck Run and Turkey Run received "excellent" ratings. These ratings were based on a range of environmental parameters including an index of biotic integrity, stream physical assessment, habitat assessment, fish species richness, and percent imperviousness.

The county initiated a Stream Physical Assessment (SPA) for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The SPA included identification and characterization of the following: stream geomorphology, obstructions, stream habitat condition, pipe and ditch outfalls, riparian buffer condition, public utility lines, erosion locations, road and other crossings, head cuts, and dumpsites. The inventory items with a negative impact on the stream were assigned an impact score and the inventory items that did not impact the stream were not scored.

The scores assessed for the various physical parameters representing the stream habitat conditions were combined for each stream segment to obtain a total habitat score. The greatest percentage of the stream habitats in the watershed group were assessed as "fair." The summary of overall stream habitat quality for the Middle Potomac streams as a percentage of the total length assessed is as follows:

Score	Percent of watershed group
"very poor"	0 percent
"poor"	10 percent
"fair"	40 percent
"good"	26 percent
"excellent"	24 percent

Future Watershed Condition

Future development in Fairfax County will present a number of challenges to restoring and protecting the Middle Potomac Watersheds due to the estimated increase in impervious area in the watersheds. Infill and redevelopment is expected to occur more frequently in the future in the Middle Potomac Watershed Group because the majority of the watershed area is already developed. It is anticipated that the percent imperviousness will increase in residential areas as additions are made to existing houses or existing houses are replaced with larger houses and existing vegetation is lost. Policy Action A1.8, explained in Chapter 9, will address this issue.

Virginia Department of Transportation (VDOT) projects will also have an impact on the imperviousness in the watersheds. VDOT has plans to improve interchanges and widen roadways, both of which could occur with minimal stormwater controls to diminish the effects of the increased imperviousness. The largest VDOT project in the watersheds is the construction of two new High Occupancy Toll (HOT) lanes along the Capital Beltway between Georgetown Pike and Springfield to be completed by 2010. Approximately half of this project goes through the Scotts Run and Pimmit Run Watersheds. HOT lanes are also being considered on other local highways, including Interstate 66, which goes through a small portion of the Pimmit Run Watershed. Policy Action A1.7 in Chapter 9 suggests an approach to manage this issue.

Another future development in the watersheds is the redevelopment of Tysons Corner in conjunction with the extension of Metro rail though the area. The Tysons Corner area will experience redevelopment as the Washington Metropolitan Area Transit Authority expands their rail lines and adds four rail stations to the area in the future. This redevelopment could further negatively impact Scotts Run unless a stormwater management strategy is implemented. The Tysons Corner Stormwater Strategy (Project SC9845), outlined in Chapter 9, recommends that Low Impact Development (LID) measures, new BMPs, BMP retrofits, and additional stormwater management requirements for developed properties without existing BMPs should be implemented to mitigate the effects of existing and future impervious areas. Fairfax County has initiated a Tysons Corner Transportation/Urban Design Study and appointed a Tysons Land Use Task Force to coordinate community participation and recommend changes to the 1994 Tysons Corner Comprehensive Plan. Coordination with the Tysons Land Use Task Force and the Department of Planning and Zoning will be essential in mitigating the impacts of the Tysons Corner redevelopment.

Changes in land use types will affect the imperviousness of the watersheds. The future watershed group imperviousness is predicted to increase to 27 percent. Mansionization will increase the imperviousness in the watersheds by an additional one percent, for a total imperviousness of 28 percent for the Middle Potomac Watershed Group.

The main issue with increased impervious area in the watersheds is the resulting increase in stormwater runoff volumes. Reducing the runoff delivered to the streams is a priority of the plan because it will reduce the amount of stream bank erosion, increasing the likelihood of success for stream restoration and other projects downstream. Runoff reduction will be accomplished through BMP retrofits, new BMPs, new LID projects, and Neighborhood Stormwater Improvement Areas.

The plan goals and actions as summarized in the next two sections offer ways to lessen the impact of the increased imperviousness from future development.

Plan Goals and Objectives

The goals for the *Middle Potomac Watersheds Management Plan* were derived from the issues identified by the community and the project team based on their analysis of the watersheds' condition. The objectives provide direction on how to achieve each of the goals, while the actions presented in Chapter 3 describe the strategy for accomplishing each objective. The actions and strategies were identified by the project team and the community and integrated comments from the steering committee and public workshop participants. The proposed strategies were then reviewed by the county to help clarify and refine the approach for implementation as part of the watershed plan review process.

Goal A: Reduce stormwater impacts to protect human health, safety, and property

Objective A1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Goal B: Protect and improve habitat and water quality to sustain native animals and plants

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Objective B2: Increase the use of Low Impact Development for all development projects to reduce runoff and improve water quality.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control, and to provide habitat for animals.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Objective B5: Restore natural stream channels, banks and beds to provide improved habitat.

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Objective C1: Improve education and outreach.

Objective C2: Improve watershed access and stewardship.

Objective C3: Promote the implementation and maintenance of LID practices.

Recommended Structural and Non-structural Actions

The plan actions are summarized below for each watershed. Full lists of plan actions for each watershed are presented in Chapters 4 through 8. If more than one of each type of project is in the watershed then the number of projects that are recommended is shown beside the project type. Priority projects will be implemented within the first fifteen years of the plan in each watershed. Detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The summary tables at the ends of Chapters 4 through 8 also list the land owners for each project location. Coordination with the land owners will be essential to the successful implementation of the projects. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Bull Neck Run Plan Actions

Below are the structural and non-structural practices for Bull Neck Run. The total cost of the priority projects is $1,420,000.

- Public Education Project
- Community Outreach Project
- LID Promotion Project
- Enforcement Enhancement Project
- Stream Assessment Project
- BMP Retrofit Project (2)
- Stream Restoration
- Buffer Restoration
- Infrastructure Improvement (2)
- Fecal Coliform Source Study
- New LID Project
- Dumpsite/Obstruction Removal (2)
- Wetland Assessment Project

Scotts Run Plan Actions

Below are the structural and non-structural practices for Scotts Run. The total cost of the priority projects is $7,720,000.

- Public Education Project
- Community Outreach Project
- LID Promotion Project
- Enforcement Enhancement Project
- Stream Assessment Project
- BMP Retrofit Project (28)
- New BMP Project (10)
- Stream Restoration (6)
- Buffer Restoration
- Infrastructure Improvement (2)
- Flood Protection Project
- Fecal Coliform Source Study
- New LID Project (6)
- Neighborhood Stormwater Improvement Areas (2)
- Tysons Corner Stormwater Improvement Area
- Dumpsite/Obstruction Removal
- Wetland Assessment Project

Dead Run Plan Actions

Below are the structural and non-structural practices for Dead Run. The total cost of the priority projects is $6,080,000.

- Public Education Project
- Community Outreach Project
- LID Promotion Project
- Enforcement Enhancement Project
- Stream Assessment Project
- BMP Retrofit Project (9)
- BMP Retrofit Project/New LID
- New BMP Project (4)
- Stream Restoration (3)
- Buffer Restoration (2)
- Infrastructure Improvement (3)
- Flood Protection Project
- Fecal Coliform Source Study
- New LID Project (6)
- Neighborhood Stormwater Improvement Areas (3)
- Dumpsite/Obstruction Removal
- Wetland Assessment Project

Turkey Run Plan Actions

Below are the structural and non-structural practices for Turkey Run. The total cost of the priority projects is $3,710,000.

- Public Education Project
- Community Outreach Project
- LID Promotion Project
- Enforcement Enhancement Project
- Stream Assessment Project
- BMP Retrofit Project
- Stream Restoration (3)
- Buffer Restoration
- Infrastructure Improvement (2)
- Fecal Coliform Source Study
- New LID Project (3)
- Dumpsite/Obstruction Removal
- Land Conservation Coordination Project
- Wetland Assessment Project

Pimmit Run Plan Actions

Below are the structural and non-structural practices for Pimmit Run. The total cost of the priority projects is $16,940,000.

- Public Education Project
- Community Outreach Project
- LID Promotion Project
- Enforcement Enhancement Project
- Stream Assessment Project
- BMP Retrofit Project (18)
- New BMP Project (3)
- Stream Restoration (5)
- Buffer Restoration (6)
- Floodplain Restoration (3)
- Infrastructure Improvement (11)
- Flood Protection Project
- Fecal Coliform Source Study
- New LID Project (31)
- Neighborhood Stormwater Improvement Areas (6)
- Dumpsite/Obstruction Removal (2)
- Wetland Assessment Project

Benefits of Structural and Non-structural Actions

Once completed, the priority projects, including BMP Retrofit, New BMP, New LID and Neighborhood Stormwater Improvement Areas, will remove an estimated 676 pounds per year of phosphorus, provide wetland habitat, and store a portion of the runoff from the one-year storm event to control the peak flows and help reduce erosion in the downstream channels.

Replacing or rehabilitating infrastructure in the Infrastructure Improvement Projects will help to alleviate flooding of houses, properties, and roadways. Stream and Buffer Restoration Projects will increase the amount of habitat and provide nutrient reduction for the streams. The Dumpsite/Obstruction Removal Projects will help to reduce the flooding of the streams and erosion of the stream banks.

Future development conditions without any alternatives (future) were compared to future development conditions with the proposed alternatives (proposed) to evaluate the effect of the proposed alternatives in the watersheds.

Table ES.1 shown on the next page presents the reductions in peak discharges and pollutant loadings in the nine Middle Potomac subwatersheds. As the table indicates, implementation of the proposed alternatives provides a reduction from the future to the proposed conditions in the ten-year peak flow as well as a reduction in pollutant loadings for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). These results are also shown on Maps 3.1 through 3.4.

Table ES.1 Pollutant Loadings and Reductions

Subwatershed	Drainage Area (ac)	Scenario	Runoff Volume (in/yr)	10-Year Peak Flow (cfs/ac)	TSS (lb/ac /yr)	TP (lb/ac /yr)	TN (lb/ac /yr)
Bull Neck Run	1,559	Existing	3.42	0.97	39.9	0.31	2.46
		Future	4.42	1.03	48.1	0.43	3.23
		Proposed	4.31	0.95	40.4	0.39	3.00
		% Load Reduction	-2%	-8%	-16%	-9%	-7%
Upper Scotts Run	1,982	Existing	11.18	1.56	213.3	0.88	8.12
		Future	12.16	1.60	231.4	0.95	8.95
		Proposed	12.01	1.39	160.2	0.82	8.05
		% Load Reduction	-1%	-13%	-31%	-14%	-10%
Lower Scotts Run	1,878	Existing	3.74	1.73	30.8	0.33	2.40
		Future	4.05	1.78	36.4	0.38	2.76
		Proposed	4.03	1.51	35.5	0.38	2.79
		% Load Reduction	0%	-15%	-2%	0%	1%
Dead Run	1,922	Existing	4.36	0.38	70.8	0.49	3.82
		Future	4.81	0.41	76.6	0.53	4.15
		Proposed	4.53	0.34	63.8	0.47	3.71
		% Load Reduction	-6%	-17%	-17%	-11%	-11%
Turkey Run	1,248	Existing	5.91	0.88	110.6	0.47	4.09
		Future	6.09	0.90	113.7	0.49	4.25
		Proposed	5.90	0.85	108.6	0.46	4.02
		% Load Reduction	-3%	-6%	-4%	-6%	-5%
Upper Pimmit Run	2,702	Existing	2.89	0.50	83.5	0.49	4.00
		Future	3.96	0.53	91.0	0.53	4.36
		Proposed	3.28	0.19	70.2	0.44	3.62
		% Load Reduction	-17%	-64%	-23%	-17%	-17%
Middle Pimmit Run	2,803	Existing	2.91	0.72	53.3	0.37	2.90
		Future	3.27	0.75	61.7	0.43	3.35
		Proposed	3.02	0.49	56.9	0.40	3.13
		% Load Reduction	-8%	-35%	-8%	-7%	-7%
Lower Pimmit Run	802	Existing	5.34	3.60	51.5	0.42	3.21
		Future	5.41	3.72	55.1	0.45	3.40
		Proposed	5.41	2.96	55.2	0.45	3.40
		% Load Reduction	0%	-20%	0%	0%	0%
Little Pimmit Run	1,776	Existing	7.19	0.45	60.8	0.44	3.40
		Future	7.41	0.46	63.2	0.46	3.56
		Proposed	7.28	0.45	60.9	0.45	3.48
		% Load Reduction	-2%	-2%	-4%	-2%	-2%
TOTAL	16,672	Existing	46.94	1.00	80.5	0.47	3.86
		Future	51.57	1.04	88.0	0.52	4.29
		Proposed	49.78	0.83	72.4	0.47	3.93
		% Load Reduction	-3%	-20%	-18%	-10%	-8%

The increased infiltration in the new BMP and LID projects reduces the peak flows, which also reduces the amount of pollutants in the downstream subwatersheds. The cumulative stream flow reductions in the watersheds from the proposed alternatives are shown on Map 3.5.

Policy Recommendations

The strategies for achieving the vision of minimizing runoff, reducing pollution, and restoring the quality of Middle Potomac Watersheds include a wide range of recommendations. Not only are the capital improvement program projects described in Chapters 4 through 8 needed to meet the goals of the watershed management plan, but policy and land use changes are also vital in mitigating the effects of existing and future development in the watersheds. The policy actions described in Chapter 9 include actions that will reduce the impact of infill development, provide incentives for developers to use LID methods, implement a stormwater strategy for the Tysons Corner area, establish wildlife corridors, and increase citizen involvement in implementing LID methods. For more details, see the Policy Action Summary Sheet on pages 22 and 23 of this Executive Summary.

An example of a previous successful policy change is the newly adopted Low Impact Development (LID) amendment to the Fairfax County Public Facilities Manual (PFM) in March 2007. This policy added six LID methods to the list of acceptable stormwater management practices for development and provides design criteria for each. The six methods added were pervious pavement, bioretention filters and basins, vegetated swales, tree box filters, vegetated roofs, and reforestation.

Implementation Plan

The actions recommended in this plan will be implemented over the 25-year life of the *Middle Potomac Watersheds Management Plan*. This plan will serve as guidance for all county agencies and officials in determining how development and redevelopment will take place within the watersheds. The plan is the first step in the process and will be implemented as a living document. As such, the implementation schedule will be updated to reflect plan changes. The proposed policy actions were not prioritized because they will be evaluated in conjunction with the policy recommendations from the other county watershed management plans.

The proposed structural and non-structural projects were first prioritized using a weighted set of five prioritization categories. The actions in the plan were assigned an impact score from 1 to 5 for each of these prioritization categories, based on a set of evaluation criteria, with 5 as the best score and 1 as the worst score. Additional information considered when determining the scores included subbasin condition rankings, geographic location, parcel ownership, and existing water quantity or water quality controls. The prioritization categories are provided below.

1. Fairfax County Board of Supervisors-Adopted Stormwater Control Project Prioritization Categories
2. Direct Regulatory Contribution
3. Public Support
4. Effectiveness/Location
5. Ease of Implementation

The total score for each project was calculated by adding the corresponding weighted scores from each category. Based on the total scores, the projects were then ranked from the highest score (high priority) to the lowest score (low priority) within each watershed.

The 25 year implementation period for the Middle Potomac Watersheds Management Plan has been divided into five-year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The project prioritization is a tool to help in developing the implementation sequencing for the proposed watershed plan projects. The projects with the top prioritization rankings were typically assigned to Group A or Group B implementation timeframes. However, other factors were also considered when assigning the implementation timeframes such as promoting projects that have high visibility and low costs but that may not have received a high priority score.

The following provisions address the funding and implementation of projects, programs, and policy recommendations in the Middle Potomac Watersheds Management Plan:

i. Projects and Programs (both structural and non-structural) as well as Policy items in this plan will first undergo appropriate review by county staff and the Board (please see iii below) prior to implementation. Board adoption of the watershed plan will not set into motion automatic implementation of projects, programs, initiatives or policy recommendations that have not first been subject to sufficient scrutiny to ensure that the projects that are funded give the county the greatest environmental benefit for the cost.

ii. Road projects not related to protection of streambeds or banks or water quality will not be funded out of the stormwater and watershed budget.

iii. The watershed plan provides a conceptual master-list of structural capital projects and a list of potential non-structural projects for the watersheds. Staff will, on a fiscal year basis, prepare and submit to the Board a detailed spending plan to include a description of proposed projects and an explanation of their ranking, based on yet to be established, specific criteria. Criteria used to assemble this list will include, but are not limited to, cost-effectiveness as compared to alternative projects, a clear public benefit, a need to protect public or private lands from erosion or flooding, a need to meet a specific watershed or water quality goal and implementable within same fiscal year that funding is provided. Staff also intends to track the progress of implementation and report back to the Board periodically.

iv. Each project on the annual list of structural projects will be evaluated using basic value-engineering cost effectiveness principles before implementation and the consideration of alternative structural and non-structural means for accomplishing the purposes of the project will be considered before implementation. This process will ensure the county's commitment to being a fiscally responsible public entity.

v. Obstruction removal projects on private lands will be evaluated on a case-by-case basis for referral to the Zoning Administrator and/or County Attorney for action as public nuisances; and otherwise to determine appropriate cost-sharing by any parties responsible for the obstructions.

vi. Stream restoration projects on private lands will be evaluated to determine means for cost-sharing by land owners directly responsible for degradation due to their land uses.

Beginning in Fiscal Year 2006, the Board of Supervisors dedicated the approximate value of one penny from the County's Real Estate tax to support the growing needs and regulatory requirements in the stormwater program. This program consists of: Regulatory Compliance, Dam Safety, Infrastructure Reinvestment, Project Implementation and Watershed Planning.

Stormwater Management generates an annual work plan that prioritizes projects from all of the completed watershed management plans. The project prioritization within each plan is taken into consideration when selecting projects for the annual work plan. Cost and benefits, feasibility, and land ownership are also considered when selecting and prioritizing projects across all of the watersheds. For example, the 2008 fiscal year work plan included approximately ten million dollars for implementation of watershed plan projects. Projects were identified from each of the adopted six watershed plans and included in the annual work program. In addition to the projects identified specifically as Watershed Project Implementation, many of the other projects include the practices identified in the watershed plans. For example, many of the dam safety projects include retrofitting a standard dry pond to include BMPs such as additional storage, forebay and a wetlands feature.

The currently adopted five-year Capital Improvement Program (CIP) provides over $22,000,000 per year for Stormwater Management and specifically identifies $500,000 per year for each approved watershed management plan for project implementation. There is an additional $3.5 million included for projects from watershed management plans that are still in progress. In addition to CIP funding, projects may be funded through the pro-rata program, or be constructed as part of a development project, or in conjunction with another county project.

Projects are evaluated on an annual basis as part of the county's budget process and development of the Stormwater Management annual work plan. As the next round of watershed management plans are completed and approved by the Board of Supervisors, the annual work plan will be developed to include the new projects that are identified in the respective watershed plans. The project selection processes described above, combined with the annual budgetary process, are the factors used in determining projects to implement.

Plan Total Cost

Costs were computed for the priority projects which will be implemented in the first 15 years of the plan. All project costs will be re-computed prior to implementation, during the design phase for each project. The total computed cost for priority projects is approximately 36 million dollars.

Bull Neck Run Watershed Summary Sheet

Overview

The Bull Neck Run Watershed has an area of approximately 1,559 acres as shown in the figure below. It is bounded to the west by Portland Place, Belleview Road, and the Madeira School; to the east by Meadow Green Lane, Dominion Reserve, and Canal Drive; to the south by Weller Avenue and Lewinsville Road; and to the north by the Potomac River.

Aerial Photograph of Bull Neck Run

The headwaters of Bull Neck Run begin at the Spring Hill District Park, which is located near the intersection of Spring Hill Road and Lewinsville Road. The stream then passes through Bull Neck Stream Valley Park and continues until it discharges to the Potomac River.

Some facts about Bull Neck Run include the following:

- Flows from south to north
- Stream length is approximately 2.5 miles
- One major unnamed tributary contributes significant stream flow

Characteristics

Fallen trees and debris are causing a severe impact to Bull Neck Run just north of Georgetown Pike

The current impervious area in this watershed is eight percent of the total area. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The current land use in the watershed is:

- Predominantly low-density residential
- Open space downstream of Old Dominion Drive and estate residential adjacent to Spring Hill Road.
- Low-density residential along the upper portions of the watershed.
- 147 acres, or nine percent of the watershed is comprised of open space, parks, and recreational areas including Greenway Heights Park, Bull Neck Stream Valley Park, and Spring Hill District Park.

For the future land use condition, open space may be replaced by estate and low-density residential development and the future imperviousness may increase to 12 percent.

The overall condition of the watershed is summarized as follows:

Bull Neck Run Watershed Condition Summary

- Current imperviousness is eight percent with the majority being low-density residential land use
- Future imperviousness is 12 percent
- 13 crossings have “minor to moderate” impacts
- Majority of the habitat quality is “fair” with inadequate buffers
- Actively widening stream
- “Moderate to severe” erosion at three locations
- Three obstruction locations block the stream
- One trash dumpsite

Upstream segments of the channel have been lined with concrete or large stones. The stream has “minor to moderate” erosion due to pipe crossings. Approximately 271 acres, or 17percent of the watershed drains to stormwater management facilities.

Stream Quality

Severe erosion downstream of the Alvord Street crossing

- The Fairfax County Stream Protection Strategy Baseline Study from January 2001 evaluated the quality of streams throughout the county and the county evaluated the physical condition of Bull Neck Run in January 2003. The stream quality for Bull Neck Run can be summarized as follows:
- “Excellent” composite site condition rating based on biological integrity, stream physical assessment, habitat assessment, fish species richness, and percent imperviousness

- Majority of the stream buffer consists of lawns
- 15 percent to 30 percent of the bank area has erosion
- 44 percent of Bull Neck Run exhibits "good" habitat quality and 31 percent of the stream exhibits "excellent" habitat quality

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, and also by the Middle Potomac Watersheds Steering Committee. They identified problem areas in Bull Neck Run such as:

- Inadequate pipe infrastructure.
- Trail erosion from overuse.
- Pollution from parking lots.

Issues/Solutions

The goals for the Middle Potomac Watersheds Management Plan were derived from the issues identified by the community and the project team based on their analysis of the watersheds' condition.

While the overall health of the Bull Neck Run Watershed is good, some projects will be needed, as well as continued monitoring of the watershed, to maintain the water quality and manage stormwater runoff volumes as the watershed becomes more developed.

Solutions recommended for the Bull Neck Run Watershed in the *Final Draft Middle Potomac Watersheds Management Plan* include structural and non-structural practices. The proposed projects have been prioritized and will be implemented over 25 years. The following projects are proposed to be implemented in the next five years. Specific details on the projects that follow can be found in Chapter 4 and Appendix A.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit.

1. Removal of channel obstructions that block stream flow and clean up of dumpsites (Dumpsite/Obstruction Removal Projects BN9901 and BN9918).
2. Restoration of vegetated stream buffers to mitigate stream bank erosion (Buffer Restoration Project BN9302).
3. Installation of low impact development techniques such as manufactured tree-box filters, bioretention areas, and bio-swales to reduce stormwater runoff volumes and improve water quality (New LID Project BN9811).
4. Retrofit of existing stormwater management facilities to provide better stormwater quantity control and water quality treatment (BMP Retrofit Project BN9105).
5. Education and outreach initiatives that will be implemented for the entire 25-year period. These projects are designed to involve the stakeholders in improving the watershed (Public Education Project BN9913, Community Outreach Project BN9914, LID Promotion Project BN9915, Enforcement Enhancement Project BN9916 and Stream Assessment Project BN9921).

The county (encompassing all county government entities) and other stakeholders of the Middle Potomac Watersheds are committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem. This commitment emphasizes the importance of protecting the county's valuable natural resources, including surface waters, and supports the sustainability and improvement of the environment, which has a direct impact on the quality of life of the county's residents.

Middle Potomac Watersheds steering committee meeting

Scotts Run Watershed Summary Sheet

Overview

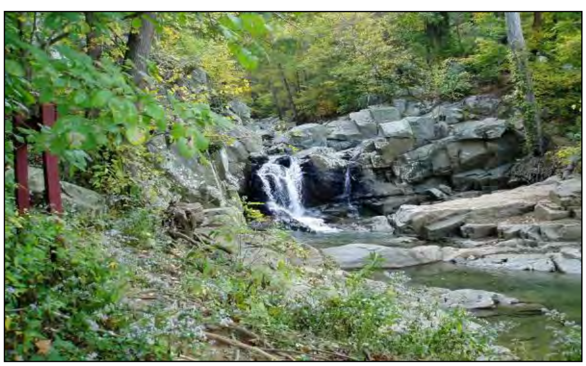
The Scotts Run Watershed has an approximate area of 3,860 acres as shown in the figure below. It is bounded to the west by Tysons Corner Shopping Center, Spring Hill Road and Canal Drive; to the east by Magarity Road, Balls Hill Road and portions of I-495; to the south by Leesburg Pike; and to the north by the Potomac River.

Aerial photograph of the Scotts Run Watershed

The headwaters of Scotts Run begin at a stormdrain system outfall located on the east side of I-495, just southeast of Tysons Corner Shopping Center. Scotts Run then flows in a northerly direction through Scotts Run Nature Preserve before it discharges to the Potomac River.

Some facts about Scotts Run include the following:

- Flows from south to north
- Length is approximately 4.5 miles
- Watershed is divided into two subwatersheds, Upper Scotts Run and Lower Scotts Run
- Several major unnamed tributaries contribute significant stream flow; Bradley Branch is the only named tributary



Falls at the downstream end of Scotts Run

Characteristics

The current impervious area in this watershed is 30 percent of the total area. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The current land use in the watershed is:

- Predominantly road right of ways.
- Commercial land, such as Tysons Corner, located to the southwest and low-density residential and forested land in the northern portions of the watershed.
- 554 acres, or 14 percent of the watershed is comprised of open space, parks, and recreational areas including McLean Hamlet Park, Scotts Run Stream Valley Park, Westgate Park, Timberly Park, and Scotts Run Nature Preserve.

For the future land use conditions, estate residential land use may be replaced by low-density residential development and the future imperviousness may increase to 33 percent.

The overall condition of the watershed is summarized as follows.

Scotts Run Watershed Condition Summary

- Current imperviousness is 30 percent with the majority being low-density residential land use
- Future imperviousness is 33 percent
- 33 of 34 crossings have “minor to moderate” impacts
- Habitat quality is “fair” with inadequate buffers
- Actively widening stream
- “Minor to moderate” erosion at 12 locations
- Five obstruction locations block the stream

The stream has “minor to moderate” erosion due to discharge from the stormdrain pipes. Approximately 743 acres in the watershed drain to stormwater management facilities.

Stream Quality

The Fairfax County Stream Protection Strategy Baseline Study from January 2001 evaluated the quality of streams throughout the county and the county evaluated the physical condition of Scotts Run in January 2003.

Severe erosion was observed at Scotts Run north of Old Dominion Drive

The stream quality for Scotts Run can be summarized as follows:

- “Very poor” composite site condition rating based on biological integrity, stream physical assessment, habitat assessment, fish species richness, and percent imperviousness
- Majority of the stream buffer is inadequate and

consists of lawns

- 15 percent to 30 percent of the bank area in Upper Scotts Run has erosion
- 40 percent to 50 percent of the bank area in Lower Scotts Run has erosion
- 57 percent of Upper Scotts Run exhibits “fair” habitat quality and 43 percent exhibits “poor” habitat quality
- 31 percent of Lower Scotts Run exhibits “excellent” habitat quality, 28 percent exhibits “good” habitat quality and 41 percent exhibits “fair”

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, and also by the Middle Potomac Watersheds Steering Committee. They identified problem areas in Scotts Run such as:

- Erosion of the stream banks.
- Obstructions in the stream channel.
- Pollution from parking lots.
- Development causing increased runoff.

Issues/Solutions

The goals for the Middle Potomac Watersheds Management Plan were derived from the issues identified by the community and the project team based on their analysis of the watersheds’ condition.

The Upper Scotts Run Watershed, which includes the Tysons Corner area, is highly urbanized, with 64 percent commercial, industrial, and road right of way land use. More development is expected as the Washington Metropolitan Area Transit Authority expands their rail lines and adds four rail stations to the area in the future. This development will be addressed by the Tysons Corner Stormwater Strategy, SC9845, discussed in more detail as Policy Action B2.5 in Chapter 9.

In contrast to the urbanization in Upper Scotts Run, Lower Scotts Run is has only 15 percent commercial, industrial, and road right of way land use. There is much more residential land use in Lower Scotts Run, as well as the 380 acre Scotts Run Nature Preserve. However, the large amount of impervious area in Upper Scotts Run impacts Lower Scotts Run through increased stormwater runoff volumes and poor water quality. One of the main problems in Lower Scotts Run is flooding, particularly in the Swinks Mill area.

Solutions recommended for the Scotts Run Watershed in the *Final Draft Middle Potomac Watersheds Management Plan* include structural and non-structural practices. The proposed projects have been prioritized and will be implemented over 25 years. The following projects are proposed to be implemented in the next five years. Specific details on the projects that follow can be found in Chapter 5 and Appendix A.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit.

1. Removal of channel obstructions that block stream flow and clean up of dumpsites (Dumpsite/Obstruction Removal Project SC9903).
2. Restoration of vegetated stream buffers to mitigate stream bank erosion (Buffer Restoration Project SC9352).
3. A Neighborhood Stormwater Improvement Area for a neighborhood with no stormwater controls to reduce flooding and increase water quality. (Neighborhood Stormwater Improvement Area SC9819).
4. Retrofit of existing stormwater management facilities to provide better stormwater quantity control and water quality treatment (BMP Retrofit Projects SC9114, SC9117, SC9126, SC9141 and SC9147).

Wet pond example

5. Construction of new stormwater management facilities such as wet ponds or dry detention basins (New BMP Projects SC9128, SC9132, SC9137, SC9142, SC9157, SC9158 and SC9167).
6. Education and outreach initiatives that will be implemented for the entire 25-year period. These projects are designed to involve the stakeholders in improving the watershed (Public Education Project SC9976, Community Outreach Project SC9977, LID Promotion Project SC9978, Enforcement Enhancement Project SC9979 and Stream Assessment Project SC9982).

The county is committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem.

Dead Run Watershed Summary Sheet

Overview

The Dead Run Watershed has an approximate area of 1,922 acres and is shown in the figure below. It is bounded to the west by Balls Hill Road and I-495; to the east by Old Chain Bridge Road and Ridge Drive; to the south by Chain Bridge Road; and to the north by the Potomac River.

Aerial photograph of the Dead Run Watershed

The headwaters of Dead Run begin near Pathfinder Lane and the stream continues through the McLean Central Park, which is located near the intersection of Old Dominion Drive and Dolley Madison Boulevard. The stream then passes through the Dead Run Stream Valley Park and continues until it discharges to the Potomac River.

Some facts about Dead Run include the following:

- Flows from south to north
- Length is approximately three miles
- Several major unnamed tributaries contribute significant stream flow
- Watershed land elevations range from 260 to 270 feet in the southern part to elevations of 55 to 85 feet in the northern part

Concrete lined portion of Dead Run

Characteristics

The current impervious area in this watershed is 25 percent of the total area. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The current land use in the watershed is:

- Predominantly medium-density residential.
- Low-density residential and low-intensity commercial throughout the lower portions of the watershed.
- 265 acres, or 14 percent of the watershed is comprised of open space, parks, and recreational areas including Langley Oaks Park, Churchill Road Park, Dead Run Stream Valley Park, and McLean Central Park.

For the future land use condition, estate residential land use may be replaced by low-density residential development and the future imperviousness may increase to 29 percent.

The overall condition of the watershed is summarized as follows.

Dead Run Watershed Condition Summary

- Current imperviousness is 25 percent with the majority being medium-density residential land use
- Future imperviousness is 29 percent
- 24 stream crossings have "minor to moderate" impacts
- Habitat quality is "fair" with inadequate buffers
- Actively widening stream
- "Moderate to severe" erosion at three locations
- Two obstruction locations block the stream
- One trash dumpsite

The stream has "minor to moderate" erosion due to pipe crossings. Approximately 294 acres in the watershed drain to stormwater management facilities.

Stream Quality

The Fairfax County Stream Protection Strategy Baseline Study from January 2001 evaluated the quality of streams throughout the county and the county evaluated the physical condition of Dead Run in January 2003.

Eroded stream banks at a tributary to Dead Run near Churchill Road

The stream quality for Dead Run can be summarized as follows:

- "Very poor" composite site condition rating based on biological integrity, stream physical

assessment, habitat assessment, fish species richness, and percent imperviousness
- Majority of the stream buffer is inadequate and consists mainly of lawns
- 30 percent to 50 percent of the bank area has erosion
- 61 percent of Dead Run exhibits "fair" habitat quality and 20 percent exhibits "good" habitat quality

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, and also by the Middle Potomac Watersheds Steering Committee. They identified problem areas in Dead Run such as:
- Frequent flooding of residential properties.
- Inadequate pipe infrastructure.
- Trail erosion from overuse.
- Pollution from parking lots.
- Non-functioning stormdrains.
- Increasing impervious area from excessive build-out of residential lots.
- Poor stream buffers.

Backyard flooding near Kyleakin Court

Issues/Solutions

The goals for the Middle Potomac Watersheds Management Plan were derived from the issues identified by the community and the project team based on their analysis of the watersheds' condition.

The Dead Run Watershed is mainly residential. The main issues in the watershed are increasing imperviousness from mansionization and flooding of homes and properties. Mansionization will increase the overall imperviousness in the watershed by one percent, which will in turn increase the stormwater runoff volumes and cause increased stream erosion.

Solutions recommended for the Dead Run Watershed in the *Final Draft Middle Potomac Watersheds Management Plan* include structural and non-structural practices. The proposed projects have been prioritized and will be implemented over 25 years. The following projects are proposed to be implemented in the next five years. Specific details on the projects that follow can be found in Chapter 6 and Appendix A.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit.

1. Removal of channel obstructions that block stream flow and clean up of dumpsites (Dumpsite/Obstruction Removal Project DE9901).
2. Restoration of streams and vegetated stream buffers to mitigate stream bank erosion and improve stream habitat. (Stream Restoration Project DE9226, Buffer Restoration Projects DE9303 and DE9310).
3. A Neighborhood Stormwater Improvement Area for a neighborhood with no stormwater controls to reduce flooding and increase water quality. (Neighborhood Stormwater Improvement Area DE9836).
4. Retrofit of existing stormwater management facilities to provide better stormwater quantity control and water quality treatment (BMP Retrofit Projects DE9106, DE9120, DE9122 and DE9130).
5. Construction of new stormwater management facilities such as wet ponds or dry detention basins (New BMP Projects DE9112 and DE9129).
6. Education and outreach initiatives that will be implemented for the entire 25-year period. These projects are designed to involve the stakeholders in improving the watershed (Public Education Project DE9939, Community Outreach Project DE9940, LID Promotion Project DE9941, Enforcement Enhancement Project DE9942 and Stream Assessment Project DE9947).

The county is committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem.

Turkey Run Watershed Summary Sheet

Overview

The Turkey Run Watershed has an approximate area of 1,248 acres as shown in the figure below. It is bounded to the west by Ridge Drive and Langley Oaks Park; to the east by Savile Lane; to the south by Georgetown Pike; and to the north by the Potomac River.

Aerial photograph of Turkey Run Watershed

The headwaters of Turkey Run begin at a natural springs located south of Georgetown Pike. Turkey Run flows under Georgetown Pike, then flows in a northerly direction until it discharges to the Potomac River.

Some facts about Turkey Run include the following:

- Flows from south to north
- Length is approximately 1.7 miles
- One unnamed tributary contributes significant stream flow
- Watershed land elevations range from 210 to 230 feet in the southern part to elevations of 55 to 75 feet in the northern part

Characteristics

Fallen trees and debris are causing a severe impact to the stream east of Turkey Run Road

The current impervious area in this watershed is 15 percent of the total area. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The current land use in the watershed is:

- Predominantly low-intensity commercial.
- Low-density residential and forested lands that are located in the upper portions of the watershed.
- The Central Intelligence Agency (CIA) and the Federal Highway Administration that are located to the east.
- 461 acres, or 37 percent of the watershed is comprised of open space, parks, and recreational areas including Langley Oaks Park, Langley Fork Park, Clemyjontri Park, Turkey Run Recreation Area, and Claude Moore Colonial Farm.

For the future land use condition, estate residential land use may be replaced by low-density residential development and the future imperviousness may increase to 16 percent.

The overall condition of the watershed is summarized as follows.

Turkey Run Watershed Condition Summary

- Current imperviousness is 15 percent with the majority being low-intensity commercial land use
- Future imperviousness is 16 percent
- Seven crossings have “minor to moderate” impacts
- Habitat quality is “excellent”
- Several locations have inadequate buffers
- Actively widening stream
- “Moderate to severe” erosion at two locations
- Two obstruction locations block the stream

At one outfall pipe location there is “minor to moderate” erosion of the channel due to the discharge from the pipe. Approximately 61 acres in the watershed drain to one stormwater management facility.

Stream Quality

Poor buffer area southwest of Kedleston Court

The Fairfax County Stream Protection Strategy Baseline Study from January 2001 evaluated the quality of streams throughout the county and the county evaluated the physical condition of Turkey Run in January 2003.

The stream quality for Turkey Run can be summarized as follows:

- “Excellent” composite site condition rating based on biological integrity, stream physical assessment, habitat assessment, fish species richness, and percent imperviousness
- Majority of the stream buffer consists of grass

- 15 percent to 30 percent of the bank area has erosion
- 60 percent of Turkey Run exhibits "excellent" habitat quality and 30 percent exhibits "fair" habitat quality

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, and also by the Middle Potomac Watersheds Steering Committee. They identified problem areas in Turkey Run such as:

- Inadequate pipe infrastructure.
- Pollution from a parking lot.

Issues/Solutions

The goals for the Middle Potomac Watersheds Management Plan were derived from the issues identified by the community and the project team based on their analysis of the watersheds' condition.

The main issue in Turkey Run is the lack of Stormwater Management ponds and Best Management Practices which can reduce downstream stormwater runoff volumes and increase water quality.

While the overall health of the Turkey Run Watershed is good, some projects will be needed, as well as continued monitoring of the watershed, to maintain the water quality and manage stormwater runoff volumes as the watershed becomes more developed.

Solutions recommended for the Turkey Run Watershed in the *Final Draft Middle Potomac Watersheds Management Plan* include structural and non-structural practices. The proposed projects have been prioritized and will be implemented over 25 years. The following projects are proposed to be implemented in the next five years. Specific details on the projects that follow can be found in Chapter 7 and Appendix A.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit.

1. Removal of channel obstructions that block stream flow and clean up of dumpsites (Dumpsite/Obstruction Removal Project TR9902).
2. Restoration of streams to mitigate stream bank erosion and improve stream habitat (Stream Restoration Project TR9201).
3. Installation of low impact development techniques such as manufactured tree-box filters, bioretention areas and bioswales to reduce stormwater runoff volumes and improve water quality (New LID Project TR9807).

Bioretention area example

4. Retrofit of existing stormwater management facilities to provide better stormwater quantity control and water quality treatment (BMP Retrofit Project TR9104).
5. Education and outreach initiatives to involve the stakeholders in improving the watershed (Public Education Project TR9914, Community Outreach Project TR9918, LID Promotion Project TR9919, Enforcement Enhancement Project TR9920 and Stream Assessment Project TR9922).

The county is committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem.

Pimmit Run Watershed Summary Sheet

Overview

The Pimmit Run Watershed has an area of approximately 8,083 acres that includes 1,356 acres of Arlington County, as shown in the figure below. It is bounded to the west by Interstate 495; to the north by Chain Bridge Road and Dolley Madison Boulevard; to the northeast by the Potomac River; to the east by Glebe Road in Arlington County; and to the south by Lee Highway and Interstate 66. The watershed is divided into four smaller subwatersheds consisting of Upper Pimmit Run, Middle Pimmit Run, Little Pimmit Run and Lower Pimmit Run.

Aerial photograph of the Pimmit Run Watershed

The headwaters of Pimmit Run begin west of Interstate 495 along Gallows Road and drain into a pond just west of the interstate near Madron Lane and Executive Court. The stream discharges into the Potomac River in Arlington County.

Some facts about Pimmit Run include the following:

- Flows from west to east
- Length is approximately 13.1 miles
- 6 major tributaries contribute significant stream flow
- Watershed land elevations range from 350 to 400 feet in the southern part to elevations of 30 to 100 feet in the northern part

The McLean Little League ball fields after flooding

Characteristics

The current impervious area in this watershed is 27 percent of the total area. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The current land use in the watershed is:

- Predominantly medium-density residential.
- Commercial in the southwest.
- Low-density residential and forested land located east of the George Washington Memorial Parkway.
- 502 acres, or six percent of the watershed is comprised of open space, parks, and recreational areas.

For the future land use condition, estate residential land use may be replaced by low-density residential development and the future imperviousness may increase to 30 percent.

The overall condition of the watershed is summarized as follows:

Pimmit Run Watershed Condition Summary

- Current imperviousness is 27 percent with the majority being medium-density residential land use
- Future imperviousness is 30 percent
- Three stream crossings had “moderate to severe” impacts
- 11 utility locations have “minor to moderate” impacts
- Habitat quality is “fair” with inadequate buffers
- Actively widening stream
- “Moderate to extreme” erosion at 28 locations
- Eight obstruction locations block the stream
- Two trash dumpsites

The stream has “minor to moderate” erosion due to pipe crossings. Approximately 609 acres in the watershed drain to stormwater management facilities.

Stream Quality

View of utility poles located in Pimmit Run

Fairfax County Stream Protection Strategy Baseline Study from January 2001 evaluated the quality of streams throughout the county and the county evaluated the physical condition of Pimmit Run in January 2003.

The stream quality for Pimmit Run can be summarized as follows:

- Impaired stream quality due to fecal coliform bacteria
- “Very poor” composite site condition rating based on

- biological integrity, stream physical assessment, habitat assessment, fish species richness, and percent imperviousness
- Majority of the stream buffer is inadequate and consists mainly of scattered shrubs, grasses and forbs
- 30 percent of the bank area has erosion
- 39 percent of Pimmit Run exhibits “fair” habitat quality and 44 percent exhibits “good” habitat quality

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, and also by the Middle Potomac Watersheds Steering Committee. They identified problem areas in Pimmit Run such as:

- Frequent flooding of residential properties.
- Inadequate pipe infrastructure.
- Low water quality.
- Pipes exposed due to erosion.
- Non-functioning stormdrains.
- Concrete channelization.
- Increasing impervious surfaces due to excessive residential build-out.
- Culverts blocked by fallen debris.
- Separation of floodplains from the stream due to streambed erosion.

Issues/Solutions

The goals for the Middle Potomac Watersheds Management Plan were derived from the issues identified by the community and the project team based on their analysis of the watersheds’ condition.

Pimmit Run is primarily residential, with over 60 percent of the watershed estate residential, low density residential, medium density residential, or high density residential land use. In Upper Pimmit Run, many of the streams have been chanelized, or paved with concrete, decreasing infiltration along the stream and also decreasing water quality. Many of the issues in the watershed are related to erosion and flooding.

Backyard flooding near Chesterfield Avenue caused by increased runoff from impervious areas

Solutions recommended for the Pimmit Run Watershed in the *Final Draft Middle Potomac Watersheds Management Plan* include structural and non-structural practices. The proposed projects have been prioritized and will be implemented over 25 years. The following projects are proposed to be implemented in the next five years. Specific details on the projects that follow can be found in Chapter 8 and Appendix A.

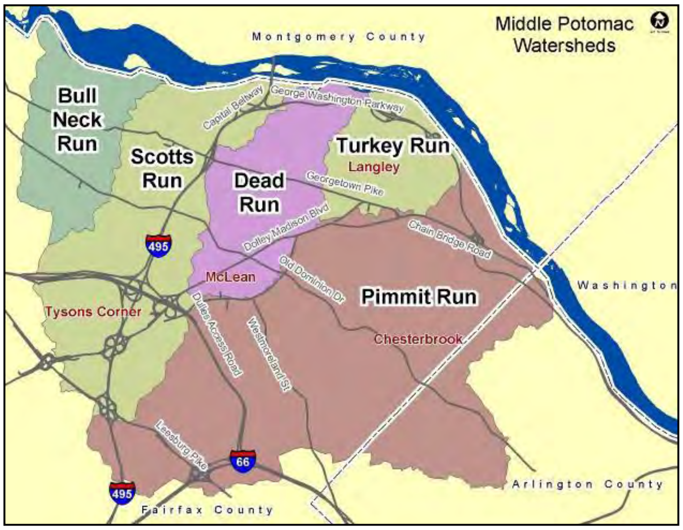
Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit.

1. Removal of channel obstructions that block stream flow and clean up of dumpsites (Dumpsite/Obstruction Removal Projects PM9902 and PM9937).
2. Restoration of vegetated stream buffers to mitigate stream bank erosion (Buffer Restoration Projects PM9301, PM9311, PM9328 and PM9379).
3. Installation of low impact development techniques such as manufactured tree-box filters, bioretention areas, and bio-swales to reduce stormwater runoff volumes and improve water quality (New LID Projects PM9822, PM9824, PM9829, PM9830, PM9831, PM9843, PM9850, PM9852, PM9856, PM9859 and PM9874).
4. A Neighborhood Stormwater Improvement Area for a neighborhood with no stormwater controls to reduce flooding and increase water quality. (Neighborhood Stormwater Improvement Area PM9819).
5. Retrofit of existing stormwater management facilities to provide better stormwater quantity control and water quality treatment (BMP Retrofit Projects PM9136, PM9148, PM9149, PM9154, PM9160 and PM9161).
6. Construction of new stormwater management facilities such as wet ponds or dry detention basins (New BMP Projects PM9144 and PM9155).
7. Education and outreach initiatives that will be implemented for the entire 25-year period. These projects are designed to involve the stakeholders in improving the watershed (Public Education Project PM9984, Community Outreach Project PM9985, LID Promotion Project PM9986, Enforcement Enhancement Project PM9987 and Stream Assessment Project PM9997).

The county is committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem.

Overview

Along with capital improvement projects, policy and land use changes are vital in mitigating the effects of existing and future development in the Middle Potomac Watersheds. The policy and land use recommendations proposed by the Middle Potomac Steering Committee include proposals that would typically involve amendments to the county code and other supporting documents such as the Public Facilities Manual (PFM).



Map of Middle Potomac Watersheds

These recommendations will need to be further evaluated by the county in light of their countywide implications.

The current planned approach for processing the policy recommendations from the Middle Potomac Watersheds Management Plan is to integrate these recommendations with similar recommendations in the other county watershed management plans that were recently completed. Specific ordinance amendments would then be drafted in light of other county initiatives and address the common ground that can be established between the various policy recommendations.

Reduction in Roadway Runoff

With roadways accounting for a significant amount of the impervious surface in Fairfax County, one recommended policy action is to encourage transportation authorities to further control runoff from both new and existing roadway pavement. Specific actions for transportation authorities include:

- Applying the same stringent stormwater controls for commercial and residential development to transportation projects.
- Reducing imperviousness along the project corridor by providing more efficient access to entrances, removing old pavement, and reducing overall pavement footprints.

Increased Use of LID

Another policy action is to increase the use of Low Impact Development (LID) for all new and existing development in order to reduce runoff and improve water quality. Methods to accomplish this include:

- Establishing design assistance, outreach programs, and educational programs for individual landowners, design professionals, developers, and technical review staff to install LID.
- Add incentives to use LID by arranging for a technical, pre-review process to ensure that proposed plans are workable and potentially acceptable to the county.
- Provide flexibility to county staff to administratively approve deviations of the minimum yard requirements in return for the use of contiguous areas needed for LID.

Policy Actions for Middle Potomac Watersheds

- Require reduced runoff from new and existing roadways
- Provide incentives for use of LID and require developers to use LID to the 'maximum extent practicable'
- Implement proposed Tysons Corner Stormwater Strategy to mitigate effects of development
- Protect stream buffers and wetlands
- Implement an LID awareness program

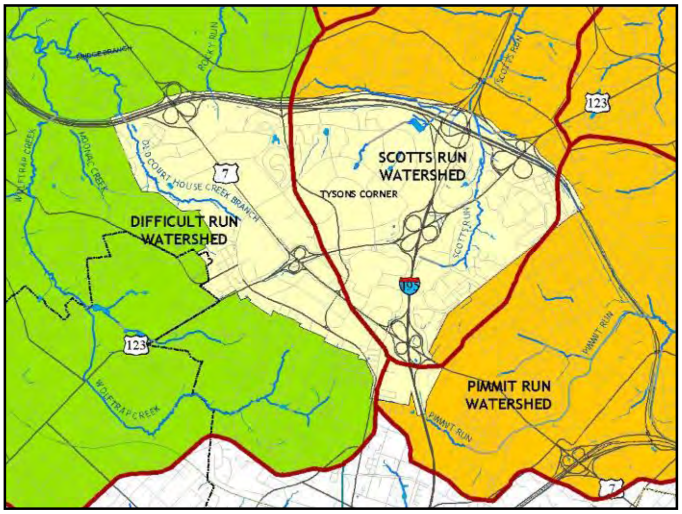
Other recommended Policy Actions that will serve to protect and improve habitat and water quality to sustain native species include:

- Providing a list of desirable LID projects so that developers considering the use of proffers can easily find where projects are needed.
- Continue to evaluate LID practices for application to private sector development projects to the maximum extent practicable.
- Requiring all public facilities to use LID to the 'maximum extent practicable'.

Tysons Corner Stormwater Strategy

Implementation of the Tysons Corner Stormwater Strategy Project SC9845 in conjunction with new metrorail stations is recommended.

Portions of Tysons Corner will be redeveloped as the Metro rail expands to the area. LID measures, new Best Management Practices (BMPs), BMP retrofits, and additional stormwater management requirements for developed properties without existing BMPs should be implemented to mitigate the effects of both new development and the existing impervious areas. Fairfax County has initiated a Tysons Corner Transportation/Urban Design Study and appointed a Tysons Land Use Task Force to coordinate community participation and recommend changes to the 1994 Tysons Corner Comprehensive Plan. Additional information on the Tysons Corner Study is available at www.fairfaxcounty.gov/dpz/tysonscorner/.



Map of Tysons Corner Watersheds

Protect Stream Buffers and Wetlands

Another goal through policy action is to restore and protect vegetated stream buffers and wetlands in order to filter pollutants from runoff, provide erosion control, improve water quality, and provide habitat for animals. A means to accomplish this is through the following:

- The county should utilize environmentally-sensitive trail design in the vegetated buffers to reduce stormwater impacts where possible.
- The county should work to encourage mitigation for wetland losses resulting from development to be mitigated within the same hydrologic area (same local watershed). In addition, the county's PFM should be changed to allow for alternate but friendlier trail and bridge designs that still meet ADA requirements where possible

Establish an LID Awareness Program

The county should promote the implementation and maintenance of LID practices through an LID Awareness Program. This can be accomplished through the following:

- Creating a program that certifies citizens to inspect rain gardens and other LID measures.
- Recommending that HOAs should post signs identifying locations of LID measures in order to prevent inadvertent damage. A universal common symbol should be developed and posted near LID measures.
- If and when a stormwater utility is established, providing opportunities for landowners to lower their utility fees by installing LID measures on their properties.

Benefits of these actions include:

- An inspection and maintenance program will help keep the LID sites functioning properly and therefore maintain and improve water quality.
- LID signs will increase public awareness of LID measures and should help to prevent inadvertent damage to LID sites.
- This action would help to increase the installation of LID methods by individual property owners.

The county is committed to protecting the streams in the watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other watershed areas to an environmentally healthy ecosystem.

Chapter 1

Introduction

1.1 Vision

The *Middle Potomac Watersheds Management Plan* offers the following vision for the future condition of the Bull Neck Run, Scotts Run, Dead Run, Turkey Run and Pimmit Run Watersheds.

"The Middle Potomac Watersheds will be protected, clean, and sustainable ecosystems that provide wildlife habitat along with balanced opportunities for public enjoyment."

This statement was developed by the Middle Potomac Watersheds Steering Committee and the Watershed Planning Team to provide a vision for protecting and improving the future condition of the watersheds. Some of the existing issues in the watersheds include flooding of property and roadways, excessive amounts of runoff, poor water quality, and degraded riparian and aquatic habitat. Much of the watersheds were developed before stormwater controls were required, allowing runoff from impervious surfaces such as roofs, roadways and sidewalks to flow directly into the streams in large quantities, often causing downstream flooding and stream deterioration, including instream erosion. The condition of the watersheds has been damaged further by recent infill development and other sources of increased imperviousness, such as road widening projects. This watershed plan describes actions for addressing the watershed issues and providing future opportunities for public enjoyment of the streams. Stakeholders in the watersheds have been actively involved in identifying the issues and developing the plan goals, objectives, and actions.

Capital projects, such as constructing new best management practices (BMPs), using Low-Impact Development (LID) methods, retrofitting existing BMPs, restoring stream buffers, and restoring streams have been recommended to address the watersheds' issues. Education and outreach actions are included in this plan to teach people about watershed problems and possible solutions and to get stakeholders involved in protecting and restoring the watersheds. The proposed structural and non-structural projects that will help to realize the plan vision are described in more detail in Chapters 4 through 8. These projects will begin to reduce the amount of runoff, improve water quality in the streams, restore stream habitat, and help the county meet its Chesapeake 2000 and Cool Counties goals.

Other methods for resolving the current issues will require the development of policies and legislation to help protect and restore the watershed ecosystems by addressing the need for effective stormwater management, enforcement of existing ordinances, and comprehensive planning. The policies and land-use recommendations in this plan will be developed in conjunction with the recommendations from the other county watershed management plans. The goal of the proposed policy and legislation will be to protect and restore the watersheds so that they can be enjoyed for many future generations. The recommended policy and land-use actions are described in more detail in Chapter 9.

The watershed plan vision is consistent with Fairfax County's *Policy Plan* (the county-wide element of the county's comprehensive plan), within which the Board of Supervisors' adopted goals can be found. The Board of Supervisors' goal for environmental protection states:

> "The amount and distribution of population density and land uses in Fairfax County should be consistent with environmental constraints inherent in the need to preserve natural resources and to meet or exceed federal, state, and local standards for water quality, ambient air quality, and other environmental standards. Development in Fairfax County should be sensitive to the natural setting to prevent degradation of the county's natural environment."

The county policy document also notes that:

> "The protection and restoration of the ecological quality of streams is important to the conservation of ecological resources in Fairfax County. Therefore, efforts to minimize adverse impacts of land use and development on the county's streams should be pursued."

This watershed management plan is intended to complement and supplement the county's policies and comprehensive plans over the next 25 years and support its commitment to the Clean Water Act and Virginia's commitment to the Chesapeake Bay Act. The county, which encompasses all county government entities and other stakeholders of the Middle Potomac Watersheds, is committed to protecting the Middle Potomac Watersheds from future degradation and promoting watershed-wide management actions that work to restore the streams and other areas in the watersheds to environmentally healthy ecosystems. This commitment emphasizes the importance of protecting the county's valuable natural resources, including surface waters, and supports the sustainability and improvement of the environment, which has a direct impact on the quality of life of the county's residents. Current stream conditions throughout the watersheds are generally poor, and this plan proposes a comprehensive strategy for improving these conditions. The plan was written to help manage future changes in the watersheds to protect the streams so they can be enjoyed by future generations. The objectives of the plan will also help the county meet or exceed federal, state, and local regulatory water quality requirements. This plan is only the first step in the process and is designed to be a living document that will be updated as becomes necessary over the 25-year implementation schedule. It will not be able to solve all of the problems in the watersheds, but will guide the county in the right direction.

The planning process initiated by Fairfax County for development of this watershed management plan included the participation and recommendations of a watershed steering committee. The Middle Potomac Watersheds Steering Committee was convened as an advisory committee for the *Middle Potomac Watersheds Management Plan* project team, and the committee members served as liaisons between their respective communities or organizations and the project team. Several public workshops were held to receive input from the community regarding the watershed issues and possible solutions. The project team used this information to help evaluate the watersheds and provide recommendations for addressing the issues.

1.2 Background

This plan was developed as part of a county initiative to create watershed management plans for all Fairfax County watersheds. The Middle Potomac Watershed Group contains some of the most diverse watersheds and is located in the northeast portion of Fairfax County. Tysons Corner, one of the largest commercial centers on the East Coast, is located in the Scotts Run Watershed, and large natural areas are located near the Potomac River in the Scotts Run, Dead Run, and Turkey Run Watersheds. The *Middle Potomac Watersheds Management Plan* provides a strategy for mitigating the impacts of development, such as increased runoff and poor water quality.

The history of the county's watershed management began in the 1940s with the conversion of agricultural land use to residential and commercial land uses. During this time, stormwater infrastructure was constructed to quickly carry runoff away from the developed areas to the creeks and streams that serve as the principal drainage system for the county. Starting in 1972, onsite detention was required for new development to minimize the effects of increased runoff from development. In the early 1980s, water quality best management practices (BMPs) were required for new development in the southern areas of the county that drained to the Occoquan drinking water reservoir. Stormwater BMPs were required for all new development in the county starting in 1993.

In the late 1970s, the county developed master drainage plans for all of the watersheds in the county, including the Middle Potomac Watersheds. This plan identified projects to solve problems that included flooding, erosion, sedimentation, and other environmental impacts and issues projected through the year 2000. The county has initiated a stream restoration and protection study and completed the *Fairfax County Stream Protection Strategy* (www.fairfax.va.us/gov/DPWES/environmental/SPS_Main.htm) in January 2001. This baseline study evaluated the condition of county streams and prioritized the watersheds for protection strategies. The *Stream Protection Strategy* program is ongoing, with further biological monitoring and assessment of stream condition. The residents of Fairfax County have also played an important role in the management of the county's watersheds, and they will continue to do so in the future.

Building on the recommendations from the *Stream Protection Strategy* baseline study, the county initiated a process to develop watershed management plans for all 30 watersheds in the county. The development of the watershed management plans includes a stream physical assessment of over 800 miles of stream; community involvement; modeling of the creeks and streams; and the development of goals, objectives, and strategies for addressing watershed issues.

1.3 Purpose

The primary reasons the *Middle Potomac Watersheds Management Plan* was developed can be summarized as follows.

1. To restore and protect the county's streams, of which 80 percent are in "fair" to "very poor condition"
2. To meet state and federal water quality standards by identifying strategies to prevent and remove pollution
3. To support Virginia's commitment to the Chesapeake 2000 Agreement to clean up the Chesapeake Bay
4. To replace the currently outdated watershed management plans and incorporate the use of new technologies
5. To take a comprehensive approach in addressing multiple regulations, commitments, and community needs

With input from the Middle Potomac Watersheds Steering Committee and other members of the community, this watershed management plan addresses these needs and requirements with a strategy for restoring and protecting the watersheds.

1.4 Plan Implementation

The Middle Potomac Watersheds Management Plan offers a range of recommendations to help reduce nutrient loadings and sediment in the streams, improve stream habitat and reduce the stormwater runoff peak flows in the primary tributaries. Plan recommendations are divided into two categories: structural and non-structural projects and policy-related recommendations. Structural projects include measures such as modifications to existing stormwater management facilities to improve water quality controls and/or improved quantity controls, new stormwater management facilities, Low Impact Development (LID) practices, and stream restoration. Modifications to existing stormwater facilities are often a cost-effective means of providing increased water quality and/or quantity control benefits. Non-structural recommendations include practices such as developing educational and outreach materials, regular stream cleanups, and supporting the formation of "Friends of" organizations and volunteer monitoring groups. It is anticipated that the structural and non-structural projects will be implemented through the following means:

- County-initiated projects via the capital improvement program
- Developer-initiated projects as waiver conditions or via the zoning approval process through proffers or development conditions
- Partnerships with volunteer groups and other organizations such as the Northern Virginia Soil and Water Conservation District.

Further information on project implementation can be found in Section 3.4.

1.5 Plan Organization

The *Middle Potomac Watersheds Management Plan* integrates environmental management, natural resource protection, and community goals to improve the watersheds. It provides a guide that:

- Describes goals and objectives to support the vision for the watersheds.
- Assesses the existing and future condition of the watersheds.
- Sets forth strategies for addressing watershed issues.
- Provides the county and the community with a management tool to make informed decisions regarding short-term and long-term actions in the watersheds.

The watershed plan chapters contain the following information.

Chapter 1	Vision, background, purpose, and plan organization
Chapter 2	General watershed information, watershed history, land use and impervious cover, tributary information, summary of existing reports and data, and future watershed condition
Chapter 3	Watershed management plan goals, objectives and actions
Chapters 4-8	Watershed characteristics, description of the storm drain infrastructure, stream geomorphology, stream habitat quality, problem areas, modeling results, proposed structural and non-structural actions, action benefits, implementation strategy, and monitoring plan
Chapter 9	Policy and land-use actions, action benefits, implementation strategy, and monitoring plan

Supplemental sections and appendices include a glossary; list of acronyms and abbreviations; references; project fact sheets with cost estimates; stream restoration information; native plant resources; a description of the modeling process; a list of the plan goals, objectives and actions; and a list of projects by type.

This document is the final draft of the *Middle Potomac Watersheds Management Plan*. It is anticipated that the final version of the plan will be made available to the public in early 2008.

Chapter 2:

Watershed Group Condition

2.1 General Watershed Group Information

The Middle Potomac Watershed Group is located in the Chesapeake Bay Watershed in the northeast part of Fairfax County, Virginia, and comprises five separate watersheds: Bull Neck Run, Scotts Run, Dead Run, Turkey Run and Pimmit Run (Figure 2.1). A portion of the Pimmit Run Watershed is located in Arlington County, Virginia, while the other four watersheds are entirely within Fairfax County.

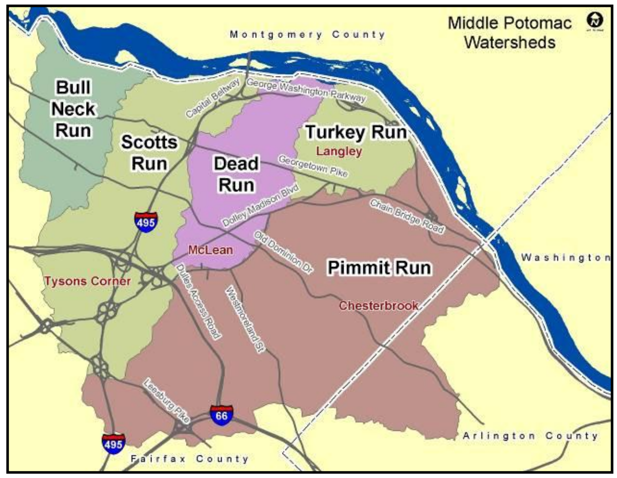


Figure 2.1 Middle Potomac Watersheds

The group is bounded to the west by the Difficult Run Watershed, to the south by the Cameron Run Watershed, and to the southeast by the Four Mile Run Watershed. The Potomac River is located to the north and northeast of the watershed group. The small areas of land located between the watersheds that drain directly into the Potomac River are also included as part of this group. The Middle Potomac Watershed Group covers an area of approximately 26 square miles (16,672 acres). The watersheds are primarily located within the Dranesville magisterial district with a small portion to the south in the Providence district.

The streams of the Middle Potomac Watershed Group generally flow from the southwest to the northeast towards the Potomac River, which eventually flows into the Chesapeake Bay. There are no tidal effects from the Potomac River because of the steep slope of the streams near their outfalls. The mouth of Pimmit Run, however, is in the tidal waters and is located below Little Falls dam.

Interstate 495, also known as the Capital Beltway, traverses the southwest portion of the Pimmit Run Watershed and continues to the northwest through the Scotts Run Watershed. It is the most heavily traveled roadway in the Middle Potomac Watershed Group. The George Washington Memorial Parkway is the second most heavily traveled roadway. It is located along the northeastern boundary of the watershed group through the Scotts Run, Dead Run, Turkey Run, and Pimmit Run Watersheds and parallel to the Potomac River. The Dulles Toll Road, Georgetown Pike, and Dolley Madison Boulevard are other major roadways located within the Middle Potomac Watershed Group. The federal government owns a large portion of land in the Turkey Run Watershed with the Central Intelligence Agency and the Federal Highway Administration located in the northeastern portion of the watershed.

The Middle Potomac Watershed Group is part of the Chesapeake Bay Preservation Area (CBPA) and the main stream corridors are located in the Resource Protection Area (RPA). The RPA is designated around all water bodies with perennial flows to protect the quality of water flowing to the Chesapeake Bay. The RPA totals approximately 1,801 acres in the watershed group. The remainder of the watershed area is part of the Resource Management Area (RMA) and if improperly used or developed could cause significant harm to water quality or diminish the functional value of the RPA. The National Wetlands Inventory map shows a total of 1,528 acres of wetlands in the Middle Potomac Watersheds. The county has performed an analysis to identify additional potential wetland areas based on soil types and ground slopes and it appears that there may be significantly more wetlands than are mapped in the National Wetlands Inventory.

2.2 History of the Watershed

The Middle Potomac Watershed Group is situated in the Piedmont Plateau, a major geological zone and an area of very old crystalline rocks. As European migration to northern Virginia increased, the stress on the natural environment also increased. Large tracts of land between Great Falls and Little Falls were granted to settlers from 1716 to 1719 and may have been cleared for farming soon thereafter. The plantations and small settlements of the colonial period were connected by a crude network of roads and trails.

As the need for large markets grew and as development moved inland from the Potomac River, several roads such as Great Road (now Leesburg Pike) and Sugarlands Rolling Road (now Georgetown Pike) were established through the Middle Potomac Watershed Group area. By the end of the 18th century, most of the land in the upper parts of the Middle Potomac Watershed Group was probably cleared and farmed although the precipitous cliffs located along the river were likely untouched.

By the mid-1800s, after a period of agricultural depression and an influx of northerners seeking inexpensive farm land, two villages called Langley and Lewinsville had taken form. Both of these villages were surrounded by tracts of very fertile land that were devoted primarily to fruit growing, general farming, and dairy farming. By the end of the century, Langley and Lewinsville had become complete villages with facilities such as a church, school, general store, blacksmith shop, post office and town hall. Until the late 1800s, only portions of the Pimmit Run Watershed had commercial development. Other areas began to develop after an electric rail line, the Great Falls and Old Dominion, was constructed between Georgetown and Great Falls. The railroad spurred growth in this area for 20 to 30 years after its construction.

By 1950, when the railroad operations were terminated, several villages had been established. New roads had been built, most notably Westmoreland Street and Great Falls Road, and the older ones, Leesburg Pike and Georgetown Pike, were significantly improved. The Pimmit Hills subdivision, built in the 1950s, was the area's first residential subdivision developed in response to the extensive population migration to the suburbs. Further subdivision development, namely Chesterbrook Gardens and Kent Gardens, occurred in the central portion of the Middle Potomac Watershed Group and in areas located along the Arlington County and the City of Falls Church borders with Fairfax County.

By the mid-1960s, major roadway development such as the Capital Beltway, the George Washington Memorial Parkway, Dolley Madison Boulevard, and the Dulles Toll Road had all been constructed. Also during this time, the CIA constructed a large office facility on a site adjacent to the Bureau of Public Roads tract, which is today the Federal Highway Administration facility. After the 1960s, the focus of residential development shifted from the single-family home subdivision to multi-family home developments and townhouse complexes. Commercial and industrial activities in the watershed area grew rapidly between 1965 and 1970 owing to the extensive development in the Tysons Corner area. The Tysons Corner Regional Shopping Center was built and in operation by 1969. It is the largest single commercial development in this area, occupying an 85-acre site within the triangle formed by Route 7, Route 123, and I-495. Approximately 1,000,000 square feet of leased retail and commercial space are located here as well as approximately 4,700 parking spaces.

2.3 Existing and Future Land Use

Impervious land cover consists of surfaces such as building roofs, asphalt pavement, or concrete pavement for roads, parking lots, driveways, and sidewalks. Additional impervious surface is added as an area is developed to its proposed build out conditions and can continue to increase as areas are redeveloped. Build out occurs when no additional capacity exists for development according to planned land uses and densities in the currently adopted *Comprehensive Plan*. Based on 2002 land use data and recent updates to the building layer, the total impervious area in the watershed is approximately 4,068 acres (24 percent of the total area) which includes Arlington County. The distribution of impervious area for general land use categories is shown in Table 2.1. The impervious area was calculated from the county's most recent Geographic Information System (GIS) data showing the paved area and rooftops (2002) and recent updates to the building layer. This information was used primarily for the hydrologic and hydraulic modeling.

Table 2.1 Middle Potomac Watershed Group Imperviousness

Land Use	Total Area (Acres)	% of Total Area	Impervious Area (Acres)	% of Total Impervious Area
Commercial/Industrial	2,337	14%	967	24 %
Residential	8,905	53%	1,681	40 %
Roads/Sidewalks	2,861	17%	1,420	36 %
Total	**14,103**	**84%**	**4,068**	**100%**

The Scotts Run and Pimmit Run Watersheds include some of the oldest developed areas in Fairfax County. The predominant existing land use in the Middle Potomac Watershed Group is medium-density, single-family residential which covers approximately 26 percent of the area in the Middle Potomac Watersheds. The next most common land use in the watersheds is low-density residential, which comprises 17 percent of the overall land area. Currently 94 percent of the developable land within the five watersheds has been developed. The existing and future land use in the watersheds is shown on Maps 2.2 and 2.3.

Table 2.2 Existing and Future Land Use in the Middle Potomac Watershed Group

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Open space, parks, and recreational areas	1,929	12%	1,905	11%
Estate residential	1,152	7%	412	2%
Low-density residential	2,768	17%	3,407	20%
Medium-density residential	4,266	26%	4,938	30%
High-density residential	719	4%	759	5%
Low-intensity commercial	2,015	12%	1,728	10%
High-intensity commercial	234	1%	485	3%
Industrial	88	1%	164	1%
Other	0	0%	0	0%
Unknown	14	0%	13	0%
Vacant/Undeveloped	626	4%	0	0%
Road right-of-way (including shoulder areas)	2,861	17%	2,861	17%
TOTAL	**16,672**	**100%**	**16,672**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

Please see the glossary for a definition of most of the land use categories.

For ultimate future build out of the watersheds, low-density residential land use may increase from 17 percent to 20 percent (Table 2.2). The future watershed group imperviousness is predicted to increase to 27 percent. There are 626 acres of vacant land and 680 acres of underutilized land in the watershed group. Underutilized parcels have a *Comprehensive Plan* density greater than the existing land use for the parcel. The majority of the underutilized parcels are currently estate residential and have a planned land use of low-density residential. The vacant and underutilized parcel information was obtained from the county's 2003 GIS data.

The Fairfax County *Comprehensive Plan* is used as a guide for county staff and the public in the planning process for land use, urban design, and transportation. The Bull Neck, Scotts, Dead, Turkey and Pimmit Run Watersheds are located primarily in the Area Plan II McLean Planning District, with some portions also located in the Area Plan II Jefferson Planning District and Area Plan I Vienna Planning District. The *Comprehensive Plan* supports mixed use development in the county, particularly in certain areas such as the Tysons Corner Urban Center. The overall major objective for future planning of transportation is to balance the growth of the areas with internal and external traffic demands. There are future plans to improve interchanges, widen roadways, install new trails, or extend mass transit rail through all of the five watersheds. The road widening and mass transit rail expansion projects occur within the existing right-of-ways; therefore the amount of road right-of-way area does not change in the future. The detailed future transportation plans for each watershed can be found in Chapters 4 through 8 under the land use sections.

2.4 Watersheds

The Bull Neck Run Watershed is approximately 1,559 acres, with 1,142 acres draining to Bull Neck Run and the remaining 417 acres draining to unnamed tributaries of the Potomac River. The Bull Neck Run main stem originates near Old Dominion Drive and flows in a northeasterly direction for nearly two miles towards its confluence with the Potomac River in the vicinity of Yellow Falls. The Madeira School and neighborhoods such as Spring Hill and Bull Neck Hundred are located in the Bull Neck Run Watershed.

The Scotts Run Watershed is approximately 3,860 acres and was divided into two subwatershed areas for this watershed management plan. The area draining to Scotts Run is 3,335 acres and 525 acres drain to unnamed tributaries of the Potomac River. Tysons Corner, Scotts Run Nature Preserve, and neighborhoods such as Swinks Mill, McLean Station, Timberly, and The Commons are located in the Scotts Run Watershed. The main stem of Scotts Run flows in a northerly direction for approximately four and a half miles from its source near the Tysons Corner shopping center to its confluence with the Potomac River near Stubblefield Falls.

The Dead Run Watershed is approximately 1,922 acres, with 1,737 acres draining to Dead Run and the remaining 186 acres draining to an unnamed tributary to the Potomac River. The Dead Run main stem flows in a northerly direction from Dolley Madison Boulevard for about three miles through a heavily developed residential area before joining the Potomac River immediately downstream of Cabin John Bridge. A portion of McLean's downtown and neighborhoods such as Evans Farm, the Cloisters, and Langley Forest are located in the Dead Run Watershed.

The Turkey Run Watershed is approximately 1,248 acres, with 704 acres draining to Turkey Run and 544 acres draining to unnamed tributaries of the Potomac River. The Turkey Run main stem is formed by the joining of two small tributaries. Claude Moore Colonial Farm, the Central Intelligence Agency, and Langley are located in the Turkey Run Watershed. The run flows mainly through undeveloped woodlands from its headwaters north of Georgetown Pike in a northerly direction to the Potomac River.

The Pimmit Run Watershed is the largest in the Middle Potomac Watershed Group, consisting of approximately 8,083 acres including 1,356 acres in Arlington County and 335 acres draining to unnamed tributaries of the Potomac River. McLean's downtown, the Potomac School, and neighborhoods such as Pimmit Hills and Marshall Heights are located in the Pimmit Run Watershed. Pimmit Run has six named tributaries and seven unnamed tributaries. The Pimmit Run main stem flows in a northeasterly direction for about eight miles, from its headwaters just beyond the Capital Beltway toward its confluence with the Potomac River immediately downstream of Chain Bridge in Arlington County. For the purposes of this watershed plan, the Pimmit Run Watershed was divided into four subwatersheds to make it easier to evaluate the characteristics of each watershed. Detailed information on the condition of each watershed is provided in Chapters 4 through 8.

2.5 Summary of Existing Reports and Data

2.5.1 Environmental Baseline Report

The *Pimmit Run Environmental Baseline Report* was written by Parsons, Brinkerhoff, Quade and Douglas in June 1975. The report presented a comprehensive view of the environmental baseline conditions for the five watersheds that constitute the Middle Potomac Watershed Group. The stream water quality and the wildlife habitat quality in the Middle Potomac Watershed Group were assessed using a range of "poor" to "excellent."

The *Environmental Baseline Report* states that all of the stream beds in the Pimmit Run Watershed are composed of soils with high erodibility. Erosion and siltation were described as severe in many areas because construction activities during the 1970s had stripped much of the protective vegetation from the stream banks. In Dead Run, stream bed erodibility varied from high near the Potomac River to moderate throughout the upper reaches of the watershed. The Bull Neck Run stream habitat was described as being in good condition due to a minimal amount of development. However, the main stem of this stream is susceptible to erosion because of the highly erodible soils in the area. Turkey Run was described as having poor channel definition and locations of severe erosion due to its soils being highly erodible. The *Environmental Baseline Report* attributed excessive turbidity and high suspended solids concentrations in Scotts Run to ongoing construction activity. Some bank erosion was evident along the reaches downstream of the interchange of the Dulles Toll Road with Interstate 495 to Old Dominion Drive.

2.5.2 Immediate Action Plan Report

The *Immediate Action Plan (IAP) Report for the Pimmit Run, Turkey Run, Dead Run, Scotts Run and Bullneck Run Watersheds* was written by Parsons Brinckerhoff, Quade and Douglas in April 1978. The report identified 42 projects for the Middle Potomac Watershed Group with an estimated cost of $2,960,000. The various projects included piping of channels, adding or replacing culverts, raising roads, and installing riprap bank protection. The purpose of these projects included protecting commercial facilities and residences from flooding, alleviating road flooding, and abating bank erosion. Five of the projects have been constructed, three have been deleted, and three projects are active and fully funded. Twenty-nine projects are inactive with no current funding and the status of two projects is unknown. The completed projects consisted of replacing culverts, stabilizing stream banks, and channelizing streams. The active projects consist of floodproofing houses and stabilizing and restoring streams. The deleted and inactive projects consist of stream stabilization and restoration, floodproofing houses, and replacing culverts. The remaining projects for each watershed are shown in tables in Chapters 4 through 8.

2.5.3 Future Basin Plan Report

The *Future Basin Plan (FBP) Report for the Pimmit Run, Turkey Run, Dead Run, Scotts Run and Bullneck Run Watersheds* was also written by Parsons, Brinckerhoff, Quade and Douglas in April 1978. This report, in conjunction with the *IAP*, specified the watershed group's projected needs up to the year 2000. The report identified 36 projects with an estimated cost of $2,005,000. Five projects have been completed, four projects are active with partial funding, two are deleted, and twenty-two projects are inactive with no current funding. The status of three projects is unknown. The completed projects consisted of replacing culverts, stabilizing stream banks, and channelizing streams. The active projects consist of floodproofing houses and stabilizing and restoring streams. The deleted and inactive projects consist of stream stabilization and restoration, floodproofing houses, and replacing culverts. The projects for each watershed are shown in tables in Chapters 4 through 8.

2.5.4 Fairfax County Master Plan Drainage Projects

As of January 2005, Fairfax County currently has 64 master plan drainage projects for the Middle Potomac Watershed Group. The projects include those identified in the *IAP* and *FBP*, along with additional projects from other sources. Thirty-three of the original master plan drainage projects have been completed and are not listed in the plan. The *Middle Potomac Watershed Management Plan* is one of the master plan drainage projects that is currently underway. The 64 master drainage projects listed in the plan consist of floodproofing houses, stabilizing and restoring streams, and replacing culverts. Thirty-four of the projects have been totally or partially incorporated into projects proposed by this plan, 24 of the projects will remain the same, and six projects require further evaluation to determine if they should be kept or eliminated. The master plan drainage projects for each watershed are shown in tables in Chapters 4 through 8.

2.5.5 Infill and Residential Development Study

The Fairfax County *Infill and Residential Development Study, Draft Staff Recommendations Report* was written by the county in July 2000. Any residential development that will occur proximate to or within already established neighborhoods is referred to as infill development. The recommendations from this study included policies for tree preservation, stormwater management, and erosion and sediment control. The recommended policies will be used to help make decisions regarding the actions recommended in this watershed plan.

Infill development is expected to occur more frequently in the future in the Middle Potomac Watershed Group because the majority of the watershed area is already developed. The average lot size for medium density residential development is 1/8 acre with an average imperviousness of 24 percent. It is anticipated that the percent imperviousness will increase in residential areas as additions are made to existing houses or existing houses are replaced with larger houses. This trend of tearing down smaller houses and replacing them with much larger houses, as well as adding large additions to existing houses that are out of character with the surrounding homes, is called mansionization. Mansionization will increase the imperviousness in the watersheds by one percent, for a total imperviousness of 28 percent for the Middle Potomac Watershed Group.

2.5.6 Fairfax County Virginia Pollutant Discharge Elimination System Permit Data

As part of the Virginia Pollutant Discharge Elimination System (VPDES) permit for its municipal separate storm sewer system (MS4), Fairfax County has initiated a program to monitor its streams on a routine basis and to identify and eliminate illicit discharges. Illicit discharges include sanitary, car wash, or laundry wastewater; radiator flushing; or improper disposal of oil and toxic materials. They are detected by monitoring the flow in the drainage system during dry weather conditions for pH, chlorine, copper, phenol, and detergents. No VPDES illicit discharge screening sites have been established in the Middle Potomac Watershed Group and as a result, there are no illicit discharge data available for this watershed group. A VPDES permit for a wastewater treatment plant has been issued to the Madeira School located at 8328 Georgetown Pike in the Bull Neck Run Watershed.

2.5.7 Stream Water Quality Reporting

The water quality in streams depends on the amount and type of pollutants in the water. Salts, chemicals, metals, oils, nutrients, sediments and other pollutants are washed into streams with stormwater runoff. Nutrients typically include nitrogen and phosphorous which are washed off from lawns that are over fertilized. Pollution of streams with bacteria may be caused by pet waste; waste from wildlife such as ducks, deer and geese; overflowing or broken sanitary sewer pipes; and poorly functioning on-site septic systems.

Virginia Department of Environmental Quality

The Virginia Department of Environmental Quality's (DEQ's) 2006 305(b)/303(d) Water Quality Assessment Integrated Report (found at www.deq.virginia.gov/wqa/ir2006.html) states that the recreation use goal for Pimmit Run is not supported due to exceedances of the fecal coliform bacteria water quality standard recorded at two DEQ water quality monitoring stations located on this stream. In addition to the bacterial impairment, DEQ's 2006 Integrated Report states that Pimmit Run is also impaired for fish consumption due to polychlorinated biphenyls (PCBs), chlordane, and heptachlor epoxide. These contaminants were found in American Eel specimens collected in 2001 and 2004 at DEQ's downstream Pimmit Run water quality monitoring station, located at the bridge at Glebe Road. The aquatic life use in Pimmit Run is fully supported with observed effects due to exceedances of the sediment screening value at the downstream portion of the stream. The 2004 DEQ Integrated Report listed Scotts Run as a Water of Concern based on citizen monitoring stations that revealed medium probability of adverse conditions for aquatic life.

Fairfax County Health Department

The Fairfax County Health Department monitored stream water quality at 84 sampling sites throughout the county in 2002. Eight of those water quality sampling sites were located in the Middle Potomac Watershed Group: four in the Pimmit Run Watershed and one in each of the other watersheds. In 2002, fifteen water samples were collected from each of these sites and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. The year 2002 was a drought year which could give the worst case assessments for the water quality samples if the dominant pollution source is a point source because nonpoint source pollution is reduced during a drought. Information regarding the parameters and data collected for the *Fairfax County 2002 Stream Water Quality Report* can be found at www.fairfaxcounty.gov/service/hd/strannualrpt. The Fairfax County Department of Public Works and Environmental Services, Stormwater Planning Division, is now monitoring the stream water quality instead of the Health Department.

Almost eight percent of samples collected from site 10-02 in the Pimmit Run Watershed showed a dissolved oxygen concentration of less than 4.0 mg/l, which is the minimum standard considered suitable for aquatic life. The average dissolved oxygen concentration for site 09-01 in the Turkey Run Watershed was 10.4 mg/l and for site 06-02 in the Bull Neck Run Watershed, it was 10.1 mg/l, both well above the daily average standard of 5.0 mg/l. For the state's current instantaneous fecal coliform standard, no more than 10 percent of the samples collected in a month shall exceed 400 fecal coliforms per 100 milliliter of water. As shown in Table 2.3 for site 10-05, 93 percent of the samples had fecal coliform counts greater than 400/100 ml, for sites 08-02 and 10-02 67 percent of the samples had fecal coliform counts greater than 400/100 ml, and for sites 06-02, 10-03, and 10-04 53 percent of the samples had fecal coliform counts greater than 400/100 ml. For fecal coliform, a count less than 200/100 ml is considered good water quality and a count of 250,000/100 ml can be considered a direct sewage discharge.

Table 2.3 Summary of Fecal Coliform Sampling in the Middle Potomac Watershed Group

Number of Fecal Coliform Samples for Each Sampling Site				
Bull Neck Run (06-02)	15	3	4	8
Scotts Run (07-01)	15	6	2	7
Dead Run (08-02)	15	2	3	10
Turkey Run (09-01)	15	3	5	7
Pimmit Run 1 (10-02)	15	3	2	10
Pimmit Run 2 (10-03)	15	2	5	8
Pimmit Run 3 (10-04)	15	3	5	8
Pimmit Run 4 (10-05)	15	0	1	14

Source: Fairfax County 2002 Stream Water Quality Report

From 2001 to 2002, Scotts Run showed a 29 percent improvement in the number of fecal coliform sample results meeting the water quality criteria. From 2001 to 2002, the geometric mean[1] of fecal coliform rose from 612 to 715 for site 10-05 and dropped from 696 to 328 for

[1] The geometric mean is used to measure the central tendency of the data. The geometric mean is calculated by multiplying a series of numbers and taking the *nth* root of the product where *n* is the number of items in the series.

site 07-01.

The Fairfax County Health Department's *2002 Stream Water Quality Report* concluded that the overall water quality of the watersheds in the Middle Potomac Watershed Group is considered fair for fecal coliform and good for the other chemical and physical parameters that were sampled. The physical and chemical parameters that were measured included fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous and heavy metals.

Volunteer Water Quality Monitoring
Within the Middle Potomac Watershed Group, there are currently five active volunteer monitoring stations. Three stations are located in the Pimmit Run Watershed and one in the Scotts Run Watershed. These stations are coordinated by the Northern Virginia Soil and Water Conservation District. There is also a site located on Bull Neck Run which is coordinated by the Audubon Naturalist Society. The data collected from all of the sites generally support the findings of the *Fairfax County Stream Protection Strategy Baseline Study*, which is described in more detail in section 2.5.9. The data from the site at Bull Neck Run indicated the presence of a more diverse benthic community, while the data from the site on Scotts Run highlighted significant biological impairment. The data from Pimmit Run showed significant impairment at all three monitoring stations. Data from volunteer efforts generally highlighted low biological integrity throughout the watersheds with most locations being rated in the lower categories of the county's ranking system.

2.5.8 Virginia Natural Heritage Resource

The Virginia Natural Heritage Resources Database describes the status and rank of rare plant and animal species throughout the state. The natural heritage resources found in the Middle Potomac Watershed Group are shown in Table 2.4.

Table 2.4 Natural Heritage Resources in the Middle Potomac Watershed Group

Common Name	State Rank
Birds	
Upland Sandpiper	Extremely Rare
Bald Eagle	Very Rare
Common Moorhen	Extremely Rare
Yellow-crowned Night-heron	Very Rare
Mussels	
Yellow Lance	Very Rare
Yellow Lampmussel	Very Rare
Green Floater	Very Rare
Brook Floater	Extremely Rare
Amphipods, Isopods & Decapods	
Northern VA Well Amphipod	Extremely Rare
Pizzini's Amphipod	Extremely Rare
Groundwater Amphipod	Extremely Rare
Rock Creek Groundwater Amphipod	Historically known but not verified in 15 years

Common Name	State Rank
Reptiles	
Wood Turtle	Very Rare
Vascular Plants	
Yellow Nailwort	Extremely Rare
Blue Scorpion-weed	Extremely Rare
Virginia Mallow	Extremely Rare
Small Whorled Pogonia	Extremely Rare
Torrey's Mountain Mint	Very Rare

2.5.9 Stream Protection Strategy

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Pimmit Run and its tributaries, Scotts Run, and Dead Run received "very poor" composite site condition ratings, whereas Bull Neck Run and Turkey Run received "excellent" ratings. These ratings were based on a range of environmental parameters including an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. Table 2.5 provides information regarding the macroinvertebrate assessment and the diversity of fish species found in the Middle Potomac Watershed Group streams as part of the *SPS Baseline Study*.

Table 2.5 Macroinvertebrate Assessment and Fish Species

Stream Name	Macroinvertebrate Assessment	Diversity of Fish Species
Bull Neck Run	Good	Low
Scotts Run 1 (Upper Scotts Run)	Poor	Very Low
Scotts Run 2 (Lower Scotts Run)	Poor	Very Low
Dead Run	Poor	Very Low
Turkey Run	Excellent	High
Pimmit Run 1 (Upper Pimmit Run)	Poor	Very Low
Pimmit Run 2 (Middle Pimmit Run)	Fair	Low
Pimmit Run 3 (Lower Pimmit Run)	Poor	Very Low
Little Pimmit Run	Poor	Very Low

Polluted stormwater runoff affects the number and diversity of macroinvertebrate and fish species. For the macroinvertebrate assessment, the number of unique species and the balance between pollution-tolerant and intolerant species were measured. The rankings ranged from excellent to very poor. A poor rating indicates decreased diversity with intolerant species being rare or absent; a very poor rating indicates that the stream is degraded with a small number of tolerant species. The fish were assessed based on the total number of unique fish species collected at each site. For the number of unique fish species collected, the ratings were high, moderate, low, or very low. Collectively, the watersheds in this group clearly highlight the impact that variations in land use can have on aquatic systems. Those watersheds with the most development, such as the Pimmit Run Watershed, ranked among the poorest quality streams in the county while those with the least amount of development, such as the Bull Neck Run Watershed, ranked among the best.

In the *SPS Baseline Study*, Pimmit Run, Scotts Run, and Dead Run were classified as Watershed Restoration Level II areas with the goals of maintaining areas to prevent further degradation and implementing measures to improve water quality and comply with Chesapeake Bay initiatives, TMDL regulations, and other water quality initiatives and standards. Although Bull Neck Run and Turkey Run are classified as Watershed Protection Areas due to high biological integrity and habitat quality, regular monitoring within both watersheds will be continued. The *Middle Potomac Watershed Management Plan* is based on the county's stream protection strategy recommendations to help achieve the goal of preserving and restoring stream quality.

2.5.10 Stream Physical Assessment

The county initiated a Stream Physical Assessment (SPA) for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The SPA included a habitat assessment, infrastructure inventory, stream characterization, and stream geomorphologic assessment. The SPA data are summarized for the entire watershed group in this section and results for each watershed are discussed in detail in Chapters 4 through 8. As part of the SPA, the following items were identified and characterized:

- Stream geomorphology
- Obstructions
- Stream habitat condition
- Pipe and ditch outfalls
- Riparian buffer condition
- Public utility lines
- Erosion locations
- Road and other crossings
- Head cuts
- Dumpsites

The inventory items with a negative impact on the stream were assigned an impact score and the inventory items that did not impact the stream were not scored. Based on the impact score, the degrees of impact were classified as "minor to moderate", "moderate to severe", or "severe to extreme". Buffer condition was only noted where it was deficient and was categorized as moderate, severe, or extreme. Table 2.6 describes the impact ranges for each of the stream inventory items.

Table 2.6 Description of Impacts

Impact	Description
Deficient Buffer Vegetation (within 100 feet of stream bank)	

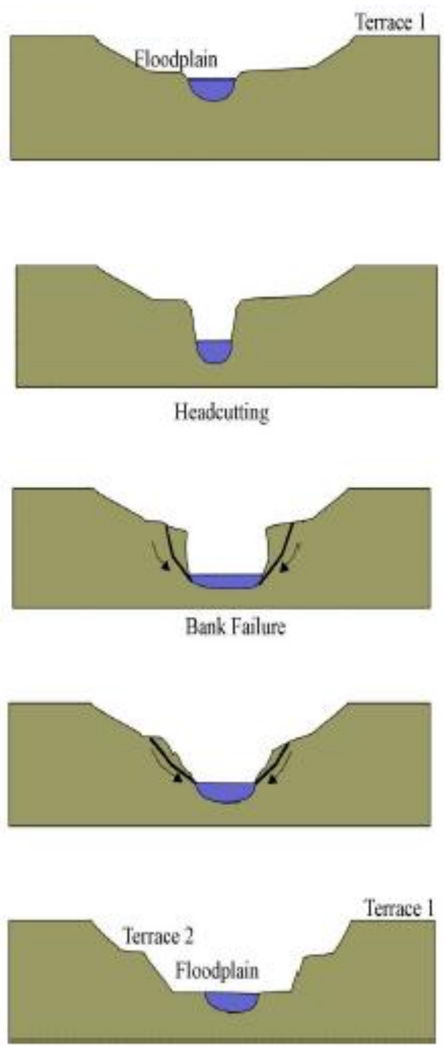
Impact	Description
Extreme	Impervious/commercial area in close proximity to a stream. The stream banks may be modified or engineered. The stream character (bank/bed stability, sediment deposition, and/or light penetration) is obviously degraded by adjacent use.
Severe	Some impervious areas and/or turf located up to the bank and water. Very little vegetation aside from the turf exists within the 25-foot zone. Home sites may be located very close to the stream. The stream character is probably degraded by adjacent use.
Moderate	Encroachment mostly from residential uses and yards. There is some vegetation within the 25-foot zone, but very little aside from turf exists within the remainder of the 100-foot zone. The stream character may be changed slightly by adjacent use.
Minor	Vegetated buffer primarily consists of native meadow (not grazed).
Dumpsites	
Severe to Extreme	Active and/or threatening sites. The materials may be considered toxic or threatening to the environment (concrete, petroleum, empty 55-gallon drums, etc.) or the site is large (greater than 2,500 square feet) and appears active.
Moderate to Severe	Dumpsite less than 2,500 square feet with non-toxic material. It does not appear to be used often, but clean-up would definitely be a benefit.
Minor to Moderate	Dumpsite appears small (less than 1,000 square feet) and the material stable (will not likely be transported downstream by high water). This site is not a high priority.
Erosion Locations	
Severe to Extreme	Impending threat to structures or infrastructure.
Moderate to Severe	Large area of erosion that is damaging property and causing obvious instream degradation. The eroding bank is generally five feet or greater in height.
Minor to Moderate	A moderate area of erosion that may be damaging property and causing instream degradation. The eroding bank is generally two feet or greater in height.
Head Cuts	
Severe to Extreme	Greater than two-foot head cut height.
Moderate to Severe	One to two-foot head cut height.
Minor to Moderate	One-half to less than one-foot head cut height.
Obstructions	

Impact	Description
Severe to Extreme	The blockage is causing a significant erosion problem and/or the potential for flooding that can cause damage to infrastructure. The stream is usually almost totally blocked (more than 75% blocked).
Moderate to Severe	The blockage is causing moderate erosion and could cause flooding. The stream is partially blocked, but obstructions should probably be removed or the problem could worsen.
Minor to Moderate	The blockage is causing some erosion problems and has the potential to worsen. It should be looked at and/or monitored.
Pipes and Ditch Outfalls	
Severe to Extreme	Stormwater runoff from a ditch or pipe is causing a significant erosion problem to the stream bank or stream. Discharge that may not be stormwater is coming from the stormwater pipe.
Moderate to Severe	Stormwater runoff from a ditch or pipe is causing a moderate erosion problem and should be fixed; it may get worse if left unattended. Discharge is coming from the pipe. It is probably stormwater, but it will be uncertain without further investigation.
Minor to Moderate	Stormwater runoff from a ditch or pipe is causing a minor erosion problem and some discharge is occurring.
Public Utility Lines (includes sanitary sewer, water, stormwater, gas, telephone, and electric lines)	
Severe to Extreme	A utility line is leaking.
Moderate to Severe	An exposed utility line is causing a significant erosion problem and/or obstruction (blockage). The potential for the sanitary line to burst or leak appears high.
Minor to Moderate	A partially exposed utility line is causing a moderate erosion problem. The line is partially visible (mostly buried in a stream bed with little if any erosion).
Road and Other Crossings	
Severe to Extreme	The condition of debris, sediment, or erosion poses an immediate threat to the structural stability of the road crossing or other structure. Major repairs will be needed if the problem is not addressed.
Moderate to Severe	The condition probably poses a threat to a road crossing or other structure. The problem should be addressed to avoid larger problems in the future.
Minor to Moderate	The condition does not appear to pose a threat to a road crossing or other structure but should be addressed to enhance stream integrity and the future stability of the structures.

Source: *Fairfax County Stream Physical Assessment Protocols*, December 2002

Stream Geomorphology

The geomorphologic assessment of the stream channels in the Middle Potomac Watershed Group was based on the conceptual incised Channel Evolution Model (CEM) developed by Schumm et al. (1984). Based on visual observation of the channel cross section and other morphological observations of the channel segment, a CEM type was assigned for the channel segment. A list of the CEM types is provided in Table 2.7 and the five stages of the channel evolution process are shown in Figure 2.2. The CEM type for the stream segments is shown on the stream geomorphology maps provided for each of the watersheds in Chapters 4 through 8.



Type 1: Well-developed base flow and bankfull channel; consistent floodplain features easily identified; one terrace apparent above active floodplain; predictable channel morphology; floodplain covered by diverse vegetation; stream banks less than or equal to 45°

Type 2: Head cuts; exposed cultural features (along channel bottom); sediment deposits absent or sparse; exposed bedrock (parts of reach); stream bank slopes greater than 45°

Type 3: Stream bank sloughing, sloughed material eroding; stream bank slopes greater than 60° or vertical/undercut; erosion on inside of bends; accelerated bend migration; exposed cultural features (along channel banks); exposed bedrock (majority of reach)

Type 4: Stream bank aggrading; sloughed material not eroded; sloughed material colonized by vegetation; base flow, bankfull, and floodplain channel developing; predictable channel morphology developing; stream bank slopes less than or equal to 45°

Type 5: Well-developed base flow and bankfull channel; consistent floodplain features easily identified; two terraces apparent above active floodplain; predictable channel morphology; stream banks less than or equal to 45°

Figure 2.2 Incised Channel Evolution Model (Schumm, Harvey, and Watson, 1984)

Table 2.7 Summary of CEM Types

CEM Type	Description
1	Stable stream banks and developed channel
2	Deep incised channel
3	Unstable stream banks and actively widening channel
4	Stream bank stabilizing and channel developing
5	Stable stream banks and widened channel

Stream Habitat Assessment

The scores assessed for the various physical parameters representing the stream habitat conditions were combined for each stream segment to obtain a total habitat score with the greatest percentage of the stream habitat in the watershed group assessed as fair. Table 2.8 describes the percentage of length for each habitat quality rating for the streams according to the total score. The habitat quality of each stream segment is shown on the stream habitat quality maps provided for each of the watersheds in Chapters 4 through 8.

Table 2.8 Summary of Overall Stream Habitat Quality

Stream Name	Percent of Stream Length				
	Very Poor	Poor	Fair	Good	Excellent
Bull Neck Run	0%	0%	25%	44%	31%
Upper Scotts Run	0%	43%	57%	0%	0%
Lower Scotts Run	0%	0%	41%	28%	31%
Dead Run	0%	12%	61%	20%	7%
Turkey Run	0%	10%	30%	0%	60%
Upper Pimmit Run	0%	30%	29%	40%	0%
Middle Pimmit Run	0%	1%	42%	57%	9%
Lower Pimmit Run	0%	20%	17%	63%	0%
Little Pimmit Run	0%	16%	68%	16%	0%
Total Watershed Group	**0%**	**10%**	**40%**	**26%**	**24%**

Streams in their natural and stable condition experience some erosion and transport of sediments. This process is directly related to the stream's geometry, velocity, and amount of flow. Sediments will naturally deposit in areas of slower velocity, such as typically seen at the downstream end of a stream, and erosion will occur where the flow velocities are higher than the stream channel banks can withstand which can typically be found at stream bends. Higher instream velocities and flows from development result in larger amounts of sediment being transported and the transport of sediment of greater weight and size. Increases in instream velocities and flows result in a stream actively widening and transporting higher amounts of sediment.

The actively widening and unstable stream beds and banks found in the Middle Potomac Watersheds are the primary source of instream sediment. Other sources include stormwater runoff from areas with disturbed soils and sand placed on roads for traction during the winter. Sedimentation causes the formation of instream islands, point bars, and shoals as well as the filling in of pools. High levels of sediment deposition can smother aquatic organisms, and pollutants that attach to sediments can be harmful to them. Sediment can also block sunlight from reaching aquatic plants and prevent visual predators from seeing their prey. Table 2.9 summarizes the sedimentation assessment from the SPA for the Middle Potomac Watershed Group.

Table 2.9 Sedimentation Assessment

Watershed	Description of Sedimentation
Bull Neck Run	Sediment deposition was mainly sand and silt with 20% of the stream bottom affected in the downstream segments and 40% to 50% of the stream bottom affected in the upstream segments.
Scotts Run	Sediment deposition was mainly fine sediment and silt with 10% to 50% of the stream bottom affected. However, 70% to 80% of the stream bottom was affected in two of the segments in the tributaries to Scotts Run.
Dead Run	Sediment deposition was mainly sand and silt with 40% of the stream bottom affected in the downstream segments and 60% to 70% of the stream bottom affected in the upstream segments.
Turkey Run	No enlargements of islands or point bars were present. Less than 20% of the stream bottom was affected by sand or silt accumulation in the downstream segments and 40% to 50% of the stream bottom affected in the upstream segments.
Pimmit Run	Fine sediment and silt surrounds 50% of the living spaces around gravel, cobble and boulders. The dominant substrate in the stream reaches has a mixture of cobble and gravel stones.

Channel disturbance is caused when a stream channel is straightened, paved with concrete, lined with riprap (stone) or otherwise altered by human activity. The county's SPA estimated the amount of channel and bank alteration as approximately 24 percent of the assessed stream lengths in the Middle Potomac Watersheds. The lengths of piped streams and concrete channels were estimated during the SPA and totaled 14,764 feet, which is approximately seven percent of the total length of stream channels included in the assessment. All of the piped and concrete channelized sections for the Middle Potomac Watershed Group were recorded in the Pimmit Run Watershed.

Channel alteration reduces or eliminates habitat for fish and aquatic insects. Concrete channels can create higher flow velocities that increase erosion downstream. Concrete channels with no vegetation along the banks create higher water temperatures that may not be suitable for fish and aquatic insects. Based upon a review of previous mapping of the area, many of the natural drainage swales and streams appear to have been eliminated, piped underground, straightened, or otherwise altered during the development of the headwater areas of the Middle Potomac Watersheds, especially in the Pimmit Run and Scotts Run Watersheds.

Although the SPA only recorded piped or concrete segments in Pimmit Run and its tributaries, other developed portions of the Middle Potomac Watersheds have streams that were altered in this way as well.

Riparian Buffer Condition

An adequate riparian buffer is a vegetated strip of land located adjacent to a stream with a minimum recommended width of 100 feet on each side of the stream. The riparian buffer should consist of a mix of native plants, including deep-rooted grasses, shrubs, and trees. Inadequate riparian buffers are those that do not meet the recommended width or have non-native, non-diversified, or insufficient vegetation.

The streams in the watershed have an average buffer zone width of 50 feet to 100 feet. The total length of deficient buffer zone along assessed streams is 133,800 feet, which is 29 percent of the total bank length that was sampled. The total length of deficient buffer zone was determined by evaluating both the left and right banks separately. The vegetative cover in the deficient buffer areas typically consists of lawn. The average impact score for the deficient buffer areas is 4.4 out of a scale of 1 to 10 with 10 as best. The results of the county's 2004 SPA riparian buffer assessment are presented for the Middle Potomac Watersheds in Table 2.10.

Table 2.10 Riparian Buffer Assessment

Watershed	Deficient Buffer Length (ft)	Length of Moderate to Extreme Buffer Deficiency	Percent of Deficient Buffer with Moderate to Extreme Deficiencies	Average Impact Score
Bull Neck Run	2,100	0	0%	3.3
Upper Scotts Run	7,950	6,170	65%	4.8
Lower Scotts Run	9,600	3,360	35%	4.1
Dead Run	23,400	4,450	19%	4.2
Turkey Run	4,000	2,400	60%	4.6
Upper Pimmit Run	34,260	15,070	44%	4.7
Middle Pimmit Run	36,040	19,820	55%	4.7
Lower Pimmit Run	4,000	1,440	36%	3.7
Little Pimmit Run	12,450	750	6%	3.3
Total Watershed Group	**133,800**	**53,460**	**39%**	**4.4**

According to statistics compiled by Virginia's Department of Conservation and Recreation (DCR), a 100-foot-wide strip of forest and grass can reduce sediment delivered to the stream by 97 percent, nitrogen by 80 percent and phosphorus by 77 percent. Deficient buffer zone width provides less filtering of pollutants in stormwater runoff. The stream banks are more likely to become unstable when bank vegetation is removed. Limited native plant diversity and density, combined with a large number of non-native plants, will not offer sufficient habitat and food for wildlife. Additionally, non-native species may out compete and replace native plants. There are conservation areas or parks adjacent to the main branches of the streams, and there are significant parklands adjacent to the streams in the lower reaches near their confluence with the Potomac River. The county's *Comprehensive Plan* proposes placing park or conservation areas around most of the streams in the watershed.

Erosion, Head Cuts, and Obstructions

Excessive and sustained high velocities usually associated with high runoff volumes can cause erosion of the stream bed and bank material. Sediment eroded from banks and beds can smother aquatic life when it is deposited downstream and sediment suspended in the water can block light needed by aquatic plants. A head cut is a sudden lowering of the level of the streambed at a certain point, caused by erosion of the streambed. This point, also called a nick-point, will work its way upstream if the head cut is actively eroding. A stream obstruction is any flow blockage, such as fallen trees, located within a stream.

The county's SPA estimated the length of eroded stream bed or banks, identified specific erosion locations, and quantified the number and location of obstructions and their impact on the stream. The impact scores for erosion, head cuts and obstructions were evaluated on a scale of 1 to 10, with 1 as minor, 5 as moderate and 10 as extreme, and are presented for the Middle Potomac watersheds in Table 2.11.

Table 2.11 Erosion Data

Watershed	Length of Eroded Bed/ Banks (ft.)	Erosion Locations	Impact Score	Number of Obstructions	Impact Score
Bull Neck Run	205	3	6.2	3	3.3
Upper Scotts Run	570	7	3.0	1	2.0
Lower Scotts Run	680	8	4.3	5	3.8
Dead Run	850	3	5.4	2	4.5
Turkey Run	680	4	4.8	2	3.0
Upper Pimmit Run	950	7	4.9	2	2.5
Middle Pimmit Run	2,275	15	5.6	7	4.2
Lower Pimmit Run	200	2	4.8	1	2.0
Little Pimmit Run	1,350	8	6.1	2	5.5
Total Watershed Group	**7,760**	**57**	**5.2**	**25**	**4.1**

The number of erosion points or obstructions in these watersheds is not unusually high for streams in a typical urbanized watershed, but their impact on the streams is still substantial. Although the impact scores are low, they can increase significantly if the obstructions are not cleared, which can lead to much more significant impacts on the streams. Erosion and obstructions have contributed to the water quality degradation of the Middle Potomac Watersheds' streams.

Pipe and Ditch Outfalls

Thirty-six pipes in the Pimmit Run Watershed showed minor to moderate stream impacts due to erosion. The other watersheds had a combined total of six pipes that had minor to moderate erosion impacts.

Public Utility Lines

Eleven utility lines in the Pimmit Run Watershed had minor to moderate stream impacts due to obstruction, erosion at stream crossings, or the loss of riparian buffer. Bull Neck Run and Turkey Run did not show any impact from utility lines. There were two locations in Scotts Run that exhibited minor impacts and one location on Dead Run that showed moderate impact due to erosion.

Road and Other Crossings

There were three crossings in the Pimmit Run Watershed that showed moderate stream impacts due to debris, sediment, and erosion. One crossing in the Upper Scotts Run Watershed exhibited severe impacts based on the amount of debris found at the upstream end of the crossing.

Dumpsites

The county's stream physical assessment identified four dumpsites: one in Bull Neck Run, one in Dead Run and two in Little Pimmit Run. The dumpsites consisted of lawn waste such as leaves and grass, furniture, a camper shell, shopping carts, and trash. The dumpsites were located in the stream, on the bank, or in a floodplain. The volume of trash found in the stream was not measured.

2.5.11 Stormwater Management Facilities

If the runoff from developed areas is controlled by a properly designed stormwater management facility, there is a reduction in the impacts to the receiving streams. Prior to 1972, the county did not require stormwater quantity reduction from development and prior to July 1993, the county did not require water quality treatment of runoff. Because so much of the Middle Potomac Watersheds area was developed before stormwater controls were required, stormwater runoff has had considerable impacts on the streams in these watersheds. Table 2.12 describes the estimated area of each watershed that is controlled by stormwater management (SWM) facilities.

Table 2.12 Watershed Area Controlled by Stormwater Management Facilities

Watershed Name	Watershed Area Controlled by SWM Facilities (Acres) [1]	Percent of Watershed Area Controlled by SWM Facilities[1]
Bull Neck Run	271	24%
Upper Scotts Run	266	13%
Lower Scotts Run	449	33%
Scotts Run Total	*715*	21%
Dead Run	264	15%

Watershed Name	Watershed Area Controlled by SWM Facilities (Acres) [1]	Percent of Watershed Area Controlled by SWM Facilities[1]
Turkey Run	61	9%
Upper Pimmit Run	315	12%
Middle Pimmit Run	300	12%
Lower Pimmit Run	20	5%
Little Pimmit Run	42	6%
Pimmit Run Total	*677*	11%
Overall	**1,988**	**15%**

[1]Does not include SWM facilities in Arlington County or facilities in areas that drain directly to the Potomac River.

2.5.12 Stormwater Infrastructure Maintenance

Stormwater infrastructure requires consistent and periodic maintenance in order to function properly. Older infrastructure must be rehabilitated or replaced when it reaches the end of its service life of approximately 50 years. Fairfax County owns and maintains approximately 1,400 miles of pipe and over 40,000 storm drain inlets and manholes countywide. Limited maintenance data are available for the stormwater conveyance infrastructure in these watersheds because the majority of it is owned by the Virginia Department of Transportation (VDOT), which only has a formal maintenance plan for bridges and major culvert crossings. VDOT's Bridges and culverts are inspected regularly and any required maintenance is performed. Based on the county's GIS drainage complaint layer, approximately 1810 drainage complaints were received from 1984 to March 2006, with the majority of the complaints related to blockages, clogs, cave-ins, flooding, and erosion. Of these 1810 complaints, 154 were flooding or erosion complaints. These 154 complaints are shown on Maps 4.1, 5.1, 5.2, 6.1, 7.1, 8.1, 8.2, and 8.3.

There are over 2,200 privately owned stormwater facilities located in the county. The SWM facility data for privately and publicly owned facilities in the Middle Potomac Watersheds are presented in Table 2.13.

Table 2.13 Stormwater Management Facility Maintenance

Watershed Name	No. of Private SWM Facilities	No. of Private SWM Facilities with Major Problems	No. of Private SWM Facilities with Minor Problems	No. of Public SWM Facilities
Bull Neck Run	1	0	0	7
Scotts Run	39	9	2	13
Dead Run	41	10	3	7
Turkey Run	0	0	0	1
Pimmit Run	107	5	11	32
Overall	188	24	16	60

NOTE: This is the best available information based upon the county's four year inspection cycle and may not reflect current conditions or facilities that have been improved. This information does not include the facilities in Arlington County.

2.5.13 On-Site Wastewater Treatment

Wastewater is treated by on-site septic systems for a portion of the watershed group area. The county does not have all of the parcels with on-site septic systems mapped in their GIS database because these tend to be older parcels. Table 2.14 shows the developed land area that is not connected to the county's sanitary sewer system. These data do not include any properties in Arlington County that may have on-site wastewater treatment. Failing or poorly maintained on-site septic systems may discharge bacteria to the county's streams.

Table 2.14 On-Site Wastewater Treatment

Watershed Name	No. of Parcels with On-Site Wastewater Treatment	Land Area with On-Site Wastewater Treatment	Percent of Watershed Area with On-Site Wastewater Treatment
Bull Neck Run	551	751	47.9%
Scotts Run	354	363	9.4%
Dead Run	176	190	9.8%
Turkey Run	69	810	64.9%
Pimmit Run	412	688	8.5%
Overall	1,562	2,802	18.3%

2.5.14 Flooding

Flooding occurs when the capacity of a stream or drainage conveyance is exceeded during a rain event. Streams convey runoff from their surrounding watershed area and can accommodate excess runoff in their floodplain, which is the broad area just above the smaller stream channel and below the tops of the main banks. Table 2.15 presents the number of potential flooding locations in each watershed with respect to the 100-year storm as obtained from the county's GIS floodplain data. This table does not include information from Arlington County for the Pimmit Run Watershed.

Table 2.15 Potential Flooding Locations

Watershed Name	Building Flooding Locations	Roadway Flooding Locations
Bull Neck Run	0	2
Scotts Run	5	5
Dead Run	4	5
Turkey Run	No Data Available*	No Data Available*
Pimmit Run	61	14

*The majority of the Turkey Run Watershed area is comprised of the CIA facility and no floodplain mapping has been done by FEMA in this area.

With the exception of the streams located within the Pimmit Run Watershed, all other streams have relatively few flooding locations; however, their associated floodplains have been encroached upon significantly. Some areas noted by the Steering Committee as having flooding concerns are: the McLean Little League ball fields, Scotts Run below Tysons Corner, and a 247 acre property known as "The Reserve." It also appears that Spring Hill Road in the Bull Neck Run Watershed and Swinks Mill Road in the Scotts Run Watershed have experienced flooding in the past.

2.6 Modeling Approach and Summary

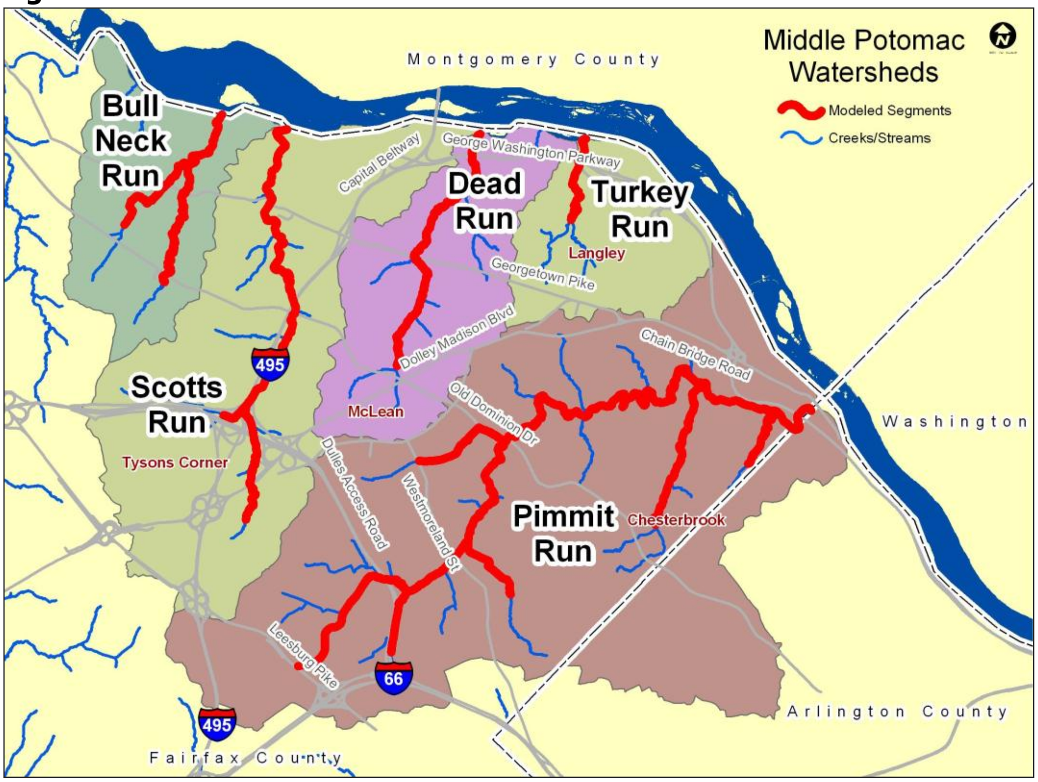
Planning level hydrologic, hydraulic, and water quality models were created for all five watersheds in the Middle Potomac Watershed Group to help identify potential for flooding, channel erosion, and to estimate pollutant loads in the watersheds. The hydrologic models calculated the amount of stormwater runoff generated by different storm events. The hydraulic models routed the stormwater runoff in the streams in order to calculate the water elevation and flow velocity. The water quality models calculated an estimated amount of pollutants generated by the different land uses in the watersheds. Current and anticipated ultimate development conditions (future) were modeled to evaluate the effects of development in the watersheds and estimate the benefits of proposed projects.

These planning level models were used to supplement the field data collected for the SPA, described in Section 2.5.10, and to evaluate the cause and effect relationship between land use, management strategies and actual stream conditions. The SPA data and subsequent field reconnaissance were the primary sources of identifying actual problem areas in the watersheds. The models were used primarily to aggregate the flow and pollutant reduction benefits of proposed improvement projects that would be achieved after project implementation.

The hydrologic and water quality models cover all 26 square miles contained in the Middle Potomac Watersheds. This area was divided into 86 subbasins that are the smallest watershed area units in the hydrologic model with an average size of approximately 194 acres. The subbasins are shown on Map 2.4 at the end of this chapter. Runoff and water quality data for existing and future conditions was generated for each of the subbasins. For the hydraulic models, all streams that traversed more than one subbasin were modeled. The hydraulic models start downstream of the headwater subbasins and continue to the Potomac River.

Figure 2.3 below shows the stream segments in the hydraulic models as well as the extent of streams walked during the SPA.

Figure 2.3 Modeled Portions of Streams in Middle Potomac Watersheds



Part of project implementation will be using the planning level models created for this plan as a foundation to develop more detailed models which will support the design of projects such as stormwater ponds and stream restoration.

The modeling guidelines in the Technical Memorandum No. 3, Stormwater Model and GIS Interface Guidelines, provided by the county, were used in developing the models. Appendix D, Watershed Modeling Process, presents the details of the model setup and results.

The work to develop the models and analyze the results included the following steps:

- Selection of subbasin scale and delineation of subbasins
- Characterization of existing soils, land use, and impervious cover based on county GIS and other mapping sources
- Collection of stream channel and crossing data
- Prediction of ultimate land use conditions based on the county *Comprehensive Plan* and zoning
- Assessment of water quantity and quality impacts to identify existing and potential future problem areas

All of the watershed areas were included in the hydrologic model. The majority of the soils data for infiltration was developed from the National Resource Conservation Service State Soil

Geographic database and the remainder of the soil data was developed from the county soil GIS data which were only available for part of the study area.

As described in Section 2.4 of Appendix D, the existing impervious cover for the model was developed from the county's GIS layers showing impervious land cover for roads, buildings, and parking areas. The paved area of sidewalks and driveways was estimated and added to the total impervious land cover calculations. The ultimate build-out land use conditions were developed from the county's *Comprehensive Plan* for underutilized and vacant parcels. The increase in residential imperviousness caused by adding on to existing houses was reflected in the future land use conditions for the hydrologic model.

The stream channel profiles and cross sections were developed from the county's topographical GIS data and the stream culvert and bridge crossing data were developed from field survey data. The hydraulic model includes approximately 22 miles of streams, as shown in Figure 4.1 in Appendix D, and 36 major road crossings over the various streams located within the Middle Potomac Watersheds. The small stream segments and tributaries near the headwaters of the major streams in the Middle Potomac Watersheds and the small streams draining directly into the Potomac River were not included in the hydraulic model. The existing stormwater management and best management practice facilities were simulated in the model to estimate the peak flow control for parcels developed from 1972 to 1993 and the peak flow control and water quality treatment for parcels developed after 1993. The county's inventory of stormwater management facilities was used to verify which parcels had stormwater controls.

The hydrologic and hydraulic models were calibrated to validate the model results. No historical stream gage data were available for the Middle Potomac Watersheds, so the calibration was based on historical flooding information for each watershed. The model parameters were adjusted during the calibration process to replicate the historical road flooding conditions. The calibrated hydrologic and hydraulic models were run for three rainfall events corresponding to the two-year return period, the ten-year return period, and the 100-year return period for both existing and future build-out conditions. Peak discharges for each subbasin were compared to evaluate the change in cumulative peak runoff flows in the streams as a result of the change in existing land use, and the results for the ten-year rainfall event are shown on Map 2.5. The subbasins with high peak runoff amounts are located in the highly developed areas of Tysons Corner and McLean. The cumulative effect of future development in Tysons Corner can be seen for the entire length of Scotts Run on Map 2.5. The cumulative peak flow amounts are described in the modeling summaries for each watershed in Chapters 4 through 8.

The model results were examined for the two- and ten-year peak rainfall events to determine the flooding locations. The results from the models were then compared to documented erosion and flooding within each subwatershed to further validate the hydraulic model. The model results for the 100-year peak rainfall event were also used to determine the boundaries of the 100-year flood limit. These boundaries were compared to the county's 100-year floodplain and found to be similar for all subwatersheds. The dwellings located in the 100-year flood limit were identified and the number of households is shown under the Flood Protection Projects in Chapters 5, 6, and 8. The county's 100-year floodplain for each watershed are shown on the Watershed Characteristics maps in Chapters 4 through 8.

The water quality model was used to determine the pollutant loading rates for the five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), dissolved phosphorous (DP), total phosphorous (TP), total Kjeldahl nitrogen (TKN), total nitrogen (TN), cadmium (Cd), copper (Cu), lead (Pb), and zinc (Zn) for each watershed. The pollutant generation parameters used for the water quality model were developed by the county. The hydrologic model was run for a continuous time period to calculate the average annual contribution of each pollutant in units of pounds per acre per year for both existing and future land use conditions and the pollutant loading rates are shown in Table 2.16. The increase in the pollutant loading rates ranges from approximately two percent to 39 percent. The increases in the pollutant loading rates for total phosphorous, total nitrogen, and total suspended solids from existing development conditions to future development conditions for each subbasin are shown on Maps 2.6, 2.7, and 2.8.

Table 2.16 Water Quality Pollutant Loading Rates

Pollutants[1]		Bull Neck Run	Upper Scotts Run	Lower Scotts Run	Dead Run	Turkey Run	Upper Pimmit Run	Middle PimmitRun	Lower Pimmit Run	Little Pimmit Run
BOD5	Existing (lb/ac/yr)	9.3	57.9	9.3	19.9	19.5	24.5	14.8	16.7	18.0
	Future (lb/ac/yr)	12.1	68.2	11.3	22.5	20.2	27.4	17.8	18.0	18.8
	% Load Increase	30%	18%	22%	13%	4%	12%	20%	8%	4%
COD	Existing (lb/ac/yr)	55.2	299.7	54.0	118.4	117.7	146.0	85.9	96.3	102.3
	Future (lb/ac/yr)	70.8	334.3	65.3	133.5	122.0	161.9	102.2	103.6	107.0
	% Load Increase	28%	12%	21%	13%	4%	11%	19%	8%	5%
TSS	Existing (lb/ac/yr)	39.9	213.3	30.8	70.8	110.6	83.5	53.3	51.5	60.8
	Future (lb/ac/yr)	48.3	231.4	36.4	76.6	113.7	91.0	61.7	55.1	63.2
	% Load Increase	21%	8%	18%	8%	3%	9%	16%	7%	4%
TDS	Existing (lb/ac/yr)	50	264	47	92	122	112	69	71	78
	Future (lb/ac/yr)	60	286	53	101	125	122	79	75	81
	% Load Increase	20%	8%	13%	10%	2%	9%	14%	6%	4%
DP	Existing (lb/ac/yr)	0.23	0.63	0.23	0.34	0.33	0.34	0.26	0.30	0.31
	Future (lb/ac/yr)	0.31	0.69	0.27	0.38	0.35	0.38	0.30	0.32	0.32
	% Load Increase	35%	10%	17%	12%	6%	12%	15%	7%	3%
TP	Existing (lb/ac/yr)	0.31	0.88	0.33	0.49	0.47	0.49	0.37	0.42	0.44
	Future (lb/ac/yr)	0.43	0.95	0.38	0.53	0.49	0.53	0.43	0.45	0.46
	% Load Increase	39%	8%	15%	8%	4%	8%	16%	7%	5%
TKN	Existing (lb/ac/yr)	1.8	4.7	1.8	2.7	2.8	2.7	2.1	2.4	2.5
	Future (lb/ac/yr)	2.4	5.0	2.1	3.0	2.9	3.0	2.4	2.5	2.6

Pollutants[1]		Bull Neck Run	Upper Scotts Run	Lower Scotts Run	Dead Run	Turkey Run	Upper Pimmit Run	Middle PimmitRun	Lower Pimmit Run	Little Pimmit Run
	% Load Increase	33%	6%	17%	11%	4%	11%	14%	4%	4%
TN	Existing (lb/ac/yr)	2.46	8.12	2.40	3.82	4.09	4.00	2.90	3.21	3.40
	Future (lb/ac/yr)	3.24	8.95	2.76	4.15	4.25	4.36	3.35	3.40	3.56
	% Load Increase	32%	10%	15%	9%	4%	9%	16%	6%	5%
Cadmium ($x 10^{-4}$)	Existing (lb/ac/yr)	2.0	3.8	2.3	2.8	2.7	2.6	2.2	2.4	2.4
	Future (lb/ac/yr)	2.5	3.7	2.4	3.0	2.8	2.8	2.4	2.5	2.5
	% Load Increase	25%	-3%	4%	7%	4%	8%	9%	4%	4%
Copper ($x 10^{-3}$)	Existing (lb/ac/yr)	13.4	87.4	6.5	21.3	46.0	30.6	14.8	9.5	13.4
	Future (lb/ac/yr)	15.0	88.9	7.3	22.1	47.0	32.4	15.9	10.3	13.7
	% Load Increase	12%	2%	12%	4%	2%	6%	7%	8%	2%
Lead ($x 10^{-3}$)	Existing (lb/ac/yr)	2.0	13.4	2.2	3.8	4.2	4.8	2.9	3.0	3.2
	Future (lb/ac/yr)	2.3	15.7	2.4	4.2	4.3	5.3	3.3	3.1	3.3
	% Load Increase	15%	17%	9%	11%	2%	10%	14%	3%	3%
Zinc ($x 10^{-2}$)	Existing (lb/ac/yr)	6.8	43.1	3.4	9.7	22.9	13.2	7.3	5.1	7.3
	Future (lb/ac/yr)	7.7	45.2	4.0	10.0	23.4	14.2	8.0	5.4	7.5
	% Load Increase	13%	5%	18%	3%	2%	8%	10%	6%	3%

[1]Does not include pollutant loadings from subbasins that drain directly to the Potomac River.

Nitrogen, phosphorus, and sediment are considered the major pollutants that compromise the health of the Chesapeake Bay and its tributaries. The main source of nitrogen in urban and suburban areas is the fertilizer used for lawns which readily dissolves in surface runoff. Phosphorus also comes from lawn fertilizer and is found attached to sediment particles that wash off the ground surface as well as dissolved in the surface runoff. Nitrogen and phosphorus are typically the limiting nutrients in water for algal growth. Large amounts of algae in the water block sunlight from reaching submerged aquatic vegetation, an important part of the aquatic ecosystem. When algae die and decay, they take essential oxygen from the water, further affecting the health of the aquatic system. The sediment in the runoff comes mainly from erosion of the land and stream channels. Excess sediment destroys aquatic habitat and, when suspended in the water, blocks sunlight from reaching the aquatic plants located at the stream bottom.

More detailed information about the existing and future conditions hydrologic and hydraulic modeling results for each watershed is presented in Chapters 4 through 8. Information on the benefits of the modeled alternatives is presented in Chapter 3.

2.7 Future Watershed Condition

Future development in Fairfax County will present a number of challenges to restoring and protecting the Middle Potomac Watersheds due to the estimated increase in impervious area in the watersheds.

Infill development is expected to occur more frequently in the future in the Middle Potomac Watersheds Group because the majority of the watershed area is already developed. It is anticipated that the percent imperviousness will increase in residential areas as additions are made to existing houses or existing houses are replaced with larger houses. This trend of tearing down smaller houses and replacing them with much larger houses, as well as adding large additions to existing houses that are out of character with the surrounding homes, is called mansionization. Policy Action A1.8, explained in Chapter 9, will address this issue.

VDOT projects will also have an impact on the imperviousness in the watersheds. VDOT has plans to improve interchanges and widen roadways, both of which could occur with minimal stormwater controls to diminish the effects of the increased imperviousness. The largest VDOT project in the watersheds is the construction of two new High Occupancy Toll (HOT) lanes along the Capital Beltway between Georgetown Pike and Springfield to be completed by 2010. Approximately half of this project goes through the Scotts Run and Pimmit Run Watersheds. HOT lanes are also being considered on other local highways, including Interstate 66, which goes through a small portion of the Pimmit Run Watershed. Policy Action A1.7 in Chapter 9 suggests an approach to manage this issue.

Another future development in the watersheds is the redevelopment of Tysons Corner in conjunction with the extension of Metro rail though the area. The Tysons Corner area will experience redevelopment as the Washington Metropolitan Area Transit Authority expands their rail lines and adds four rail stations to the area in the future. This redevelopment will further negatively impact Scotts Run unless a stormwater management strategy is implemented. The Tysons Corner Stormwater Strategy Project SC9845, outlined in Chapter 9, recommends that LID measures, new Best Management Practices (BMPs), BMP retrofits, and additional stormwater management requirements for developed properties without existing BMPs should be implemented to mitigate the effects of existing and future impervious areas. In addition, Fairfax County has initiated a Tysons Corner Transportation/Urban Design Study and appointed a Tysons Land Use Task Force to coordinate community participation and recommend changes to the 1994 Tysons Corner Comprehensive Plan. Coordination with the Tysons Land Use Task Force and the Department of Planning and Zoning will be essential in mitigating the impacts of the Tysons Corner redevelopment.

Changes in land use types will also affect the imperviousness of the watersheds. The future watershed group imperviousness is predicted to increase to 27 percent. Mansionization will increase the imperviousness in the watersheds by one percent, for a total imperviousness of 28 percent for the Middle Potomac Watersheds Group.

The main issue with increased impervious area in the watersheds is the resulting increase in stormwater runoff volumes. Reducing the runoff delivered to the streams is a priority of the plan because it will reduce the amount of stream bank erosion, increasing the likelihood of success for stream restoration projects downstream. Runoff reduction will be accomplished through BMP retrofits, new BMPs, new LID projects, and Neighborhood Stormwater Improvement Areas.

The plan goals and actions, as summarized in the next chapter, offer ways to lessen the impact of the increased imperviousness due to future development.

Chapter 3:

Watershed Plan Goals, Benefits, Implementation and Monitoring

3.1 Watershed Plan Goals, Objectives and Actions

The *Middle Potomac Watersheds Management Plan* will be implemented over the next 25 years. The intent of the plan is to protect Bull Neck Run, Scotts Run, Dead Run, Turkey Run and Pimmit Run from future degradation and promote watershed-wide management actions that work to restore the streams to a healthy ecosystem.

The goals for the *Middle Potomac Watersheds Management Plan* were derived from the issues identified by the community and the project team based on their analysis of the watersheds' condition. The issues driving each goal are explained in greater detail below, as are the supporting reasons for the goal.

GOAL A: Reduce stormwater impacts to protect human health, safety and property.

The increased volume of stormwater runoff from development is the primary cause of the stormwater problems in the Middle Potomac Watersheds. The watersheds have an average 24 percent imperviousness with approximately 1,979 acres of developed land not controlled by any stormwater management facility (e.g. dry detention). Prior to 1972, the county did not require stormwater quantity reduction from development and prior to July 1993, the county did not require water quality treatment of runoff. Because so much of the Middle Potomac Watersheds area was developed before stormwater controls were required, only 12 percent of the watersheds' developed land is controlled by stormwater management facilities.

Stormwater runoff from development has had considerable impacts on the watersheds. Stream channels have eroded and widened to accommodate the increased peak flow rates and volume of stormwater runoff. Properties and possibly structures are impacted when the stream bank erodes and the stream becomes wider. In some cases, the existing storm drain infrastructure does not have the capacity to handle the amount of increased runoff, which causes certain areas to flood. Flooding of roadways and houses can put people's safety at risk and decrease property values because of yard flooding. Human health can be affected by pollutants, such as fecal coliform bacteria and toxic substances, in stormwater that is discharged to the streams.

This goal seeks to reduce stormwater impacts to help protect human health, safety and property. The objectives and actions that are recommended to meet this goal will help to reduce stormwater velocities, volumes, flooding, and pollutants by implementing projects such as constructing new stormwater management facilities, retrofitting existing stormwater management facilities, improving storm drain infrastructure, and removing stream obstructions. These actions will help provide safer and healthier watersheds for the future.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Development in the watersheds has caused poor water quality and degraded stream habitat which creates an unsustainable environment for animals and plants. The habitat quality is rated as fair for the majority of the streams in the Middle Potomac Watersheds. According to the Stream Physical Assessment (SPA), which is discussed in Section 2.5.10, there are approximately 25 miles of degraded buffers and 2.8 miles of eroded stream banks at least two feet high in the watersheds, most likely caused by increased stormwater runoff volumes. In the SPA, stream bank heights had to be at least two feet high to be considered eroded. Some of the streams have been paved and/or straightened and there are hardened stream bank areas with little or no buffer vegetation, both of which decrease the available habitat in the watersheds. Clearing for development is destroying some wetlands and the increased stormwater runoff and pollution from development is degrading the remaining wetlands which would otherwise provide water quality benefits and habitat for fish, animal, and plant populations. In order to provide a sustainable environment for animals and plants, the buffer areas, wetlands, and natural stream channels will need to be restored after the stormwater runoff volumes and pollutants from existing development are reduced.

The environment section of the county's Policy Plan states under Objective 2, "Protect and restore the ecological integrity of streams in Fairfax County" and "Prevent and reduce pollution of surface and groundwater resources." The objective and actions for this goal will help support the county's Policy Plan by improving habitat areas with poor condition and improving the water quality in order to increase the diversity of animals and plants. This goal will also help protect native biodiversity which includes animal and plants, as well as other components of the watershed ecosystems, such as soil microbes, fungi, and algae. The actions for this goal include protecting and restoring streams and stream buffer areas including removal of invasive plants, protecting and restoring wetlands, promoting wildlife corridors, constructing new stormwater management facilities, and retrofitting existing stormwater management facilities. The restoration of habitat and the increased diversity of animals and plants will provide healthier watersheds for the public to enjoy.

GOAL C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Long term stewardship of the Middle Potomac Watersheds will help to achieve the other goals in the plan by making the public aware of the watershed issues and getting them involved in the implementation of watershed management plan actions. The community has been involved in the development of the *Middle Potomac Watersheds Management Plan* and continued involvement will help to achieve the long-term vision for the watersheds. Creating educational information such as brochures, notices, and signs to distribute throughout the watersheds are a few of the plan actions that will increase awareness and understanding of watershed issues and challenges. Reaching out to the community by providing workshops, training programs, and implementing community service projects will foster a deeper appreciation of the watersheds which will inspire the community to take responsibility for their preservation and restoration. This goal is important for community involvement in implementing plan actions, communicating successes, and monitoring progress to modify the plan as necessary to adapt to changing conditions and ensure future success.

The objectives below provide direction on how to achieve each of these goals, while the actions describe the strategy for accomplishing each objective. The actions and strategies identified by the project team and the community were revised to address the comments from the steering committee and public workshop participants. The proposed strategies were also reviewed by the county to help clarify and refine the approach for implementation as part of the watershed plan review process. The following tracks have been identified for the implementation of watershed management plan recommendations throughout the county:

1. Structural and non-structural projects:
   - County-initiated projects via the capital improvement program
   - Developer-initiated projects as waiver conditions or via the zoning approval process through proffers or development conditions
   - Volunteer group implementation
2. Policy recommendations

Structural and non-structural recommendations are described in this chapter and policy recommendations are described in Chapter 9. The policy recommendations include proposals that would typically involve amendments to the county code and other supporting documents such as the *Public Facilities Manual*. These recommendations will need to be further evaluated in light of their countywide implications. The current planned approach for processing the policy recommendations from the *Middle Potomac Watersheds Management Plan* is to integrate these recommendations with similar recommendations developed as part of watershed management plans that were recently completed. Specific ordinance amendments would then be drafted in light of other county initiatives and address the common ground that can be established between the various policy recommendations.

One question frequently asked by the public during the watershed plan review process was, "How will the county pay for the actions recommended in the plan?" Possible funding sources for the proposed actions in this plan include the general fund, bond issue, grants, cost-sharing, proffers from developers, or establishment of a stormwater utility. Annual general fund stormwater allocations have ranged from $760,000 to $2.2 million over the past three years. The last stormwater bond referendum to be approved was in 1988 in the amount of $12 million (subject to cash flow restrictions). Currently, $3.7 million of the stormwater bond amount is allocated to existing projects. Examples of current grant and cost-sharing opportunities include the Chesapeake Bay Small Watershed Grant Program, Five Star Restoration Challenge Grants, Federal Watershed Initiative and Environmental Education Grants, Fairfax County's Land Preservation Fund, Chesapeake Bay Restoration Fund, and the US Army Corps of Engineers Section 319 and 206 Grants. The most recent stormwater grants awarded in the county include watershed protection, monitoring of a Reston pond, and creation of wetlands. The county will maintain a list of projects in the plan that are suitable for proffer by developers to facilitate the construction of the recommended projects.

Since the mid-1990s, the county has been considering the feasibility of a stormwater user fee or utility. For the Stormwater Needs Assessment Project, the *Stormwater Advisory Committee Recommendations to the Fairfax County Board of Supervisors and Consultant Recommendations to Fairfax County,* March 28, 2005, provided support for a long-term dedicated source of funding for the county's stormwater management program. Starting with the FY 2006 budget, the Fairfax County Board of Supervisors approved the dedication of one cent of the real estate tax rate for stormwater management projects focusing primarily on project implementation and infrastructure maintenance. Other funding approaches may be considered by the county for the future.

The following sections describe the objectives and recommended actions that will help to achieve the goals for the Middle Potomac Watersheds.

3.1.1 Goal A Objectives and Actions

GOAL A: Reduce stormwater impacts to protect human health, safety and property.

3.1.1.1 Objective A1

Objective A1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

Strategy to Achieve Action: Retrofit suitable existing stormwater management facilities and BMPs to make them more effective at decreasing the peak flows and capturing pollutants. Retrofitting stormwater management facilities will allow them to exceed the original performance criteria or standards that were used to design each facility.

The existing stormwater management (SWM) facilities and BMPs could be structurally retrofitted by various means. For example, increasing the area draining to the facility would increase the area mitigated by the stormwater management facility. This retrofit would require the existing storm drain system to be modified or a new storm drain system to be constructed to redirect and convey the additional runoff to the facility. One of the goals of retrofitting a stormwater management facility would be to have a greater reduction in peak runoff downstream of the facility. Retrofits could also be performed to enhance water quality treatment.

These capital projects may be publicized by the county to developers as items appropriate for proffers in rezoning cases. Although future rezoning in the Middle Potomac Watersheds may be limited, having a list of potential proffers is a good first step towards having developers undertake these voluntary projects. It should be noted that if these capital projects were undertaken as proffers it would be in addition to meeting on-site stormwater management requirements.

Retrofit options that may be suitable for implementation include:

1. Increasing detention storage with additional excavation and/or grading. Some of the stormwater management facilities in these watersheds have very little area for additional grading to enlarge the facility; therefore, adding additional depth through excavation may be an alternative method of increasing storage volume.
2. Modifying or replacing the existing riser structures and outlet controls to further reduce the discharge rate from the stormwater management facility. Due to constructability considerations, such as the dimensions and configuration of the riser and inverts and dimensions of the outlet pipe, most outlet control structures will require replacement with newly designed structures. This option should result in the facility being able to provide the necessary routed storage for the one-year storm event with an extended detention release rate over 24 hours. Reducing peak flows by means of one-year extended detention over a 24-hour period will help to reduce downstream erosion by controlling the more frequent, smaller storms and will also provide volume control benefits for the larger, less frequent storms.
3. Adding infiltration features such as trenches or bioretention to promote greater peak flow reduction and groundwater recharge, and to improve water quality treatment. Some dry detention basins have a concrete flow channel that may need to be removed. At some wet ponds, channels draining to the pond may be converted to infiltration facilities. An evaluation of the soil properties at an existing facility will be required to verify that infiltration features will be suitable.
4. Modifying basins that are currently "short circuiting" (i.e., having length to width ratios less than 2:1 or have inflow points in close proximity to basin outlets). These basins can be modified by adding baffles or meandering low flow channels, which will also help to reduce peak flows for smaller storm events.
5. Redirecting runoff from additional drainage area to an existing stormwater management facility to provide water quantity control and water quality treatment to a greater area. Modifications to the existing stormwater conveyance system or construction of a new drainage system may be required to redirect runoff from the additional drainage area. The capacity of the existing facility will need to be evaluated to determine if additional flows can be discharged to the facility and if modifications to the outlet structure are needed.
6. Adding water quality treatment to facilities that currently provide only water quantity control by installing a new water quality opening or adding a wetland bench. Adding vegetation to the bottom of dry ponds will help improve sediment capture and removal of pollutants.
7. Planting buffer vegetation around the perimeter and banks of facilities to filter runoff, provide habitat for animals, and improve aesthetics.

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described in Chapters 4 through 8 and are shown on Maps 4.3, 5.5, 5.6, 6.3, 7.3, 8.7, 8.8, and 8.9. The retrofit locations are grouped by subwatershed and ownership (public or private).

Watershed Benefit: The recommended retrofit projects will benefit the watersheds by reducing the peak flows delivered to the streams and helping to improve water quality by increasing pollutant removal (depending on the type of retrofits that are made). Reducing the peak flows will help reduce the amount of bank erosion that is taking place in each watershed. Retrofit locations were chosen because they are in highly developed areas, are located at the upstream end of streams, or were identified as needing modification or repair. The water quantity control benefit and pollutant removal benefit have been calculated for some of the projects and this information is provided in Tables 4.7, 5.7, 6.7, 7.6, and 8.7. This action will also help to meet the objectives of Action B1.1

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.

Strategy to Achieve Action: Construct new BMPs including LID practices to detain the runoff from existing surrounding developments that do not currently have stormwater management controls. Conventional BMP options that may be suitable for implementation include wet retention ponds, dry detention basins, shallow wetlands, pond and wetland combinations, infiltration basins and sand filters. LID projects may include installing bioretention, porous pavement, green roofs, manufactured BMPs, vegetative methods, and groundwater recharge. These LID options are described in more detail below:

1. Bioretention methods such as rain gardens may be installed in low lying open areas and near disconnected downspouts. Bioswales, grassed swales, and infiltration trenches can be installed to replace shallow eroding ditch depressions that normally carry stormwater. Many of the schools and parks in the watersheds have eroding ditches along the outskirts of the properties and around the fields.
2. Porous pavement is a permeable pavement surface that allows infiltration of runoff through its surface. The ideal location for porous pavement is in overflow or outer edge parking areas where usage is limited.
3. Green roofs consist of a lightweight growing medium planted with tolerant forms of vegetation that may be installed on the roofs of buildings. They allow rainfall to be captured in the planting media and used by the plants, averaging at least a 50 percent reduction in runoff. Green roofs can be an aesthetic benefit, reduce building heating and cooling costs, and increase the life of the waterproof membrane by three times.
4. Manufactured BMPs are different types of water quality inlets that help remove pollutants by filtering or settling runoff. One type of manufactured BMP, called a Filterra, uses a shrub or tree placed in filtering media to help remove pollutants. This can also be called a tree box filter. Another type of manufactured BMP is a StormCeptor, which is a compact unit that treats and removes pollutants based on gravity separation. Other types include the Downstream Defender, StormFilter, and the StormTreat System. Most manufactured BMPs can be placed underground in parking areas and typically treat runoff from small drainage areas. They are ideally designed to remove suspended solids, oil, and grease and are usually capable of removing larger debris. Regular maintenance is required to keep them operating as designed.
5. Vegetative methods use plants to help filter pollutants from runoff and can be used adjacent to parking lots, building landscaped areas, and buffer areas adjacent to streams.
6. Groundwater recharge and stormwater detention can be accomplished by methods such as rain barrels that capture runoff from roofs and release it into the ground at a slower rate after the rain event.

LID methods may be installed in conjunction with traditional BMPs at some of the proposed sites. The type of BMP selected for construction will depend on a detailed assessment of site conditions and will be decided in conjunction with public input during the design process. Property owners and stakeholders such as homeowners associations, the Fairfax County Park

Authority, the Fairfax County School Board, and community members will be contacted prior to designing these projects in order to receive approval for the use of the land and to receive input and gain support during the design process. Some of the recommended new BMP projects may be implemented through proffered commitments offered by developers during the rezoning process.

The new BMP projects have been grouped by ownership (public or privately owned land) and type (conventional BMPs or LID methods). The proposed new BMP locations are described in Chapters 4 through 8 and are shown on Maps 4.3, 5.5, 5.6, 6.3, 7.3, 8.7, 8.8, and 8.9.

Public BMP and LID Projects

School properties were targeted for BMP or LID projects because, with the exception of the Potomac School and the Saint Luke School, the properties are owned by the county, usually have large impervious areas, often have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues. Conventional BMPs suitable for school properties include dry detention basins, shallow wetlands, and infiltration basins. The most likely LID methods for schools include adding buffers along parking areas, installing rain gardens and bioretention areas near buildings, and planting vegetation along ditches, streams and property boundaries. Manufactured BMPs can be placed underneath parking lots to treat the runoff. Plans to construct new buildings or renovate existing buildings should consider green roofs as an option. If artificial turf is installed in athletic fields, environmentally safe artificial turf should be used and the fields should be designed to store and treat stormwater runoff from nearby parking lots and buildings.

Parks were also targeted for BMP or LID projects because the land is owned by the Park Authority and county facilities should be examples of environmentally friendly design. BMP or LID projects at parks will help educate the public about ways to remove pollutants from runoff. Conventional BMPs suitable for park properties include wet retention ponds, dry detention basins, shallow wetlands, and pond and wetland combinations. The most likely LID methods for parks include adding porous pavement to outlying parking areas, installing buffer strips adjacent to parking areas, installing bioretention areas, and using vegetative methods to treat runoff from impervious areas. Manufactured BMPs may be used in parking lots to treat runoff from small areas. Educational signs should be placed near LID projects at schools and parks to explain the purpose and benefits of the LID methods.

Private BMP and LID Projects

BMP and LID projects were recommended for privately owned commercial properties, multi-family residential developments, and places of worship as listed in Chapters 4 through 8. These project sites were chosen because they have large impervious areas and do not have existing stormwater management controls. Conventional BMPs suitable for private properties will depend on the available area and the flow characteristics of the site. The most likely LID retrofits for the multi-family residential, commercial, and church/temple sites include installing buffers adjacent to the parking areas, installing bioretention in the landscape areas near buildings and in parking lots, and planting vegetation at the edges of the property especially near ditches and streams. Manufactured BMPs may be installed underneath parking lots to treat the runoff from small drainage areas. Porous pavement may be an option for parking areas that are used infrequently. Since maintenance of these facilities is essential to their success, the property owners should be trained in proper maintenance techniques and/or requirements. Projects on private lands will be evaluated to determine a means for cost-sharing by land owners. Fairfax County should set up a program to monitor the maintenance of these private facilities.

Watershed Benefit: The majority of the streams in the Middle Potomac Watersheds are actively widening because of the increased stormwater runoff from surrounding developed areas. The new BMP locations were chosen because they can treat runoff from highly developed areas that do not have existing stormwater management controls in place. Targeting these areas for new BMPs will help to reduce peak flows in the streams and remove pollutants from the runoff which will help to improve water quality. Reducing the runoff delivered to the streams will reduce the amount of stream bank erosion, increasing the likelihood of success for stream restoration projects downstream. The water quantity control benefit and pollutant removal benefit have been calculated for some of the new BMPs described above and this information is provided in Tables 5.8, 6.8, 7.7, and 8.8

Cooperating with volunteers when installing LID practices such as rain gardens is a great way to get the community involved and spread information about the benefits of reducing runoff and improving water quality. Organizations such as the Northern Virginia Soil and Water Conservation District and the Virginia Department of Forestry currently help communities install rain gardens in Fairfax County. The county will work with these and other organizations to encourage volunteer participation in the planting and maintenance of rain gardens. Educational signs about the LID projects should be installed to provide information about the purpose and benefits of each project. This action will also help to meet the objectives of Action B1.2.

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.

Strategy to Achieve Action: The neighborhoods selected as Neighborhood Stormwater Improvement Areas do not have existing stormwater management controls and the runoff from these neighborhoods contributes to downstream erosion problems. These neighborhoods are typically medium density residential areas and have a greater amount of imperviousness than low density residential areas. Extensive infill development and mansionization of existing homes in the targeted neighborhoods have also caused increased peak flows. Targeting these neighborhoods for LID measures will help to mitigate the effects of the impervious surfaces and to improve the effectiveness of stream restoration projects downstream.

The residents of the neighborhoods, Fairfax County Department of Transportation (FCDOT), and VDOT will need to be involved in the planning and design process for these LID projects. Education of and outreach to individual property owners will need to be performed to encourage the voluntary installation of LID practices on private property. County staff should encourage the use of LID practices to meet stormwater management requirements for infill and redevelopment sites.

LID techniques for the neighborhoods include installing rain gardens, porous pavers, rain barrels, manufactured BMPs, vegetative measures, and redirecting downspouts away from driveways. The type of LID practices selected for construction will depend on the detailed site conditions in the neighborhoods and on public input received during the design process. The areas targeted as Neighborhood Stormwater Improvement Areas are shown on Maps 5.5, 5.6, 6.3, 8.7, and 8.8.

Watershed Benefit: The majority of the streams in the Middle Potomac Watersheds are actively widening due to the amount of runoff they receive, and installing LID practices in these neighborhoods will help to reduce peak flows and erosion. These neighborhoods have large amounts of impervious surface and the majority of the areas do not have stormwater management controls. Installing rain barrels and rain gardens is a great way to get the community involved and spread information about the benefits of reducing runoff and improving water quality. Educational signs about the LID projects should be placed in common areas in the targeted neighborhoods to provide information about the purpose and the benefits of LID practices. These neighborhood LID projects will help to promote the use of LID methods by showing developers how LID methods could be successfully incorporated into subdivision design. This action will also help to meet objectives of Action B1.2.

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.

Strategy to Achieve Action: Reconnecting the stream channels to the floodplains involves removing any existing concrete channel or regrading the stream banks to allow stream flows to spread through the natural floodplain area. Channel bank height may need to be reduced in areas where the stream banks are higher than the floodplains and flows cannot reach the floodplains. The floodplain reconnection projects will be performed in conjunction with stream restoration projects.

Watershed Benefit: Reconnecting the stream channels to the floodplains will give the stream overflow a chance to spread out, which will help slow down the velocity and reduce the volume of flow in the downstream channel. Reducing the peak flow in the channel will reduce the effects of erosion and downcutting in the channel.

Action A1.5: Remove detrimental channel obstructions.

Strategy to Achieve Action: Channel obstructions that block stream flow should be removed if they are endangering a structure or causing flooding or severe erosion. Channel obstructions are constantly changing and will be assessed in the field before removal. A program should be established to identify and address future blockages on a regular basis.

Watershed Benefit: Removing the obstructions will help to restore the capacity of the stream and prevent erosion of the banks caused by the blockages.

Action A1.6: Stabilize eroding stream banks using bioengineering methods.

Strategy to Achieve Action: The county stream physical assessment identified many stream segments in the Middle Potomac Watersheds with eroded banks that would be good candidates for stream restoration projects. Public access to the streams should be included as part of the stream restoration projects where feasible. In areas where the stream velocities are high, a variety of stream restoration techniques will be needed to reduce velocities and achieve the desired results of reducing erosion and improving aquatic habitat. These stream restoration techniques include J-hook vanes, cross vanes, and W-weirs. Also, the use of stream restoration bank protection techniques such as root wad revetments, boulder revetments, or riprap to protect and stabilize the banks will be needed where the stream velocities remain high. Some reaches of the streams may tolerate higher velocities and more detailed geotechnical information will need to be collected during the design process to determine the allowable erosive velocities in each stream reach.

Stream restoration activities may include riparian vegetation plantings, removal of invasive species with limited use of herbicides, physical removal of unstable trees, modification of culverts, floodplain creation, channel reconfiguration, bioengineering of stream banks, selective placement of in-stream habitat structures, and trash/debris removal. These activities have been divided into two different categories – restoration of the riparian corridor and modifications to the stream channel – and are discussed in more detail in Appendix B of this plan. Activities associated with restoration of the riparian corridor and modifications to the stream channels are shown on Maps 4.3, 5.5, 5.6, 6.3, 7.3, 8.7, 8.8, and 8.9. More detailed information will need to be collected prior to stream restoration design to determine the constraints and evaluate what stream restoration techniques will be feasible. The goals of the stream restoration for each reach may need to be modified based on the additional information collected prior to the stream restoration design.

Restoring the streams to stabilize the banks will also help protect the properties located adjacent to the streams. Stabilizing eroding stream banks will help protect land owners' property and ensure their safety. The projects for this action will also help to achieve Goal B and are described under Action B5.1.

Watershed Benefit: The impacts of these projects were not modeled for this watershed management plan because their impacts cannot be accurately calculated without further study.

However, the general benefits of projects such as these are reduced stream erosion, improved aquatic habitat, protection of land owner property, and public safety. Typically, stream restoration projects help stop erosion by reducing flow velocities to levels that are not erosive. The point at which flow velocities begin to erode stream banks depends on local soil conditions.

Policy Actions A1.7 and A1.8 regarding road widening projects and infill development are discussed in Chapter 9.

3.1.1.2 Objective A2

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve the existing stormwater infrastructure to prevent flooding of roadways and property.

Strategy to Achieve Action: The problematic storm drainage structures will need to be evaluated for modification or replacement. The goal of improving the storm drain infrastructure is to reduce flooding to surrounding areas.

Storm drain improvement options that may be suitable for implementation in the watersheds include:

1. Modifying or replacing the existing headwalls and curtain walls of culvert outlets. Due to constructability considerations, such as dimensions and configuration, most of the headwalls and curtain walls will require replacement with newly designed structures.
2. Replacing the existing culvert with a properly sized culvert or installing two parallel culverts to help mitigate flooding.
3. Installing an energy dissipater or stilling basin at the outfall end of the culvert in order to prevent stream bank erosion.
4. Rehabilitating or replacing storm drainage pipes, inlets, and outlets that are failing or need repair because of age or inadequate capacity.
5. Increasing the capacity and stability of ditches that are severely eroding and are causing flooding in surrounding areas.

Watershed Benefit: The locations presented in Chapters 4 through 8 were targeted for infrastructure improvements because of flooding complaints. The flooding is occurring because of failing or inadequate storm drain systems. Replacing or rehabilitating the infrastructure will help to alleviate the flooding.

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.

Strategy to Achieve Action: Locations targeted for improvement may be causing erosion of the streams and are therefore recommended for infrastructure improvements.

Watershed Benefit: The locations presented in Chapters 4 through 8 were targeted for infrastructure improvement because they are impacting the streams in a negative way. Modifying them will help to prevent erosion of the streams.

Action A2.3: Protect structures located in the 100-year flood limit from flooding.

Strategy to Achieve Action: Flood protection may include floodproofing, building a floodwall, or a home buyout program.

Floodproofing involves retrofitting a structure so that water cannot enter the building or damage HVAC equipment. Some methods of floodproofing may include:

- Applying a waterproof coating or membrane to the exterior walls of the building.
- Installing watertight shields over doors, windows, and other openings.
- Anchoring the building as necessary so that it can resist floatation.
- Installing backflow valves in sanitary and storm sewer lines.
- Raising utility system components, HVAC machinery, and other pieces of equipment so that they are above the expected flood level.
- Installing a sump pump and foundation drain system.
- Strengthening walls so that they can withstand the pressures of flood waters and the impact of flood borne debris.

Tables 5.10, 6.10 and 8.10 list the number of properties in the Middle Potomac Watersheds that are located in the 100-year flood limit and/or have been recommended for flood protection.

Watershed Benefit: Flood protection will mitigate or prevent flood damage to structures from the 100-year storm event and possibly from more frequent storms as well.

3.1.1.3 Objective A3

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.

Strategy to Achieve Action: Collaborate with Virginia Department of Environmental Quality and Department of Conservation and Recreation to perform studies to identify the sources of fecal coliform bacteria in the Middle Potomac Watersheds and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced.

Watershed Benefit: Scotts Run and Pimmit Run have been identified by the Virginia Department of Environmental Quality as impaired streams due to high levels of bacteria; Bull Neck Run could be also added to the list due to its poor water quality. The proposed studies will allow the evaluation and identification of the sources of fecal coliform bacteria in the watersheds. The studies would also allow a baseline to be established against which progress toward reducing fecal coliform bacteria in the stream can be measured. The ultimate goal of the study action plan would be to remove these streams from Virginia's list of impaired waters. If the studies show that the source of fecal coliform bacteria is poorly functioning septic systems, it may be possible to connect areas with on-site septic systems to the county's centralized wastewater treatment system if the areas are within the county's Approved Sewer Service Area.

3.1.2 Goal B Objectives and Actions

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

3.1.2.1 Objective B1

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.
Action B1.1: Retrofit existing stormwater management facilities and BMPs.

Strategy to Achieve Action: The existing stormwater management (SWM) facilities and BMPs could be structurally retrofitted by increasing the detention storage area, modifying the outlet structure to reduce the rate of discharge, providing infiltration features, creating a wetland bench, or planting a vegetated buffer. Increasing the area draining to the facility may also be desired to increase the overall area treated by the stormwater management facility. Increasing the area draining to the facility would require the existing storm drain system to be modified or a new storm drain system to be constructed to redirect and convey the additional runoff to the facility. One of the goals of retrofitting a stormwater management facility would be to increase water quality treatment and to have a greater reduction in peak flows downstream of the facility.

These capital projects may be proffered by developers in rezoning cases in addition to satisfying on-site stormwater management requirements. Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described in Action A1.1 and are shown on Maps 4.3, 5.5, 5.6, 6.3, 7.3, 8.7, 8.8, and 8.9.

Watershed Benefit: The recommended retrofit projects will benefit the watersheds by reducing the peak flows delivered to the streams and helping to improve water quality by increasing pollutant removal. Reducing the peak flows will help reduce the amount of bank erosion that is taking place in the streams and prevent excessive sediment from polluting the stream which will improve both water quality and habitat. Improving water quality is necessary in order to ensure that animals and plants can survive and flourish.

The retrofit locations were chosen because they are in highly developed areas, are located in the headwaters of streams, or were identified as being in need of modification or repair. The benefits of the projects that will be implemented first have been calculated and this information is provided in Tables 4.7, 5.7, 6.7, 7.6, and 8.7.

Action B1.2: Construct new BMPs including LID methods.

Strategy to Achieve Action: Conventional BMP options that may be suitable for implementation include wet retention ponds, dry detention basins, shallow wetlands, pond and wetland combinations, infiltration basins and sand filters. LID projects may include installing bioretention, porous pavement, green roofs, manufactured BMPs, vegetative methods, and groundwater recharge. LID methods may be installed in conjunction with traditional BMPs at some of the proposed sites. The type of BMP selected for construction will depend on a detailed assessment of site conditions and will be decided in conjunction with public input during the design process. Property owners and stakeholders such as homeowners associations, the Fairfax County Park Authority, the Fairfax County School Board, and community members will be contacted prior to designing these projects in order to receive approval for the use of the land and to receive input and gain support during the design process. The recommended new BMP projects may be used as proffers offered by developers during the rezoning process.

The proposed new BMP and LID projects are described in Chapters 4 through 8. The proposed new BMP locations are shown on Maps 5.5, 6.3, 8.7, and 8.8.

Watershed Benefit: The Middle Potomac streams are actively losing habitat and wildlife because of the increased stormwater runoff and associated pollutants from surrounding developed areas. The new BMP locations were chosen because they can treat runoff from highly developed areas that do not have existing stormwater management controls in place. Targeting these areas for new BMPs will help to reduce peak flows in the streams and remove pollutants from the runoff which will help to improve water quality. Reducing the peak flow will increase the likelihood of success for stream restoration projects downstream, which will in turn help to improve water quality, allowing the aquatic life to survive and flourish. The benefits of the LID and BMP projects that will be implemented first have been calculated and this information is provided in Tables 4.8, 5.8, 6.8, 7.7, and 8.8.

3.1.2.2 Objective B2

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

Policy Actions B2.1 through B2.5, which address various developments, including the Tysons Corner Stormwater Strategy, are discussed in Chapter 9 under Objective B2.

3.1.2.3 Objective B3

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control, and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities.

Riparian buffers are needed to support watershed health by filtering runoff from adjacent land, controlling erosion, and providing habitat for native plants and animals. The county's Chesapeake Bay Preservation Ordinance protects riparian buffers along perennial streams from being disturbed or developed. Objective 10 of the environment section of the county's Comprehensive Plan states: "Conserve and restore tree cover on developed and developing sites. Provide tree cover on sites where it is absent prior to development." The watershed plan objective for restoring and managing riparian buffers helps to meet this comprehensive plan objective.

Strategy to Achieve Action: Restoring riparian buffers on public property should be the first step. The need for easements on private property will have to be determined to facilitate the restoration of riparian buffers in these areas. In most cases, the removal of invasive species and the restoration of native species should be included in buffer restoration projects. If invasive species are removed, the use of herbicides should be limited and other methods, such as manual removal, employed where possible. Appropriate buffer materials and species mixes should be selected based on the restoration goals for each area. The deficient buffer locations, described in Chapters 4 through 8, were found during the 2002 Stream Physical Assessment and are potential locations for buffer restoration projects. The locations are shown on Maps 4.2, 5.3, 5.4, 6.2, 7.2, 8.4, 8.5, and 8.6.

Watershed Benefit: The restoration of riparian buffers will increase the amount of habitat area, protect floodplain areas from erosion, protect properties from damage due to lateral stream movement, decrease stormwater runoff, and help filter pollutants from runoff. The pollutant removal rates for buffers vary depending on buffer width, soil types, buffer vegetation types, and runoff amounts and are not easily quantified. Therefore, the pollutant removal quantity for the buffer restoration projects has not been calculated for this plan.

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).

Strategy to Achieve Action: Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers. The county and community groups should provide educational and technical assistance to property owners with land adjacent to streams to help them manage existing buffers. Technical and educational assistance may include information about the benefits of riparian buffers, planting of native vegetation, identification and removal of invasive species, healthy pruning, limited use and correct application of fertilizers and herbicides, pet waste disposal, and proper disposal of leaves and grass clippings. It will also be important to educate utilities, such as power and sewer companies, which may use vegetation management techniques that are harmful to stream buffers adjacent to utilities. This is a problem in the Pimmit Run Watershed in particular.

Watershed Benefit: This action will help in maintaining and restoring buffers that will provide stream bank and shoreline protection, provide habitat area, and help to filter pollutants from runoff.

Action B3.3: Increase enforcement of stream buffer violations.

Strategy to Achieve Action: Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation. The county may need to hire more staff to increase the enforcement of buffer violations. Ongoing stream physical assessments will help to determine the amount of buffer being lost or gained. The Fairfax County Park Authority should be a key part of the enforcement effort.

Watershed Benefit: Increasing enforcement of buffer violations will help to prevent the removal of sensitive buffer vegetation and to restore the buffer in those areas where vegetation was removed. Buffers provide filtering of pollutants from stormwater runoff, erosion control, and habitat for wildlife.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.

Strategy to Achieve Action: In most cases, invasive species should be removed from stream buffers and the buffers should be replanted with native plants. All projects will be field-evaluated prior to implementation to prioritize them based on the severity of the problem and the benefit of the project. In general, areas that have a functioning buffer of non-native vegetation will be lower priority than those that have a deficient buffer or no buffer.

Watershed Benefit: This action will allow native vegetation to flourish and provide a food source and habitat for native species. It will also help in creating more sustainable buffers, which will provide stream bank and shoreline protection, habitat area, and filtering of pollutants from runoff.

Action B3.5: Protect stream buffer areas from development.

Strategy to Achieve Action: The county should coordinate with property owners of large undeveloped parcels adjacent to streams to protect stream buffer areas from development.

Watershed Benefit: Protecting stream buffers from development will help to prevent increases of runoff from development and ensure the stream habitat and water quality do not become more degraded in the future.

Policy Actions B3.6 and B3.7, which address trail design and wildlife corridors, are discussed in Chapter 9.

3.1.2.4 Objective B4

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.

Strategy to Achieve Action: A wetlands functions and values survey should be performed, either by county staff or a contractor. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watersheds and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. Areas identified as having the greatest potential for conservation and restoration should be given the highest priority. The county should seek funding from the Virginia Department of Game and Inland Fisheries and the Virginia Department of Conservation and Recreation to support this effort.

Watershed Benefit: The amount of wetlands in the watersheds is certainly less than what existed in the past but the magnitude of the decline and the location and extent of remaining wetlands are not known. This study will help to identify important information related to wetlands, such as habitat, flood control, and wildlife nursery benefits, and will establish a baseline condition against which future actions and priorities can be measured. In addition to providing habitat for fish, animal, and plant populations, wetlands can serve as areas where the public can observe wildlife. Wetlands will also benefit water quality by filtering pollutants from stormwater runoff and reducing peak flows by acting as a detention area for stormwater runoff. Wetlands typically remove over 70% of suspended solids, 40% of phosphorous, and 20% of nitrogen from the water that is stored in and flows through them.

Policy Action B4.2, which discusses wetland loss mitigation policy, is discussed in Chapter 9.

3.1.2.5 Objective B5

Objective B5: Restore natural stream channels, banks and beds to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural stream geometries, and remove concrete from stream banks and beds

Strategy to Achieve Action: Restoring streams and their tributaries will improve the condition of the aquatic habitat and should be carefully coordinated with the objectives of reducing the quantity and improving the quality of runoff in order to prevent further erosion and channel widening.

Stream restoration projects may include replacing concrete channels and gabion lined stream banks with soft structure measures, such as live fascines, vegetated geogrids, and brush mattresses. The locations of proposed stream restoration activities are described in Chapters 4 through 8 and shown on Maps 4.3, 5.5, 5.6, 6.3, 7.3, 8.7, 8.8, and 8.9.

Watershed Benefit: The impacts of these projects were not modeled; however, the general benefits of projects such as these are reduced stream erosion and improved aquatic habitat. Typically, stream restoration projects arrest erosion or reduce erosive velocities to sustainable levels.

3.1.3 Goal C Objectives and Actions

GOAL C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

3.1.3.1 Objective C1

Objective C1: Improve education and outreach.

Action C1.1: Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects. Students could attend watershed workshops and engage in taking care of LID measures at their schools as well as stream cleanups and other conservation activities. Provide activities and suggestions for student science fair projects.

Strategy to Achieve Action: The Stormwater Planning Division (SWPD) should coordinate with the Fairfax County Public Schools to provide information about educational opportunities. The SWPD staff and volunteer organizations should organize hands-on and community service projects such as stream and dumpsite cleanups, LID site maintenance, rain garden construction, and water quality monitoring projects for students. Educational workshops for students may include topics such as building and maintaining LID sites and water quality monitoring.

Watershed Benefit: An on-going relationship between teachers and SWPD staff will facilitate getting information to students and involving them in implementing some of the plan actions. Providing community service projects throughout the watersheds will allow students to apply lessons learned in the classroom to real life situations and experiences, while helping to restore the watersheds. Having the students maintain LID sites at their schools will provide properly functioning and aesthetically pleasing sites in addition to education.

Action C1.2: Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the Middle Potomac Watersheds Management Plan.

Strategy to Achieve Action: A group of county employees, teachers, and citizens who are active stewards of the watersheds should develop watershed planning fact sheets and lesson plans which will provide educational information about watershed protection and the Middle Potomac Watersheds Management Plan. The fact sheets and lesson plans could contain specific information pertaining to the individual watershed where the school is located, such as boundaries, water quality, and habitat. The group should distribute the fact sheets and lesson plans to the teachers and give a presentation to explain the educational materials.

Watershed Benefit: Teaching students about the watersheds will increase the students' awareness and understanding of watershed issues and challenges. Through the fact sheets and lesson plans, the students can learn how their individual actions affect the streams and what they can do to protect and improve the watersheds.

Action C1.3: Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact. Provide downloadable educational materials on the watershed program Web site and create materials that target the following groups with messages that will resonate with each group's interests.

- Homeowners associations (e.g. McLean Citizens Association, existing HOA committees)
- Development community (designers, engineers, contractors and realtors)
- Trail and bicycle groups (Boy Scouts, trails clubs etc.)
- "Friends of" groups (groups organized to protect specific streams)
- Environmental and conservation groups
- Major landowners (the CIA, National Park Service)
- Churches and faith-based groups (also use churches to target immigrant populations)
- Pet owners that use stream side parks (via brochures at vet offices and pet supply stores)

Strategy to Achieve Action: The county should take all of its educational information (event flyers, brochures, and future educational material) and consolidate it on a watershed program Web site. Information pertaining to each group should be categorized under individual sections. This will provide citizens easy access to educational information and current events.

Watershed Benefit: More citizens may get involved in watershed activities and become better informed if the educational material is easy to access on the watershed program Web site.

Action C1.4: Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups. Provide the slide show on the Web and on CD. Include explanatory text and timing so that the show can be run automatically.

Strategy to Achieve Action: A watershed planning slide show should be created by county staff and/or a volunteer community organization to explain the watershed concept, existing problems, and proposed future improvements for the watersheds. Meetings should be set up with civic groups, watershed associations, businesses, realtors, etc., to show the slide show and answer any questions.

Watershed Benefit: The slide show will help to educate stakeholder groups by increasing public awareness of the Middle Potomac Watersheds. The stakeholder groups may want to participate in the implementation of certain projects and/or help further educate the public about the watersheds. Educating stakeholder groups will give them a deeper understanding of their watershed and inspire them to take personal responsibility for its preservation and restoration.

3.1.3.2 Objective C2

Objective C2: Improve watershed access and stewardship.

Action C2.1: Encourage voluntary donation of trail and conservation easements.

Strategy to Achieve Action: County staff should meet with the property owners whose land will be affected by the county's future trails plan in order to encourage the donation of trail easements. The donation of conservation easements should also be encouraged as a way to further protect the riparian areas adjacent to the streams. During the meeting, environmentally friendly trail design should be discussed to show homeowners that trails can have a minimal impact on their property.

Watershed Benefit: The donation of trail easements will make it easier for the county to develop new environmentally friendly trails throughout the watersheds. The trails will provide greater access to the streams which will increase public awareness and enjoyment of the streams and build stewardship of watershed resources. Well planned trails in donated easements will also help protect natural areas by limiting trampling and ad hoc trail creation. The donation of conservation easements will guarantee additional protection for the RPA.

Action C2.2: Promote annual or semiannual cleanup projects for streams.

Strategy to Achieve Action: Partner with community groups, such as homeowners associations, and school community service organizations to clean up trash and dumpsites in the watersheds. The county may need to provide assistance to volunteer groups for the removal of bulk trash items. Specific locations were identified by the public and from the stream physical assessment and are described in Chapters 4 through 8.

Watershed Benefit: Removing the trash and debris that pollute the streams will improve stream quality and habitat and avoid chemical contamination and physical threats to safety. This action will help foster a feeling of stewardship in the watersheds and provide a good opportunity for public education and outreach.

Action C2.3: Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes. (See also Action C1.1 related to development of educational materials). It would also be helpful to work with the Northern Virginia Soil and Water Conservation District and the Virginia Department of Conservation and Recreation to provide information about appropriate lawn care practices.

Strategy to Achieve Action: Develop brochures that suggest other disposal options for yard waste such as composting, using it as mulch, or incorporating it into the soil. The instructions and benefits for different disposal options can be explained in the brochures. The brochures should also describe the harmful effects of improperly disposing of yard waste such as polluting the streams and blocking their flow.

Watershed Benefit: Educating the homeowners about how to properly dispose of yard waste and the harmful effects of improperly disposing of yard waste may help to lessen the amount of yard waste delivered to the streams which will improve water quality and habitat.

Action C2.4: Improve enforcement of anti-dumping regulations, e.g., install anti-dumping signage with a phone number for reporting violations.

Strategy to Achieve Action: Investigate methods for increasing the enforcement of illegal dumping regulations in the watersheds, perhaps by hiring more inspectors or a contractor to perform dumpsite monitoring and investigations of potential illegal dumpsites. Installing anti-dumping signs with a phone number for reporting violations at all dumpsite locations will encourage citizens to help the county enforce the regulations.

Watershed Benefit: The benefit to the watersheds will be less pollution in the stream as a result of illegal dumping which will help improve the health of the watersheds (see also Action C2.2).

Action C2.5: If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.

Strategy to Achieve Action: Educational information such as brochures and notices should be sent out with the utility bill in order to educate landowners on stormwater issues and proposed watershed projects. Incentives for reducing stormwater runoff can be included in mailings, for example: obtaining a lower utility fee if LID methods are installed. If this incentive is used to reduce utility fees then the landowner should be required to list that LID measure on their deed in order for the practice to continue under future ownership. Other brochure ideas such as the benefits of LID measures or how to install rain gardens can also be included in the mailings.

Watershed Benefit: Sending information out with a stormwater utility bill would increase public knowledge and consciousness about stormwater issues and proposed projects. Through the brochures and notices, the landowners can gain an understanding of how their individual actions affect the streams and obtain information about what they can do to help protect and improve their watershed.

Action C2.6: Form a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.

Strategy to Achieve Action: County staff should support the formation of a volunteer community organization of active citizens to aid in the stewardship of the Middle Potomac Watersheds and to help plan implementation activities. The volunteer group can help plan community service projects for students and community members, such as stream clean-ups. They can work with teachers and county staff to develop fact sheets and lesson plans on watershed protection for teachers to integrate into their syllabi. In addition, they can help present the slide show about watersheds (see Action C1.4) and give educational lectures to interested groups.

Watershed Benefit: The volunteer community organization will support and monitor the implementation of the watershed management plan. They can provide information to the community, teachers, and interested groups in order to promote a deeper understanding of the watersheds and inspire others to take greater responsibility for watershed protection and restoration.

Action C2.7: Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation Six Year Plans, road standards and mitigation projects.

Strategy to Achieve Action: Integrate the watershed management plan with the existing state and local government plans in order to coordinate watershed actions with other planned projects. For example, a proposed new BMP may be located near a road widening project and the BMP may be able to be constructed as part of the road widening project.

Watershed Benefit: Integrating the various plans should make it easier to construct some of the proposed projects and may provide a greater opportunity for earlier implementation of the watershed projects.

Action C2.8: Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.

Strategy to Achieve Action: Install signs throughout the watersheds to convey information such as identification of streams and watershed boundaries. Due to the ethnic and cultural diversity of the citizens in the watersheds, provide signs both in English and in other languages. Also, encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Watershed Benefit: Providing information about the streams and watersheds on signs will educate the community and promote awareness about the streams.

3.1.3.3 Objective C3

Objective C3: Promote the implementation and maintenance of low impact development (LID) practices.

Action C3.1: Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily. Provide an awards program for businesses that achieve impressive LID applications. Businesses can use this as a marketing tool for clients.

Strategy to Achieve Action: A LID recognition program can be implemented to provide awards to businesses and neighborhoods that voluntarily implement LID measures and that provide exemplary maintenance of LID measures. The awards may include a plaque and recognition in the newspaper and on the county Web site.

Watershed Benefit: A LID recognition program will help promote the implementation and continued maintenance of the LID measures.

Action C3.2: Demonstrate that LID can increase property values (e.g. a realtor can market the value of an aesthetically pleasing and ecologically beneficial rain garden). Provide case examples of this and publish them. Develop detailed case studies of successful LID projects and provide financial evidence of economic successes (e.g. sold lots for higher prices, sold development parcels faster, spent less on LID than conventional methods.

Strategy to Achieve Action: Research should be performed to determine the extent to which LID measures may increase property values. This information should be published and provided to economic development agencies, real estate agents, and private developers. Local examples of increased property values due to the use of LID methods should be cited in the publication.

Watershed Benefit: Developers will be more likely to implement LID methods if it is known that the LID methods will increase the value of their property. The LID methods will benefit the watersheds by providing greater control and treatment of stormwater runoff especially for areas that do not have existing stormwater controls.

Action C3.3: Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits. For example, provide marketing of eco-office parks, healthy landscapes, safer and more environmentally sensitive and attractive developments, and more beautiful environments to attract clients and employees.

Strategy to Achieve Action: Create a marketing package to give to developers of properties who use LID measures extensively. The marketing package will contain examples of brochures and print ads that highlight the environmental benefits of LID measures and describe the aesthetic advantages. The developers can use this information to create marketing materials for their site in order to promote the advantages of developments that use LID practices.

Watershed Benefit: A marketing package will encourage developers to use LID methods on their site which will help control the stormwater runoff and treat the pollutants in the runoff. It will also help raise homeowners' awareness of stormwater controls and alternatives.

Action C3.4: Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods. Provide materials in multiple languages such as English, Spanish, Korean, etc.

Strategy to Achieve Action: County staff should create a training and certification program or endorse an already established program to train landscapers on installation and maintenance of LID practices. Land care companies will benefit from being county certified, making them more likely to be selected by property owners should the county require the use of LID practices to the 'maximum extent practicable' (see Actions B2.2 and B2.3 in Chapter 9).

Watershed Benefit: When LID measures are installed and maintained correctly, they will provide a greater benefit in controlling stormwater and removing pollutants from runoff. This action may also encourage more widespread use of LID practices due to an increase in landscapers trained in installation and maintenance.

Action C3.5: Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them. Provide a list of stores that carry LID supplies.

Strategy to Achieve Action: County staff should meet with businesses such as hardware stores, home improvement stores, nurseries, and building material suppliers to explain the benefits of LID methods and encourage them to supply materials used in the construction of LID methods such as rain gardens, pervious pavers, and rain barrels. Providing homeowners and landscaping companies easy access to LID materials will make it more likely that they will construct LID methods. The companies supplying the materials could also supply educational brochures about LID practices to homeowners and contractors. These companies would benefit from free advertising by being on a list of LID material suppliers provided by the county.

Watershed Benefit: Providing easy access to building materials for LID methods will enable homeowners and contractors to construct them more easily and make it more likely that they will be used. LID methods will help to reduce runoff and its associated pollutants.

Action C3.6: Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries. Consider asking a major store chain to print the brochures.

Strategy to Achieve Action: Develop brochures and distribute them to hardware stores, home improvement stores, and nurseries throughout the watersheds. The brochures should discuss the different LID methods and how to install and maintain them. For example, a brochure might discuss the elements of a rain garden. The county could set up a meeting with the owners and employees of the stores and nurseries to educate them on stormwater runoff problems and the benefits of LID methods. Once the employees and owners have been informed about LID methods, they will be able to explain the brochures and answer questions from customers.

Watershed Benefit: The brochures will increase public knowledge about LID methods which may increase the implementation of LID methods such as rain gardens, rain barrels, and grass swales throughout neighborhoods. The installation of additional LID methods will help reduce the amount of runoff entering the streams and improve their water quality.

Policy Actions C3.7 through C3.9, regarding citizen involvement in implementing LID measures, are discussed in Chapter 9.

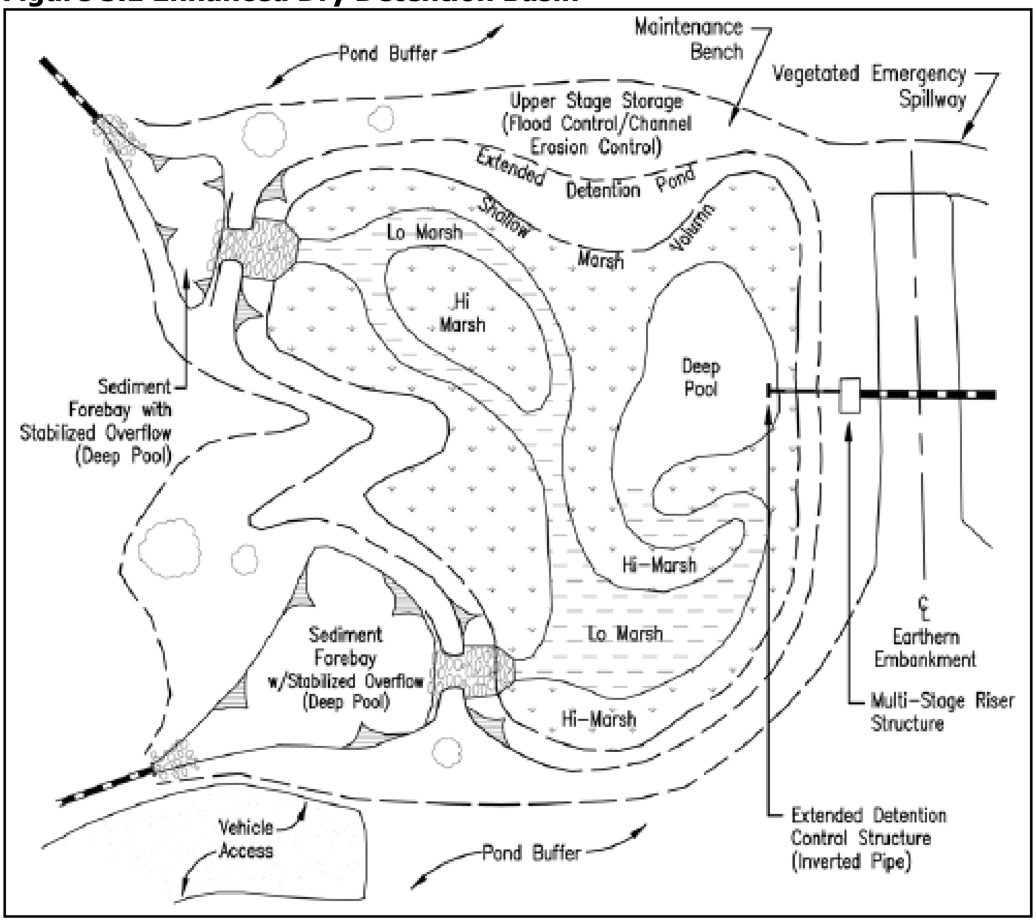
3.2 Watershed Project Types

As described in the previous section, there are many different types of projects proposed for the Middle Potomac Watersheds. This section summarizes the various project types and the project options, if any.

BMP Retrofit

Description: Retrofit suitable existing stormwater management facilities and BMPs to make them more effective at decreasing the peak flows and capturing pollutants. Retrofitting stormwater management facilities will allow them to exceed the original performance criteria or standards that were used to design each facility. A dry detention basin is shown in Figure 3.1 and a wet retention pond is shown in Figure 3.1.

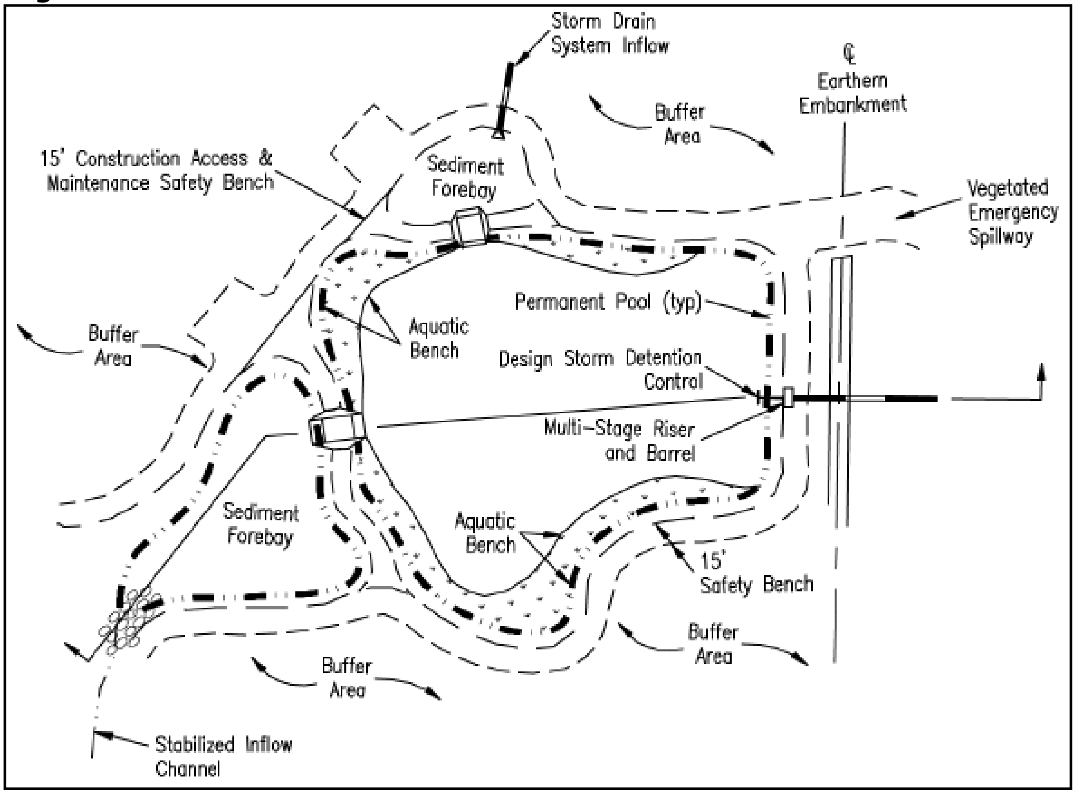
Figure 3.1 Enhanced Dry Detention Basin



Source: Virginia Stormwater Management Handbook, Volume I (1999)

Retrofit Options: There are many options available for retrofitting existing SWM and BMPs. These options include increasing detention storage with excavation, modifying or replacing the existing riser structures and outlet controls, adding infiltration features, modifying basins that are currently "short circuiting", redirecting runoff from additional drainage area, adding water quality treatment, and planting buffer vegetation.

Figure 3.2 Wet Retention Pond

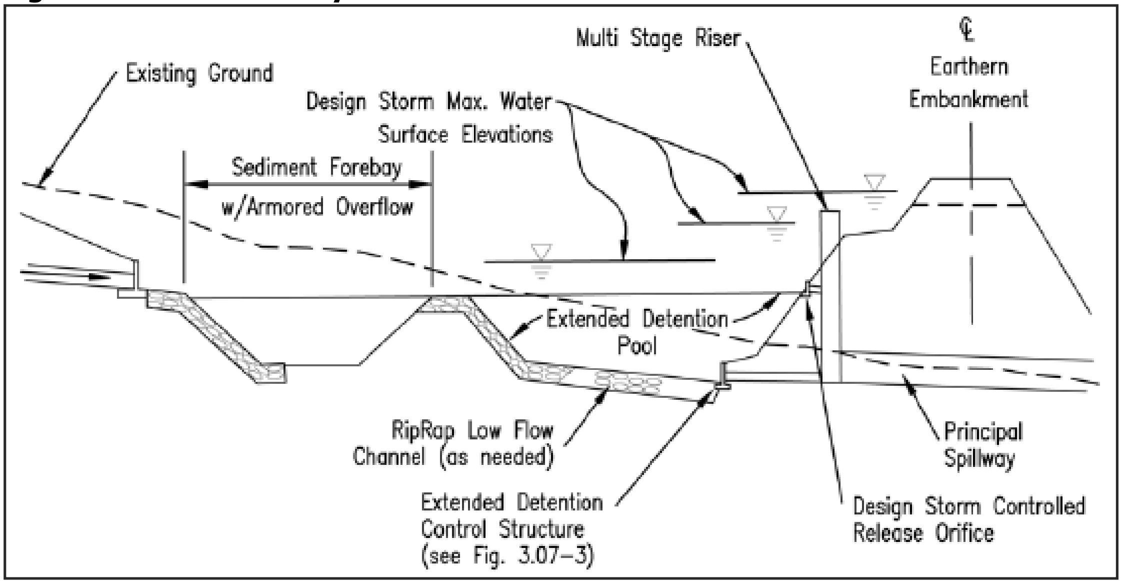


Source: Virginia Stormwater Management Handbook, Volume I (1999)

New BMP

Description: New BMPs are constructed to detain runoff from existing developments that do not currently have stormwater management controls. Locations targeted for new BMPs were parks, schools, privately owned commercial properties, multi-family residential developments, and places of worship. Conventional BMP options that may be suitable for implementation on these properties are wet retention ponds and dry detention basins, shown in Figures 3.3 and 3.4. The BMPs will help to reduce peak flows in the streams and remove pollutants from the runoff which will help to improve water quality.

Figure 3.3 Enhanced Dry Detention Basin

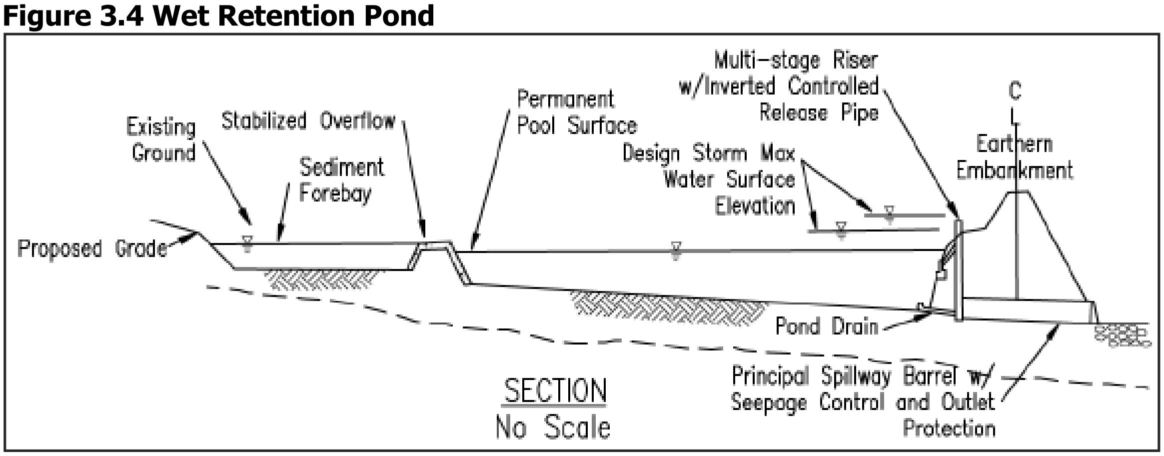


Source: Virginia Stormwater Management Handbook, Volume I (1999)

Options: Based on the project area characteristics, either wet retention ponds or dry detention ponds could be used. A dry detention pond basin incorporates a shallow wetland in its bottom. The shallow wetland provides pollutant removal through wetland plant uptake, absorption, physical filtration, and decomposition.

Through gravitational settling, high removal rates of particulate and soluble pollutants can be achieved in retention basins. When an even higher degree of pollutant removal efficiency is required, the basin can be enhanced by using various modifications relating to the size and design of the permanent pool.

Figure 3.4 Wet Retention Pond

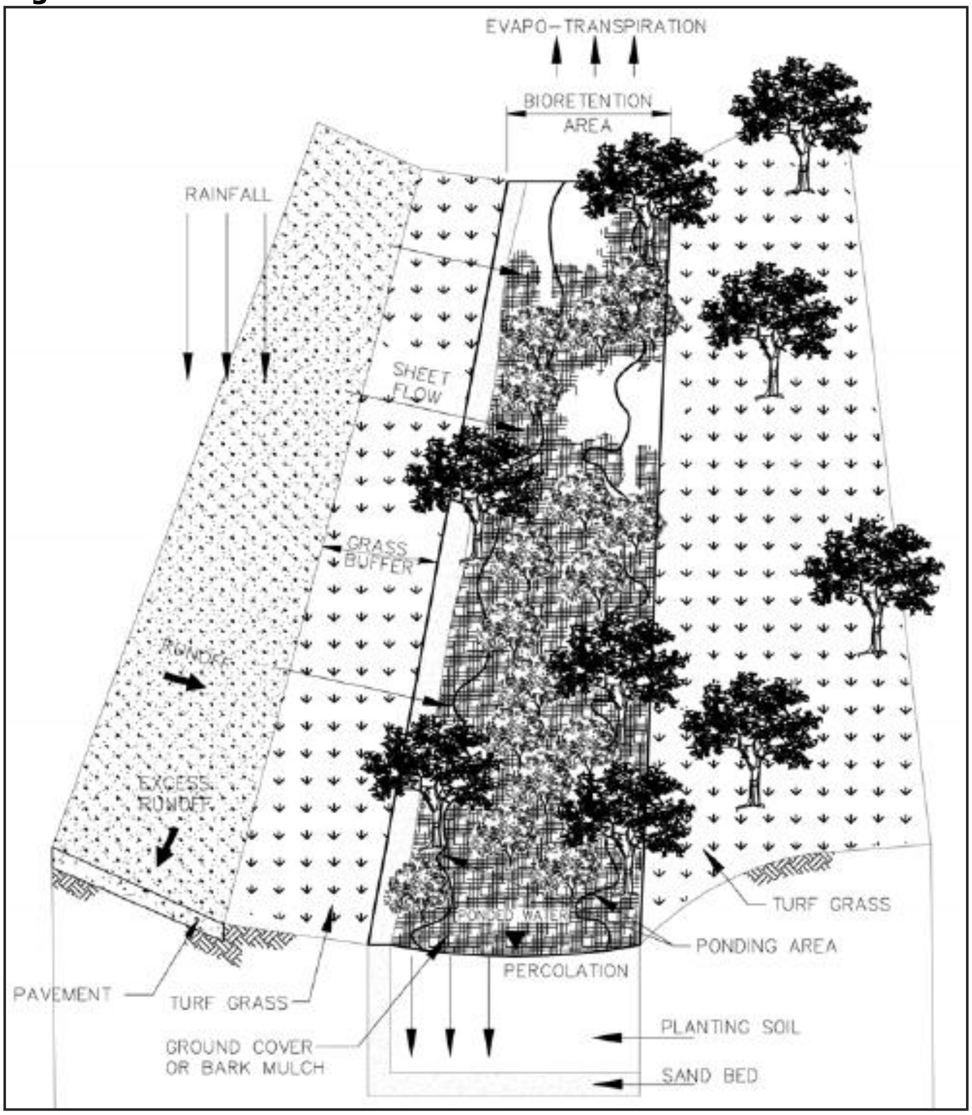


Source: Virginia Stormwater Management Handbook, Volume I (1999)

New LID

Description: Low Impact Development (LID) methods are used to detain runoff from existing properties that do not currently have stormwater management controls. The LID methods provide runoff reduction as well as a reduction in phosphorus and other pollutants. LID projects may include bioretention areas (also known as rain gardens), porous pavement, green roofs, manufactured BMPs (such as Filterras), vegetative methods, and groundwater recharge. A schematic of a bioretention basin is shown in Figure 3.5.

Figure 3.5 Bioretention Basin



Source: Virginia Stormwater Management Handbook, Volume I (1999)

LID Options: Bioretention methods such as rain gardens may be installed in low lying open areas and near disconnected downspouts. Bioswales, grassed swales, and infiltration trenches can be installed to replace shallow eroding ditch depressions that normally carry stormwater. Porous pavement could be installed at outer edge parking areas where usage is limited. Green roofs may be installed on the roofs of buildings which will allow rainfall to be captured in the planting media and used by the plants. Tree box filters, which treat runoff from small drainage areas, can be placed around parking areas. Vegetative methods use plants to help filter pollutants from runoff and can be used adjacent to parking lots, building landscaped areas, and buffer areas adjacent to streams. Groundwater recharge and stormwater detention can be accomplished using rain barrels that capture runoff from roofs and release it into the ground at a slow rate after the rain event.

Neighborhood Stormwater Improvement Area

Description: The neighborhoods selected as Neighborhood Stormwater Improvement Areas (NSIAs) do not have existing stormwater management controls and the runoff from these neighborhoods contribute to downstream erosion problems. These neighborhoods have a greater amount of imperviousness due to extensive infill development and mansionization of existing homes which has caused increased peak flows. Targeting these neighborhoods for LID measures will help to mitigate the effects of the impervious surfaces and to improve the effectiveness of stream restoration projects downstream.

Options: LID techniques for the NSIAs include installing rain gardens, porous pavers, rain barrels, manufactured BMPs, vegetative measures, and redirecting downspouts away from driveways.

Stream Restoration

Description: The restoration of an environmentally degraded stream involves modifications to many different physical, chemical, and biological components of the stream ecosystem. The restoration of the riparian corridor is the most common technique used in stream restoration. In areas where the stream velocities are high, a variety of stream restoration techniques will be needed to reduce velocities and achieve the desired results of reducing erosion and improving aquatic habitat. Restoring the streams to stabilize the banks will also help protect the properties located adjacent to the streams. Stabilizing eroding stream banks will help protect land owners' property and ensure their safety.

Options: Stream restoration activities may include riparian vegetation plantings, removal of invasive species, physical removal of unstable trees, modification of culverts, floodplain creation, channel reconfiguration, bioengineering of stream banks, selective placement of in-stream habitat structures, and trash/debris removal. Stream restoration is discussed in more detail in Appendix B of this plan.

Buffer Restoration

Description: Riparian buffers are needed to support watershed health by filtering runoff from adjacent land, controlling erosion, and providing habitat for native plants and animals. The restoration of riparian buffers will increase the amount of habitat area, protect floodplain areas from erosion, protect properties from damage due to lateral stream movement, decrease stormwater runoff, and help filter pollutants from runoff.

Options: Restoring riparian buffers on public property should be the first step. The need for easements on private property will have to be determined to facilitate the restoration of riparian buffers in these areas. In most cases, the removal of invasive species and the restoration of native species should be included in buffer restoration projects. If invasive species are removed, the use of herbicides should be limited and other methods, such as manual removal, employed where possible. Appropriate buffer materials and species mixes should be selected based on the restoration goals for each area.

Floodplain Restoration
Description: Reconnecting the stream channels to the floodplains will give the stream overflow a chance to spread out, which will help slow down the velocity and reduce the volume of flow in the downstream channel. Reducing the peak flow in the channel will reduce the effects of erosion and down-cutting in the channel.

Options: Floodplain restoration may involve removing existing concrete channel or re-grading the stream banks to allow stream flows to spread through the natural floodplain area. Channel bank height may need to be reduced in areas where the stream banks are higher than the floodplains and where flows cannot reach the floodplains. Floodplain reconnection projects should be performed in conjunction with stream restoration projects.

Flood Protection
Description: Flood protection will mitigate or prevent flood damage to structures from the 100-year storm event and possibly from more frequent storms as well. Flood protection may include floodproofing, building a floodwall, or a home buyout program.

Options: Floodproofing involves retrofitting a structure so that water cannot enter the building or damage HVAC equipment. Some methods of floodproofing includes applying a waterproof coating or membrane to the exterior walls of the building, installing watertight shields over doors, windows, and other openings, anchoring the building as necessary so that it can resist floatation, installing backflow valves in sanitary and storm sewer lines, raising utility system components, HVAC machinery, and other pieces of equipment so that they are above the expected flood level, installing a sump pump and foundation drain system and strengthening walls so that they can withstand the pressures of flood waters and the impact of flood borne debris.

Infrastructure Improvement
Description: The goal of improving the storm drain infrastructure is to reduce flooding to surrounding areas. The flooding occurs due to failing or inadequate storm drain systems. Replacing or rehabilitating the infrastructure will help to alleviate the flooding

Options: Storm drain improvement options that may be suitable for implementation in the watersheds include modifying or replacing existing culverts with a properly sized culverts, rehabilitating or replacing storm drainage pipes, inlets, and outlets that are failing or need repair because of age or inadequate capacity and increasing the capacity and stability of ditches that are severely eroding and are causing flooding in surrounding areas.

Project Numbering
Projects are identified using a numbering convention (XX9YZZ) where:

XX is the watershed code. The two letter watershed codes are as follows:
Bull Neck Run – BN

Scotts Run – SC
Dead Run – DE
Turkey Run – TR
Pimmit Run – PM

Y is the project category:
0 – Not used
1 – BMP Projects
2 – Stream Restoration Projects
3 – Buffer Restoration and Floodplain Restoration Projects
4 – Infrastructure Improvement Projects
5 – Not used
6 – Flood Protection Projects
7 – Fecal Coliform Projects
8 – LID Projects
9 – Dumpsite/Obstruction and Policy Projects

ZZ is the unique ID number for projects in each watershed. So Project DE9438 is in the Dead Run Watershed, is an Infrastructure Improvement Project, and was the 38th project created in the Dead Run Watershed.

3.3 Benefits of Plan Actions

Water quality models were used to quantify the benefits of the plan's proposed structural alternatives, including BMP Retrofits, New BMPs, New LID Projects and Neighborhood Stormwater Improvement Areas. Non-structural alternatives, such as public education projects, are also part of the watershed plan; however, due to the difficulty in quantifying the benefits of these projects, these alternatives were not modeled.

As explained in Section 2.6, modeling guidelines were provided by Fairfax County. Design storms were used in the models to quantify reductions in peak flow rates for the two-, ten-, and 100-year storm events, while a continuous simulation was utilized to approximate annual pollutant load reductions between the future and future proposed conditions.

Future development conditions without any alternatives (future) were compared to future development conditions with the proposed alternatives (proposed) to evaluate the effect of the proposed alternatives in the watersheds.

The benefits of the proposed structural alternatives are:

1. Reductions in peak stormwater discharges resulting in

    - Reductions in road, house, and yard flooding
    - Reductions in stream velocities and potential stream erosion

2. Reductions in pollutant loads resulting in improved stream water quality

Table 3.1 shown below presents the reductions in peak discharges and pollutant loadings in the nine Middle Potomac subwatersheds. As the table indicates, implementation of the proposed alternatives provides a reduction from the future to the proposed conditions in the ten-year peak flow as well as a reduction in pollutant loadings for total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). These results are also shown on Maps 3.1 through 3.4.

Table 3.1 Pollutant Loadings and Reductions

Subwatershed	Drainage Area (ac)	Scenario	Runoff Volume (in/yr)	10-Year Peak Flow (cfs/ac)	TSS (lb/ac /yr)	TP (lb/ac /yr)	TN (lb/ac /yr)
Bull Neck Run	1,559	Existing	3.42	0.97	39.9	0.31	2.46
		Future	4.42	1.03	48.1	0.43	3.23
		Proposed	4.31	0.95	40.4	0.39	3.00
		% Load Reduction	-2%	-8%	-16%	-9%	-7%
Upper Scotts Run	1,982	Existing	11.18	1.56	213.3	0.88	8.12
		Future	12.16	1.60	231.4	0.95	8.95
		Proposed	12.01	1.39	160.2	0.82	8.05
		% Load Reduction	-1%	-13%	-31%	-14%	-10%
Lower Scotts Run	1,878	Existing	3.74	1.73	30.8	0.33	2.40
		Future	4.05	1.78	36.4	0.38	2.76
		Proposed	4.03	1.51	35.5	0.38	2.79
		% Load Reduction	0%	-15%	-2%	0%	1%
Dead Run	1,922	Existing	4.36	0.38	70.8	0.49	3.82
		Future	4.81	0.41	76.6	0.53	4.15
		Proposed	4.53	0.34	63.8	0.47	3.71
		% Load Reduction	-6%	-17%	-17%	-11%	-11%
Turkey Run	1,248	Existing	5.91	0.88	110.6	0.47	4.09
		Future	6.09	0.90	113.7	0.49	4.25
		Proposed	5.90	0.85	108.6	0.46	4.02
		% Load Reduction	-3%	-6%	-4%	-6%	-5%
Upper Pimmit Run	2,702	Existing	2.89	0.50	83.5	0.49	4.00
		Future	3.96	0.53	91.0	0.53	4.36
		Proposed	3.28	0.19	70.2	0.44	3.62
		% Load Reduction	-17%	-64%	-23%	-17%	-17%
Middle Pimmit Run	2,803	Existing	2.91	0.72	53.3	0.37	2.90
		Future	3.27	0.75	61.7	0.43	3.35
		Proposed	3.02	0.49	56.9	0.40	3.13
		% Load Reduction	-8%	-35%	-8%	-7%	-7%
Lower Pimmit Run	802	Existing	5.34	3.60	51.5	0.42	3.21
		Future	5.41	3.72	55.1	0.45	3.40
		Proposed	5.41	2.96	55.2	0.45	3.40
		% Load Reduction	0%	-20%	0%	0%	0%
Little Pimmit Run	1,776	Existing	7.19	0.45	60.8	0.44	3.40
		Future	7.41	0.46	63.2	0.46	3.56
		Proposed	7.28	0.45	60.9	0.45	3.48

Subwatershed	Drainage Area (ac)	Scenario	Runoff Volume (in/yr)	10-Year Peak Flow (cfs/ac)	TSS (lb/ac /yr)	TP (lb/ac /yr)	TN (lb/ac /yr)
		% Load Reduction	-2%	-2%	-4%	-2%	-2%
TOTAL	16,672	Existing	46.94	1.00	80.5	0.47	3.86
		Future	51.57	1.04	88.0	0.52	4.29
		Proposed	49.78	0.83	72.4	0.47	3.93
		% Load Reduction	-3%	-20%	-18%	-10%	-8%

The runoff volume shown in the table indicates the inches of water that will run off from each subwatershed area every year. Higher runoff amounts indicate a more urbanized subwatershed, with a greater imperviousness. Since the proposed model uses the same land use conditions as the future model, an overall difference in runoff volume of zero percent was expected in the subwatersheds.

The peak flows shown in the table are the highest flows expected during the ten-year storm, spread out over the area of each subwatershed. The Upper and Middle Pimmit Run Subwatersheds have the greatest reduction in peak flows, over 30 percent, for the ten-year storm. The total reduction in peak flows over the entire Middle Potomac Watersheds area is 19 percent for the ten-year storm. This reduction in flow will provide significant benefits downstream through lower water surface elevations and decreased stream bank erosion.

The pollutant loadings shown in Table 3.1 represent the pounds of pollutants per acre which discharge from the subwatersheds every year. These pollutants flow into the Potomac River, and then into the Chesapeake Bay, contributing to its deterioration. The implementation of the proposed alternatives will reduce the amount of pollutants released into the bay and help Fairfax County meet the requirements of the Chesapeake 2000 agreement.

The total reduction in TSS for the watersheds is greater than the reduction in TN and TP because TSS is more easily removed by the settling that takes place within BMP and LID projects. Since some of the TP and TN are dissolved, removing these pollutants is much harder than removing the TSS. The Upper Pimmit and Upper Scotts Run subwatersheds have the greatest reductions in pollutants due to the large number of proposed alternatives in these watersheds.

The increased infiltration in the new BMP and LID projects reduces the peak flows, which also reduces the amount of pollutants in the downstream subwatersheds. The cumulative stream flow reductions in the watersheds from the proposed alternatives are shown on Map 3.5.

3.4 Implementation of Plan Actions

The actions recommended in this plan will be implemented over the 25-year life of the *Middle Potomac Watersheds Management Plan*. This plan should serve as guidance for all county agencies and officials in helping to steer and determine development and redevelopment within the watersheds. The plan should also be implemented as a living document and the implementation schedule should be updated to reflect plan changes. The initial implementation schedule was first developed using the prioritization criteria provided by the county and modified to consider other relevant factors. The proposed policy actions (Chapter 9) were not prioritized because they will be evaluated with the policy recommendations from the other county watershed management plans.

The proposed projects were first prioritized using a weighted set of five categories. The actions in the plan were assigned an impact score from 1 to 5 for each of the prioritization categories with 5 as the best score and 1 as the worst score. The information used to determine the scores included subbasin condition rankings, geographic location (upstream, downstream); parcel ownership (public, private), and existing water quantity or water quality controls (stormwater management pond, best management practice pond). Structural and non-structural capital projects were prioritized using the same categories. The categories and the weight associated with each category are indicated below. The evaluation factors for each category are listed in descending importance.

1. Fairfax County Board of Supervisors-Adopted Stormwater Control Project Prioritization Categories (40%)

Evaluation Factors
a. Projects that are mandated by state or federal regulations for immediate implementation and projects that address critical/emergency dam safety issues
b. Projects that alleviate structures from damage by floodwaters or by being undermined by severe erosion
c. Projects that achieve stormwater quality improvement in specific conformance with the county's obligation under the Chesapeake Bay initiatives and/or the VPDES permit for storm sewer system discharges
d. Projects that alleviate severe stream bank and channel erosion
e. Projects that alleviate moderate and minor stream bank and channel erosion
f. Projects that alleviate yard flooding
g. Projects that alleviate road flooding

2. Direct Regulatory Contribution (10%)

Evaluation Factors
a. Hybrid projects that accomplish multiple objectives
b. Projects that contribute directly to MS4 and Virginia Tributary Strategies compliance
c. Projects that contribute to TMDL compliance only
d. Projects that have indirect water quality benefits
e. Projects that mitigate flooding

3. Public Support (10%)

Evaluation Factors
a. Projects supported by the advisory committee based on the acceptability of the project in the community
b. Projects supported by the affected residents only. Includes projects that address issues on individual properties such as floodproofing or yard flooding.

4. Effectiveness/Location (25%)

Evaluation Factors
a. Quantity control projects in headwaters areas that lack stormwater management controls
b. Quality control projects in areas that have only quantity controls
c. Projects with greater benefit to cost ratios, such as higher pollutant reduction efficiency, increased retrofit area, etc
d. Stream restorations that require upstream runoff quantity reductions through retrofit or new ponds. These should be targeted for 10+ years from watershed plan completion
e. Projects with low benefit to cost ratios

5. Ease of Implementation (15%)

Evaluation Factors
a. Less complex projects and projects without land acquisition requirements will be easier to implement. This includes: • tree buffer restoration • debris/trash removal • SWM retrofits in county maintained facilities where no additional land rights are required • stream restorations that do not require upstream runoff quantity reductions and are proposed on sites with significant land owner support • LID retrofits at schools and other county facilities • non-structural projects that do not require policy changes or ordinance amendments • other priority projects that have significant land owner support
b. Study projects, wetland surveys, monitoring projects
c. Other pond and LID retrofits, other stream restorations that do not require upstream runoff quantity reductions
d. All other projects

The total score for each project was calculated by adding the corresponding weighted scores from each category. Based on the total scores, the projects were then ranked from the highest score (high priority) to the lowest score (low priority) within each watershed.

The proposed projects located in subbasins with the poorest existing conditions, subbasins with the greatest increase in future imperviousness, or subbasins with the highest likelihood of improvement or preservation received higher scores based on their ability to improve and maintain the overall quality of subbasin area. The proposed projects in the headwaters of each watershed received higher scores than projects in the downstream portions due to the impact of the projects in the headwaters on a greater portion of the streams. The projects located on public parcels received higher scores when compared to the projects on private parcels due to their greater ease of implementation and perceived public support. The projects which typically have a higher priority include new BMP projects, BMP retrofits, and new LID practices. For BMP retrofit projects, the stormwater management (SWM) ponds with only water quantity controls received a higher score when compared to BMPs which have both water quantity controls and water quality treatment. This is due to the fact that SWM ponds can be easily retrofitted with water quality treatment features while the improvement of existing water quality treatment features is more difficult.

The 25 year implementation period for the Middle Potomac Watersheds Management Plan has been divided into five-year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The project prioritization is a tool to help in developing the implementation sequencing for the proposed watershed plan projects. The projects with the top prioritization rankings were typically assigned to Group A (0 to 5 years) or Group B (5 to 10 years) implementation timeframes. However, other factors were also considered when assigning the implementation timeframes such as promoting projects that have high visibility and low costs but that may not have received a high priority score. These types of projects include buffer restoration and obstruction removal projects which were assigned to Group A or B. The projects were also grouped based on distributing the costs throughout the 25-year implementation period. Sequencing and geographic location were also considered so that the successful implementation of Group A or B projects will reduce stormwater impacts in a specific subbasin and make it possible to implement other projects in the later timeframes. For example, a new BMP pond constructed in the first five years would help to reduce the stormwater peak flows to the receiving stream making it more feasible to perform a stream restoration project at a later time.

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are intended to start within the first five years and continue to be implemented throughout the 25-year plan period. Hence, these projects are designated as Group A*. The tables in Sections 4.4, 5.4, 6.4, 7.4, and 8.4 show the implementation timeframes for the proposed capital projects in each watershed.

6. Other Considerations

Following adoption of the second watershed management plan to be completed in the county, the Fairfax County Board of Supervisors (Board) issued a written statement reaffirming its long history of environmental vigilance, endorsed by its adoption of the Environmental Agenda, which calls for the need to complete the watershed management planning process. The Board stated that the watershed management plans represent a menu of options and concepts that require an additional level of fiscal scrutiny. As a result, it is anticipated that the structural and non-structural projects presented in this plan will be implemented through the following means:

- County-initiated projects via the capital improvement program
- Developer-initiated projects as waiver conditions or via the zoning approval process through proffers or development conditions
- Partnerships with volunteer groups and other organizations such as the Northern Virginia Soil and Water Conservation District

The policy recommendations include proposals that would typically involve amendments to the County Code and other supporting documents such as the Public Facilities Manual. These recommendations will need to be further evaluated by the county in light of their countywide implications. The planned approach for processing the policy recommendations is to integrate Middle Potomac recommendations with those developed for the other completed plans starting in 2008.

The following provisions address the funding and implementation of projects, programs, and policy recommendations in the Middle Potomac Watersheds Management Plan:

i. Projects and Programs (both structural and non-structural) as well as Policy items in this plan will first undergo appropriate review by county staff and the Board (please see iii below) prior to implementation. Board adoption of the watershed plan will not set into motion automatic implementation of projects, programs, initiatives or policy recommendations that have not first been subject to sufficient scrutiny to ensure that the projects that are funded give the county the greatest environmental benefit for the cost.

ii. Road projects not related to protection of streambeds or banks or water quality will not be funded out of the stormwater and watershed budget.

iii. The watershed plan provides a conceptual master-list of structural capital projects and a list of potential non-structural projects for the watersheds. Staff will, on a fiscal year basis, prepare and submit to the Board a detailed spending plan to include a description of proposed projects and an explanation of their ranking, based on yet to be established, specific criteria. Criteria used to assemble this list will include, but are not limited to, cost-effectiveness as compared to alternative projects, a clear public benefit, a need to protect public or private lands from erosion or flooding, a need to meet a specific watershed or water quality goal and implementable within same fiscal year that funding is provided. Staff also intends to track the progress of implementation and report back to the Board periodically.

iv. Each project on the annual list of structural projects will be evaluated using basic value-engineering cost effectiveness principles before implementation and the consideration of alternative structural and non-structural means for accomplishing the purposes of the project will be considered before implementation. This process will ensure the county's commitment to being a fiscally responsible public entity.

v. Obstruction removal projects on private lands will be evaluated on a case-by-case basis for referral to the Zoning Administrator and/or County Attorney for action as public nuisances; and otherwise to determine appropriate cost-sharing by any parties responsible for the obstructions.

vi. Stream restoration projects on private lands will be evaluated to determine means for cost-sharing by land owners directly responsible for degradation due to their land uses.

Beginning in Fiscal Year 2006, the Board of Supervisors dedicated the approximate value of one penny from the County's Real Estate tax to support the growing needs and regulatory requirements in the stormwater program. This program consists of: Regulatory Compliance, Dam Safety, Infrastructure Reinvestment, Project Implementation and Watershed Planning.

Stormwater Management generates an annual work plan that prioritizes projects from all of the completed watershed management plans. The project prioritization within each plan is taken into consideration when selecting projects for the annual work plan. Cost and benefits, feasibility, and land ownership are also considered when selecting and prioritizing projects across all of the watersheds. For example, the 2008 fiscal year work plan included approximately ten million dollars for implementation of watershed plan projects. Projects were identified from each of the adopted six watershed plans and included in the annual work program. In addition to the projects identified specifically as Watershed Project Implementation, many of the other projects include the practices identified in the watershed plans. For example, many of the dam safety projects include retrofitting a standard dry pond to include BMPs such as additional storage, forebay and a wetlands feature.

The currently adopted five-year Capital Improvement Program (CIP) provides over $22,000,000 per year for Stormwater Management and specifically identifies $500,000 per year for each approved watershed management plan for project implementation. There is an additional $3.5 million included for projects from watershed management plans that are still in progress. In addition to CIP funding, projects may be funded through the pro-rata program, or be constructed as part of a development project, or in conjunction with another county project.

Projects are evaluated on an annual basis as part of the county's budget process and development of the Stormwater Management annual work plan. As the next round of watershed management plans are completed and approved by the Board of Supervisors, the annual work plan will be developed to include the new projects that are identified in the respective watershed plans. The project selection processes described above, combined with the annual budgetary process, are the factors used in determining projects to implement.

3.5 Monitoring of Plan Actions

This section describes the monitoring actions and targets for determining the success or failure of the future structural and non-structural plan actions. The monitoring will help to determine if the plan actions should be modified in the future to improve their effectiveness or to address changing watershed conditions.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

- **Monitor:** Number of projects completed.
- **Target:** 100% of projects completed within implementation year group.

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A1.5: Remove detrimental channel obstructions.

- **Monitor:** Number of projects completed.
- **Target:** 100% of projects completed within implementation year group.

Action A1.6: Stabilize eroding stream banks using bioengineering methods.

- **Monitor:** Number of projects designed and completed.

- **Target:** 100% of projects completed within designated implementation year group.

Action A2.1: Improve the existing stormwater infrastructure to prevent flooding of roadways and property.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A2.3: Protect structures located in the 100-yr flood limit from flooding.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action A3.1: Identify sources of fecal coliform bacteria in the watershed and seek to reduce controllable sources.

- **Monitor:** Watershed outfalls for fecal coliform bacteria.
- **Target:** Monitor representative number of county outfalls each year for fecal coliform bacteria and track and eliminate illicit discharges if found.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action B1.2: Construct new BMPs including LID methods.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities.

- **Monitor:** Number of projects completed.
- **Target:** 100% of projects completed within implementation year group.

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them.

- **Monitor:** Number of workshops held, number of brochures distributed.
- **Target:** Distribute "Got Buffer?" brochure to 5% of property owners each year.

Action B3.3: Increase enforcement of stream buffer violations.

- Monitor: Number of violations enforced.
- Target: Implement a buffer monitoring and assessment program to be included in the county's current stream monitoring efforts.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.

- **Monitor:** Number of stream miles that have been surveyed and invasive plants replaced.
- **Target:** Encourage volunteer invasive management programs like the Fairfax County Park Authority's Invasive Management Area program. Remove invasives during stream and buffer restoration projects where feasible.

Action B3.5: Protect stream buffer areas from development.

- **Monitor:** Miles of Resource Protection Area (RPA) restored. Number and acreage of new riparian conservation easements.
- **Target:** Protect existing buffer and restore deficient buffers in RPAs. Conservation easements on all stream corridors and creek buffer areas.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.

- **Monitor:** Performance of wetlands function and value survey.
- **Target:** Identify the location, size, owner, type, and quality of existing wetlands of in the watershed. Catalog the wetlands with the greatest potential for restoration.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural stream geometrics, and remove concrete from stream banks and beds.

- **Monitor:** Number of projects designed and completed.
- **Target:** 100% of projects completed within implementation year group.

Action C1.1: Establish an on-going relationship with civics and science teachers at middle and high schools who need to provide students with either opportunities for serve credits or hands-on projects.

- **Monitor:** Number of students participating in stormwater improvement projects. Number of ideas for student activities generated.

- **Target:** Develop educational material. Distribute educational information to the schools in the watersheds each year for the next 5 years.

Action C1.2: Write and distribute a watershed planning fact sheet and lesson plan to teachers.

- **Monitor:** Number of fact sheets and lesson plans distributed.

- **Target:** Develop and distribute brochures and lesson plans to all schools in the watershed. Update and repeat on a yearly basis.

Action C1.3: Consolidate existing educational materials that describe the value of the watersheds and make the materials accessible through one county contact.

- **Monitor:** Creation of county Public Information Officer position in Stormwater Management.

- **Target:** Create position by 2010.

Action C1.4: A watershed planning slide show should be created by county staff and/or volunteer community organization to explain the watershed concept, existing problems, and proposed future improvements for the watersheds.

- **Monitor:** Number of slide shows presented.

- **Target:** Create and present slide show to the applicable businesses in the watershed.

Action C2.1: Encourage voluntary donation of trail and conservation easements.

- **Monitor:** Number and acreage of easements donated.

- **Target:** Solicit voluntary donations from the homeowners along streams in the watersheds, beginning in the highest priority subbasins.

Action C2.2: Promote annual or semiannual cleanup projects for streams.

- **Monitor:** Number of linear feet of streams cleaned and number of people participating in cleanup activities each year.

- **Target:** Clean-up of increasing number of linear feet of streams each year.

Action C2.3: Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.

- **Monitor:** Number of brochures distributed.
- **Target:** Develop and distribute brochures to the homeowners in the watershed, beginning in the subbasins with the worst conditions.

Action C2.4: Improve enforcement of anti-dumping regulations.

- **Monitor:** Number of anti-dumping enforcements.
- **Target:** Reduce dump site complaints.

Action C2.5: If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.

- **Monitor:** Amount of educational materials distributed.
- **Target:** Distribute brochures to the homeowners in the watershed, beginning in the subbasins with the worst conditions.

Action C2.6: Form a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.

- **Monitor:** Support the formation of a volunteer organization.
- **Target:** Formation of community organization.

Action C2.7: Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation Six Year Plans, road standards and mitigation projects.

- **Monitor:** Whether or not the plan has been integrated in other government planning efforts.
- **Target:** Integrate watershed plan into all government planning efforts beginning in 2009.

Action C2.8: Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.

- **Monitor:** Number of signs posted.

- **Target:** Place signs in the watersheds each year for the next 5 years, beginning in the highest priority subbasins.

Action C3.1: Recognize businesses and neighborhoods that implement LID measures voluntarily.

- **Monitor:** Development and implementation of recognition program.

- **Target:** Develop and implement recognition program for the watershed.

Action C3.2: Demonstrate that LID can increase property values (e.g. a realtor can market the value of an aesthetically pleasing and ecologically beneficial rain garden).

- **Monitor:** Number of case studies developed.

- **Target:** Several case studies should be developed per year starting in 2010.

Action C3.3: Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.

- **Monitor:** Number of brochures distributed.

- **Target:** Distribute brochures to the businesses in the watershed each year, beginning in the highest priority subbasins.

Action C3.4: Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.

- **Monitor:** Development and implementation of training and certification program through the county's Engineers and Surveyors Institute (ESI) training program.

- **Target:** Landscaping employees are trained and certified through the county's ESI training program.

Action C3.5: Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them. Provide a list of stores that carry LID supplies.

- **Monitor:** Number of LID material suppliers contacted.

- **Target:** Contact all potential LID material suppliers in county.

Action C3.6: Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries. Consider asking a major store chain to print the brochures.

- **Monitor:** Number of stores where brochures have been distributed.
- **Target:** Distribute brochures to the applicable businesses in the county each year.

Chapter 4

Bull Neck Run Watershed

4.1 Watershed Condition

The Bull Neck Run Watershed has an area of approximately 1,559 acres as shown on Map 4.1. Approximately three-quarters of that area, or 1,142 acres, drains to Bull Neck Run itself and 417 acres drain directly to the Potomac River from unnamed tributaries. This tributary area has been added to the total watershed area to facilitate planning. The entire watershed is bounded to the west by Portland Place, Belleview Road, and the Madeira School; to the east by Meadow Green Lane, Dominion Reserve, and Canal Drive; to the south by Weller Avenue and Lewinsville Road; and to the north by the Potomac River. There is one major tributary and several small tributaries to Bull Neck Run.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Bull Neck Run Watershed Condition Summary

- **Current imperviousness = Eight percent with the majority of land in low density residential uses.**
- **Future imperviousness = 12 percent**
- **The majority of the residential development is served by on-site sewage disposal systems.**
- **All of the 13 stream crossings have "minor to moderate" impacts.**
- **There are eight BMPs in the watershed.**
- **The majority of the habitat quality is fair with inadequate buffers.**
- **Most of the stream is actively widening and the impact of erosion was observed as "moderate to severe" at three locations.**
- **Three obstruction locations have "moderate to severe" impacts.**
- **One trash dumpsite was observed.**

4.1.1 Watershed Characteristics

The headwaters of Bull Neck Run begin at the Spring Hill District Park, which is located near the intersection of Spring Hill Road and Lewinsville Road. The stream then passes through Bull Neck Stream Valley Park. Bull Neck Run flows from south to north throughout the watershed. The length of Bull Neck Run from its headwaters to its outfall at the Potomac River is approximately 2.5 miles.

One major unnamed tributary, which is located to the west of the main channel, has a length of approximately 7,600 feet and contributes significant runoff and drainage area to Bull Neck Run. There are also two small unnamed streams, with lengths of 1,200 and 2,600 feet, that drain directly into the Potomac River. They are included in the Bull Neck Run watershed to facilitate planning. The terrain in the watershed is moderate with land elevations ranging from 300 to 350 feet in the southern part to elevations of 70 to 80 feet in the northern part. The creek has a moderate-gradient slope of almost two percent.

4.1.2 Existing and Future Land Use

Land use in the upstream portion of the watershed is predominantly low-density residential. Other major land uses are open space downstream of Old Dominion Drive and estate residential land use adjacent to Spring Hill Road. There are currently 147 acres of open space, parks, and recreational areas in the Bull Neck Run Watershed, which account for approximately nine percent of the existing land use. The parks and recreational areas in the Bull Neck Run Watershed include Greenway Heights Park, Bull Neck Stream Valley Park, and Spring Hill District Park. There are 192 acres that are currently vacant or undeveloped and 132 acres that are currently underutilized. Undeveloped and underutilized parcels make up 21 percent of the watershed area and primarily have a future proposed land use of low-density residential. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 1.22 acres of wetlands in this watershed. Table 4.1 summarizes the existing and future land use in the Bull Neck Run Watershed.

Table 4.1 Bull Neck Run Watershed Land Use

	Land Use			
	Existing		Future	
Land Use Description[1]	Area (Acres)	%	Area (Acres)	%
Bull Neck Run				
Open space, parks, and recreational areas	124	11%	151	13%
Estate residential	302	26%	181	16%
Low-density residential	380	33%	621	54%
Medium-density residential	42	4%	42	4%
High-density residential	0	0%	0	0%
Low-intensity commercial	54	5%	54	5%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%

Land Use Description[1]	Land Use Existing Area (Acres)	%	Future Area (Acres)	%
Vacant/Undeveloped	147	13%	0	0%
Road right-of-way (including shoulder areas)	93	8%	93	8%
TOTAL	1,142	100%	1,142	100%
Unnamed Tributaries to the Potomac River				
Open space, parks, and recreational areas	23	6%	23	6%
Estate residential	93	22%	138	33%
Low-density residential	13	3%	13	3%
Medium-density residential	0	0%	0	0%
High-density residential	0	0%	0	0%
Low-intensity commercial	238	57%	238	57%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	45	11%	0	0%
Road right-of-way (including shoulder areas)	5	1%	5	1%
TOTAL	417	100%	417	100%
Total Bull Neck Run Watershed	**1,559**	**100%**	**1,559**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

The current impervious area in this watershed is eight percent of the total area. Together, the predicted land use changes will increase the future imperviousness by four percent for a total of 12 percent imperviousness in the watershed. In the future, under ultimate build out conditions, it is anticipated that most of the vacant/undeveloped land and some estate residential land will be replaced by low-density residential development. In addition to the predicted change in land use, mansionization will increase the impervious area in the watershed by 2.6 acres.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The Fairfax County Comprehensive Plan for land use in the Bull Neck Run Watershed calls for low-density residential development – not to exceed one dwelling unit per five acres – in the watershed and future transportation improvements include installing new trails. The improvements are described in more detail below.

The planned trails for Bull Neck Run Watershed include:

- The Potomac Heritage National Scenic trail with a six- to eight-foot-wide natural surface or stone dust trail along Georgetown Pike.

- A stream valley trail with a six- to eight-foot-wide natural surface or stone dust trail along the Potomac River.
- A major eight-foot-wide asphalt or concrete trail along Spring Hill Road, Old Dominion Drive, and Lewinsville Road.
- A new bike lane at Old Dominion Drive.
- A minor four- to eight-foot-wide asphalt or concrete trail along Bull Neck Run.

4.1.3 Existing Stormwater Management

The headwaters of Bull Neck Run begin near the southern part of the watershed at the outfall pipe of a storm drain system. The remaining portions of Bull Neck Run are conveyed in an open channel to the stream's confluence with the Potomac River. The storm drain systems, which contribute to several minor tributaries of Bull Neck Run, consist of minor networks of storm drain pipes and culverts. These outfalls vary in size, ranging from 12 inches in diameter to a 15-foot by nine-foot box culvert. Most segments of the outfall channels are experiencing minor to moderate erosion due to the culvert crossings.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Map 4.1 shows the location of the crossings and their erosional impacts on the streams. None of the 13 crossings evaluated in the SPA had a "moderate to severe" or "severe to extreme" impact on the stream.

The county's list of master plan drainage projects shows that there are three identified projects in this watershed. Table 4.2 summarizes the type of master plan drainage project, project name/location, project cost and current project status.

Table 4.2 Bull Neck Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/Location	Old Project Number	Cost	Status
Stream stabilization	Bull Neck Run	BN211	$316,000	Keep as CIP project.
Replace culvert at Georgetown Pike	Georgetown Pike	BN411	$464,656	Keep as CIP project.
Add culvert at Alvord Street	Alvord St	BN412	$97,110	Keep as CIP project.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According the MSMD data, three complaints regarding flooding and erosion were registered with the county. The locations of these complaints are shown on Map 4.1. Projects were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the county's MSMD BMP inspection database, there are one private and seven public stormwater management facilities located in the Bull Neck Run Watershed. The single private facility is located near the crossing of Lewinsville Road and Spring Hill Road. The public facilities are located throughout the upstream portion of the watershed. The area served by stormwater management facilities in this watershed is 271 acres out of the total area of 1,559 acres, or 17 percent of the watershed. The types of facilities are provided in Table 4.3. The facilities in the table are shown on Map 4.1, along with six additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these six sites.

Table 4.3 Bull Neck Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities	
	Privately owned	Publicly owned
Bioretention	-	-
Dry pond	1	6
Manufactured BMP	-	-
Parking lot	-	-
Roof top detention	-	-
Sand filter	-	-
Infiltration Trench	-	-
Underground	-	1
Wet pond	-	-
Total	**1**	**7**

Note: The source of data for this table was the MSMD database.

4.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil group B. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups.

The geomorphology of the stream segments of Bull Neck Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrate in the majority of stream segments is gravel; however, the downstream reaches of Bull Neck Run consist mainly of bedrock.
- The majority of reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.
- The upstream segments are paved with concrete or reinforced with riprap; hence, no geomorphic assessment was performed.
- Portions of the upstream- and downstream-most reaches are of CEM type 4, which means that they are stabilizing and a new channel configuration is developing.

Map 4.2 shows the stream segment CEM type in the watershed. Fallen trees and debris obstructing the flow were observed at three locations along Bull Neck Run. The impact of this debris on the stream is moderate to severe. No head cuts were observed. One dumpsite was identified during the SPA.

4.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality does not have any monitoring stations located on Bull Neck Run. There is one volunteer water quality monitoring site located on Bull Neck Run which is coordinated by the Audubon Naturalist Society. The data collected from this site generally support the findings of the Fairfax County Stream Protection Strategy Baseline Study and indicate the presence of a benthic community that is more diverse than the other Middle Potomac Watersheds. There is also a volunteer water quality monitoring site along Bull Neck Run coordinated by the Northern Virginia Soil and Water Conservation District, but there was no data available for this monitoring site.

The Fairfax County Health Department monitored stream water quality at one sampling site in the Bull Neck Run Watershed, located at Georgetown Pike. In 2002, water samples were collected from this site and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. The average dissolved oxygen concentration for the sampling site on Bull Neck Run was 10.1 mg/l, which is well above the minimum standard of 4.0 mg/l. In 2002, fifty-three percent of the water samples in Bull Neck Run had fecal coliform counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 1400/100 ml. For fecal coliform, a count less than 200/100 ml is considered good water quality and a count of 250,000/100 ml can be considered a direct sewage discharge. Approximately 751 acres of the Bull Neck Run Watershed, or 48 percent, are served by on-site sewage disposal systems. The on-site sewage area covers all of the major development in the Bull Neck Run Watershed except the McLean Hunt Estates and a portion of The Reserve, which are both served by sanitary sewer. The other areas in the watershed not served by on-site systems or sanitary sewer are mostly undeveloped areas such as river valleys and parks. Properties with on-site sewage systems are shown on Map 4.2, but this information is based on the best available data only and may not be completely accurate.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Bull Neck Run received an "excellent" rating. The rating was based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. Bull Neck Run was classified as a Watershed Protection Area due to high biological integrity and habitat quality.

The stream reaches of Bull Neck Run have high gradient slopes and are classified as the riffle/run prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The habitat assessment for Bull Neck Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- In half of the stream reaches, at least four habitat types were common such as large rocks, undercut banks, and deep pools.
- Two upstream channel reaches are made of concrete; hence, no habitat was assessed.

- Dominant substrate in the stream reaches is a mixture of gravel, stones and boulders.
- Sediment deposition is mainly sand and silt with 20 percent of the stream bottom affected in the downstream segments and 40 to 50 percent of the stream bottom affected in the upstream segments.
- Approximately 20 to 30 percent of the stream segments have minor alterations of the channel or banks. One of the two unnamed streams that discharge directly to the Potomac River and the downstream reaches of Bull Neck Run exhibit no channel disturbance.
- Most of Bull Neck Run has a run-to-riffle ratio of 15, which implies a moderate frequency of occurrence of riffles. Increased riffle frequency enhances the diversity of a stream community by producing high-quality habitat.
- For most of Bull Neck Run, the water fills approximately 70 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- Forty-four percent of Bull Neck Run exhibits good habitat quality and 31 percent exhibits excellent habitat quality as depicted on Map 4.1. The remaining stream segments require minor bank stabilization to protect adjacent properties from future problems.
- A majority of the channel banks have approximately 80 percent vegetated cover with few barren or thin areas. Fifteen to 30 percent of the banks have erosional areas. The majority of the deficient stream buffer consists of lawn grass with 50 to 100 feet of buffer width. The locations of deficient buffer areas along the stream corridor are shown on Map 4.2.

4.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the observations are included in the following table. Map 4.1 shows the locations of the problems identified.

Table 4.4 Problem Locations Identified During Public Forums

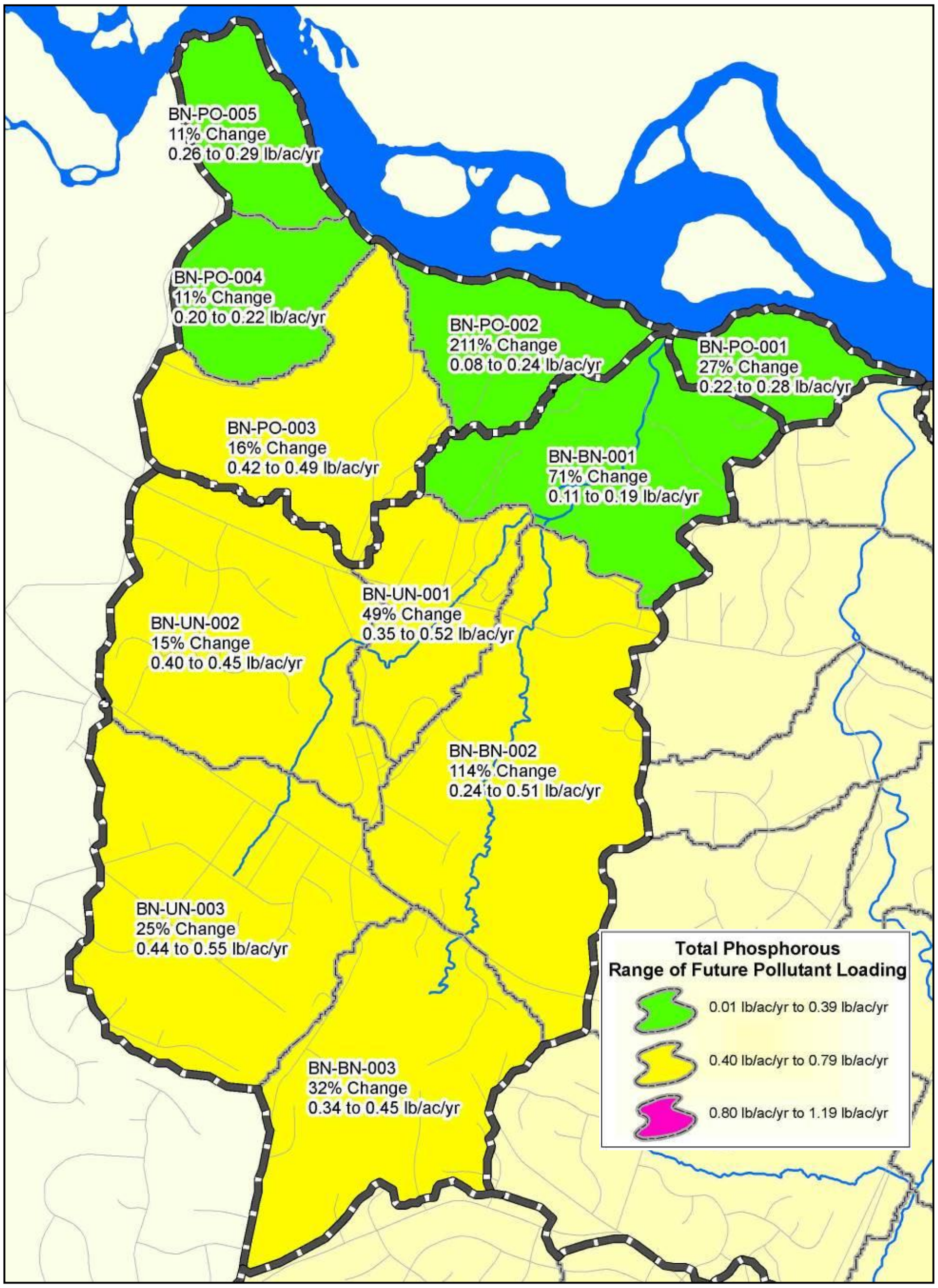
Map ID	Description
BN1	This location and problem could not be verified and was not considered in the watershed plan.
BN2	Location: Spring Hill Recreation Center near Bull Neck Run Problem: This location seems to have too much parking. When this area is redeveloped, an accurate assessment of parking needs and use alternatives to reduce impervious surface should be completed. Observation: LID techniques may help mitigate the effects of the parking area. New LID Project BN9811 has been added at this location.
BN3	Location: Bull Neck Stream Valley Park near McLean Hunt Estates Problem: Trails have not been maintained in 20 years, causing them to break up and the edges to erode. All of the silt is going down into Bull Neck Run and the tributaries. This is also a safety issue for those utilizing the trails for recreational purposes. This site would require more than repaving. If the water did not rush down, but rather it was channeled or absorbed elsewhere, some of the erosion would be stopped. Observation: The asphalt trails are in poor condition. Erosion appeared insignificant along the trail. This issue will be referred to the Fairfax County Park Authority.

4.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Bull Neck Run

Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Bull Neck Run Watershed, which consists of the area draining to Bull Neck Run and a smaller area draining directly to the Potomac River. Eleven subbasins were created for the model in order to provide more detail for the modeling results. The subbasins with the future total phosphorus loading are shown in Figure 4.1.

Figure 4.1 Bull Neck Run Future Total Phosphorous Loading



4.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model, the current watershed imperviousness is nine percent, which generates low to moderate peak runoff flows. The predicted increase in peak flows from existing land use conditions to potential future development conditions may be attributed to the predicted increase in imperviousness to 13 percent and future development of vacant parcels to low density residential areas. Table 4.5 shows the cumulative peak runoff flows and the comparison between the peak flows for the existing and future land use conditions for the two and ten-year rainfall events.

Table 4.5 Bull Neck Run Cumulative Peak Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
BN-BN-001C	552	639	16%	1,520	1,600	5%
BN-BN-002C	483	580	20%	1,300	1,370	5%
BN-BN-003C	92	107	16%	237	239	1%
BN-PO-001C	51	54	6%	148	152	3%
BN-PO-002C	62	71	15%	207	219	6%
BN-PO-003C	190	194	2%	428	433	1%
BN-PO-004C	66	66	0%	229	229	0%
BN-PO-005C	88	88	0%	211	211	0%
BN-UN-001C	289	336	16%	720	777	8%
BN-UN-002C	227	270	19%	504	570	13%
BN-UN-003C	152	181	19%	362	386	7%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the large amount of open space. The subbasins that drain to Bull Neck Run have a predominant land use of low density residential for both existing and future land use conditions. The predicted increase in pollutant loads can be attributed to the projected development of vacant parcels to low density residential areas. Table 4.6 shows the comparison of the existing and future pollutant loading rates for the Bull Neck Run Watershed.

Table 4.6 Bull Neck Run Pollutant Loads

Pollutants		Bull Neck Run Subbasins						Potomac Tributary Subbasins				
		BN-BN-001	BN-BN-002	BN-BN-003	BN-UN-001	BN-UN-002	BN-UN-003	BN-PO-001	BN-PO-002	BN-PO-003	BN-PO-004	BN-PO-005
BOD5	Existing (lb/ac/yr)	2.3	6.2	11.7	6.1	12.4	10.9	4.3	1.9	17.8	9.9	13.2
	Future (lb/ac/yr)	3.5	12.4	14.6	10.9	14.8	13.9	5.2	3.9	18.7	9.9	13.2
	% Load Increase	52%	100%	25%	79%	19%	28%	21%	105%	5%	0%	0%
COD	Existing (lb/ac/yr)	13.8	38.3	69.9	33.0	72.7	62.0	24.9	12.2	105.8	59.6	79.0
	Future (lb/ac/yr)	20.1	72.1	86.6	60.3	87.4	78.6	30.2	21.9	110.9	59.6	79.0
	% Load Increase	46%	88%	24%	83%	20%	27%	21%	80%	5%	0%	0%
TSS	Existing (lb/ac/yr)	7.9	16.2	48.4	17.7	52.0	35.6	14.0	7.3	104.0	61.5	81.5
	Future (lb/ac/yr)	11.2	31.8	57.7	32.3	61.8	44.2	16.8	12.0	108.9	61.5	81.4
	% Load Increase	42%	96%	19%	82%	19%	24%	20%	64%	5%	0%	0%
TDS	Existing (lb/ac/yr)	15	29	67	25	66	50	24	16	106	61	81
	Future (lb/ac/yr)	19	46	78	43	80	60	28	19	110	61	81
	% Load Increase	27%	59%	16%	72%	21%	20%	17%	19%	4%	0%	0%
DP	Existing (lb/ac/yr)	0.08	0.21	0.25	0.25	0.28	0.31	0.15	0.05	0.32	0.15	0.20

Pollutants		Bull Neck Run Subbasins						Potomac Tributary Subbasins				
		BN-BN-001	BN-BN-002	BN-BN-003	BN-UN-001	BN-UN-002	BN-UN-003	BN-PO-001	BN-PO-002	BN-PO-003	BN-PO-004	BN-PO-005
	Future (lb/ac/yr)	0.13	0.40	0.32	0.37	0.32	0.39	0.19	0.17	0.34	0.15	0.20
	% Load Increase	63%	90%	28%	48%	14%	26%	27%	240%	6%	0%	0%
TP	Existing (lb/ac/yr)	0.11	0.24	0.34	0.35	0.40	0.44	0.22	0.08	0.42	0.20	0.26
	Future (lb/ac/yr)	0.19	0.51	0.45	0.52	0.45	0.55	0.28	0.24	0.49	0.22	0.29
	% Load Increase	73%	113%	32%	49%	13%	25%	27%	200%	17%	10%	12%
TKN	Existing (lb/ac/yr)	0.6	1.5	2.0	2.0	2.3	2.4	1.2	0.4	2.7	1.3	1.8
	Future (lb/ac/yr)	1.1	2.9	2.5	2.8	2.5	3.0	1.6	1.4	2.9	1.3	1.8
	% Load Increase	83%	93%	25%	40%	9%	25%	33%	250%	7%	0%	0%
TN	Existing (lb/ac/yr)	0.84	1.87	2.71	2.59	3.11	3.22	1.61	0.58	4.03	2.02	2.68
	Future (lb/ac/yr)	1.43	3.69	3.41	3.75	3.45	3.97	2.06	1.81	4.29	2.02	2.68
	% Load Increase	70%	97%	26%	45%	11%	23%	28%	212%	6%	0%	0%
Cadmium	Existing (lb/ac/yr)	1.0	1.8	2.5	2.2	2.6	2.7	1.7	1.0	2.2	0.9	1.2
(x 10^{-4})	Future (lb/ac/yr)	1.5	2.6	3.0	2.9	2.9	3.1	2.1	1.7	2.3	0.9	1.2
	% Load Increase	50%	44%	20%	32%	12%	15%	24%	70%	5%	0%	0%
Copper	Existing (lb/ac/yr)	1.8	3.9	14.9	3.1	16.2	7.5	3.0	1.9	44.6	27.2	36.1
(x 10^{-3})	Future (lb/ac/yr)	2.3	6.1	16.8	5.5	18.9	9.0	3.5	2.3	46.7	27.2	36.1
	% Load Increase	28%	56%	13%	77%	17%	20%	17%	21%	5%	0%	0%
Lead	Existing (lb/ac/yr)	0.8	1.4	2.9	1.0	2.7	2.1	1.2	0.9	3.2	1.8	2.4
(x 10^{-3})	Future (lb/ac/yr)	0.9	1.8	3.3	1.8	3.3	2.5	1.4	0.8	3.3	1.8	2.4
	% Load Increase	13%	29%	14%	80%	22%	19%	17%	-11%	3%	0%	0%
Zinc	Existing (lb/ac/yr)	0.9	2.2	7.6	1.7	8.2	4.0	1.4	0.8	22.3	13.6	18.0
(x 10^{-2})	Future (lb/ac/yr)	1.1	3.4	8.6	3.0	9.7	4.9	1.7	1.2	23.3	13.6	18.0
	% Load Increase	22%	55%	13%	76%	18%	23%	21%	50%	4%	0%	0%

4.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Bull Neck Run from the confluence of its main stem with its southwestern tributary to its confluence with the Potomac River. The hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for the entire modeled length of Bull Neck Run. However, the unnamed tributary to Bull Neck Run showed overtopping for all storm events at a double 24-inch corrugated metal pipe culvert at Spring Hill Road. This location was also identified as a flooding location by the Steering Committee. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor overtopping where there are adjacent and connected floodplains. Since the future land use conditions are nearly the same as the existing land use conditions, the future conditions hydraulic modeling results are consistent with the existing conditions results.

The majority of the 100-year event is contained within the current main channel banks. This is because the main channel has become more incised in response to increased runoff generated by development in the watershed. However, the floodplains are utilized where they are connected to the stream channel. Floodplains play an important role in reducing flow velocities and it is important that streams remain connected with them wherever possible. The 100-year floodplains for the modeled portions of the stream are consistent with the county's 100-year floodplain data for the majority of Bull Neck Run. At the upstream end of the junction of the main stem and the southwest tributary, the floodplains are narrower when compared to the county's 100-year floodplains, which indicates that the stream is experiencing downcutting due to increased flows and velocities. These results are consistent with the 2001 SPA findings which document that Bull Neck Run is establishing a geometry that can accommodate existing increased flows in the southwest tributary of Bull Neck Run and the upstream portions of Bull Neck Run. No properties had buildings located in the 100-year floodplain in this watershed. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

The velocities produced by the hydraulic model for the two-year rainfall event in the Bull Neck Run Watershed average approximately 5 ft/sec. The average velocity at the southwest tributary is 4.5 ft/sec while the upstream portions of the main stem average only 3.9 ft/sec.

4.2 Management Plan Strategy

This section outlines proposed projects for the Bull Neck Run Watershed. The locations of the projects in this section are shown on Map 4.3. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Bull Neck Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit options in the following project descriptions have been taken from the list above.

Public BMP Retrofits

- Publicly owned dry detention SWM basin at the Spring Hill Recreation Center located at 1239 Spring Hill Road. This facility is located at the headwaters of Bull Neck Run and detains the runoff from surrounding neighborhoods before entering the stream. Adding water quality controls will benefit the downstream conditions. As part of the retrofit project, a watershed education area should be built around the BMP and stream to educate adults and children about watershed issues. Possible retrofit options include 6 and 7. (BMP Retrofit Project BN9105)

Private BMP Retrofits

- Retrofit the wet SWM pond located behind 8198 Hunting Hill Lane owned by the McLean Country Estates Homeowners Association. Residents note that the pond often overflows during rain storms and the outflow is filled with sediment. Possible retrofits include 2, 6, and 7. (BMP Retrofit Project BN9106)

The size of the proposed drainage areas and the benefits from the proposed BMP retrofits are included in Table 4.7.

Table 4.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
BN9105	BN-BN-003	1239 Spring Hill Road	24.1	6.7	0.4
BN9106	BN-UN-002	8198 Hunting Hill Lane	74.5	8.7	2.7

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.
Parks were targeted for LID projects because the land is owned by the county, greatly facilitating implementation, and county facilities should be examples of environmentally friendly design. It is hoped that seeing LID projects on county lands will inspire residents to implement similar measures on their own properties.

- Construct LID demonstration projects at the Spring Hill Recreation Center located at 1239 Spring Hill Road. This recreation center facility is owned by Fairfax County Park Authority. LID options may include installing bioretention in the parking medians and in the landscaped areas especially on the northeast side of the building. Buffers could be installed adjacent to the parking lot and tree box filters may be used to replace the existing drainage structures. (New LID Project BN9811)

The pollutant removal benefit for the proposed LID project is described in Table 4.8.

Table 4.8 Benefits of New LID

Project Number	Subbasin ID	Location	Proposed Drainage Area (Acres)	Total Phosphorus Removal (lbs/yr)
BN9811	BN-BN-003	1239 Spring Hill Road	4.5	4.2

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and

encourage LID practices on private property.
There are no neighborhood LID projects in this watershed.

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.
There are no floodplain restoration projects in this watershed.

Action A1.5: Remove detrimental channel obstructions.
Channel obstructions that block stream flow, like the ones listed below, should be removed. Dumpsites and obstructions in the watershed will vary over time. It may be necessary to clean up future dumpsites and/or obstructions that are not listed below or shown on any of the watershed maps.

- Remove three stream obstructions in Bull Neck Run. One of the three obstructions is located north of Georgetown Pike on Bull Neck Run and the other two sites are located east of Spring Hill Road and south of Old Dominion Drive. The SPA identified logs and other debris in the stream that need to be cleaned up to help restore the flow capacity in the stream. (Dumpsite/Obstruction Removal BN9901)
- Remove stream dumpsite located west of Old Cedar Road at Old Cedar Court, behind 1080 Old Cedar Road. (Dumpsite/Obstruction Removal BN9918)

Action A1.6: Stabilize eroding stream banks using bioengineering methods.
The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.
Improve the existing stormwater infrastructure at the following locations.

- Improve the capacity of the pipe culvert crossing at a tributary to Bull Neck Run at Spring Hill Road. This location has experienced flooding in the past. (Infrastructure Improvement BN9412)
- The trapezoidal channel next to 8344 Old Dominion Drive needs maintenance and repair. It is estimated that approximately 120 feet of the channel needs to be replaced and an additional 40 feet of the channel needs to be cleaned. The current condition of the channel may be causing house flooding at this location. (Infrastructure Improvement BN9419)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.
There are no infrastructure projects of this type in this watershed.

Action A2.3: Protect structures located in the 100-year flood limit from flooding.
There are no flood protection projects in this watershed.

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.
Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Bull Neck Run Watershed using E. coli as the indicator bacteria and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced. (Fecal Coliform Source Study BN9720)

Water samples collected from Bull Neck Run in 2002 exceeded the state's current instantaneous fecal coliform standard stating that no more than 10 percent of the samples collected in a month shall exceed 400 fecal coliforms per 100 milliliter of water. The ultimate goal of the proposed study would be to reduce the amount of fecal coliform bacteria in Bull Neck Run and prevent it from becoming listed as impaired.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.
The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.
The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.
The three deficient buffer locations described in the project below were found during the 2002 SPA (see map 4.2) and are potential locations for buffer restoration. Stream Restoration Project BN9203 is proposed at the fourth location, leaving only 1,550 feet needing buffer restoration. The locations of the stream sections for the project listed below are shown on Map 4.3. It should be noted that the stream reaches identified in the following project description and on the map designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated. Steps to protect existing vegetated buffers are included in Public Education Project BN9913 described later in

this chapter.

- Evaluate the buffer vegetation adjacent to the stream along 1,550 feet of an unnamed tributary located to the west of Bull Neck Run. If necessary, restoration will be done in three segments, 550 feet just upstream of Georgetown Pike, 550 feet near Hunting Hill Lane and 450 feet just upstream of Old Dominion Drive. (Buffer Restoration BN9302).

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action; details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
There are no land conservation projects in this watershed.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.

- A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project BN9917)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.
Bull Neck Run is actively widening along the majority of its length and the stream protection strategy composite site condition rating was "excellent". In order to maintain this rating, the proposed stream restoration projects should be carefully executed in order to prevent further erosion and channel widening. The locations of the proposed stream restorations are described below and shown on Map 4.3. It should be noted that the stream reaches identified in the following project description and on the map designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

- Evaluate the bed and banks of 1,500 linear feet of Bull Neck Run in two sections between Weller Avenue and Sparger Street and restore where necessary. These portions of Bull Neck Run are in a transitional phase of stream bank evolution from a stable stream to a widening/stabilizing stream. This type of channel incision is causing a change in the stream slope. Thirty percent of this stream has been previously disturbed and is imbedded with sediment. Approximately 30 percent of the channel has been altered and the banks are 30 to 50 percent eroded. Proposed activities include channel reconfiguration, trash and debris removal, riparian vegetation planting and some installation of small in-stream habitat improvement structures such as long vanes. All natural materials will be used in the construction of all in-stream structures. All stream crossings should have adequate culvert inlet and outlet protection installed to help prevent erosion. (Stream Restoration BN9203)

- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not included in the SPA will be evaluated in this project. (Stream Assessment Project BN9921)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.

Public Education Project BN9913 will include the following actions:

- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.
- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.
- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.
- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.
- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.
- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.
- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.
- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation (VDOT) Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.

Community Outreach Project BN9914 will include the following actions:

- Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects.

- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.
- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project BN9916 will include the following actions:

- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact Development (LID) practices.

LID Promotion Project BN9915 will include the following actions:

- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries.

4.3 Benefits of Plan Actions

Two BMP retrofit projects and one LID project are proposed for the Bull Neck Run Watershed to help improve the water quality of the stream. The channel erosion control volume to be provided by the BMP retrofit projects will serve approximately 55 percent of the required channel erosion control volume for the 103 acres controlled by the BMPs. The total additional phosphorus removal for all of the proposed projects is estimated to be 20 lbs/year upon successful implementation of these projects.

Approximately 1,500 linear feet of Bull Neck Run will be restored as part of the proposed stream restoration project. This project will help minimize the velocity of the stream as well as reduce the erosion of the stream banks. Approximately 1,550 linear feet of stream buffers will be restored by implementing the buffer restoration project. These projects will increase the amount of habitat and provide nutrient reduction for Bull Neck Run. The obstruction removal project will help to reduce the flooding of the stream and erosion of the stream banks.

4.4 Implementation of Plan Actions

As explained in Chapter 3, the recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The implementation schedule presented below was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. More detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Bull Neck Run is $1,420,000. The priority projects are summarized in Table 4.9 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 4.9 Summary of Bull Neck Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
BN9105	BMP Retrofit Project	Fairfax County Park Authority (FCPA)	$80,000	3.75	A
BN9811	New LID Project	FCPA	$250,000	3.75	A
BN9302	Buffer Restoration	Private Residential and McLean Country Estates HOA[1]	$80,000	3.55	A
BN9106	BMP Retrofit Project	McLean Country Estates HOA[1]	$340,000	3.25	B
BN9203	Stream Restoration	Private Residential and Dogwoods Addition to Woodhaven Association[1]	$910,000	3.40	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 8.12 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 4.10 Summary of Bull Neck Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
BN9913	Public Education Project	Watershed-wide Project	N/A	A*
BN9914	Community Outreach Project	Watershed-wide Project	N/A	A*
BN9915	LID Promotion Project	Watershed-wide Project	N/A	A*
BN9916	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
BN9921	Stream Assessment Project	Watershed-wide Project	N/A	A*
BN9901	Dumpsite/Obstruction Removal	FCPA and Private Residential[1]	1.95	A
BN9918	Dumpsite/Obstruction Removal	FCPA	1.95	A
BN9917	Wetland Assessment Project	Watershed-wide Project	2.95	C
BN9412	Infrastructure Improvement	VDOT and Private Residential[1]	3.10	**
BN9419	Infrastructure Improvement	FCPA and Private Residential[1]	2.70	D
BN9720	Fecal Coliform Source Study	Watershed-wide Project	2.70	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.

**These projects will be coordinated directly with VDOT.

Chapter 5

Scotts Run Watershed

5.1 Watershed Condition

The Scotts Run Watershed has an area of approximately 3,860 acres. It is bounded to the west by Tysons Corner Shopping Center, Spring Hill Road and Canal Drive; to the east by Magarity Road, Balls Hill Road and portions of I-495; to the south by Leesburg Pike; and to the north by the Potomac River. This watershed drains significant commercial and medium-density residential areas located near Tysons Corner—the largest commercial shopping area in the county. The watershed is divided into two subwatersheds: Upper Scotts Run, which includes 1,982 acres, and Lower Scotts Run, which includes 1,353 acres. There are also 525 acres of land that drain directly to the Potomac River that have been included in this watershed for planning purposes. The watershed is shown on Maps 5.1 and 5.2. There are several major tributaries in the watershed including Bradley Branch, which is located in Lower Scotts Run.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Scotts Run Watershed Condition Summary

- **Current imperviousness = 30 percent with the majority being low density residential land use.**
- **Future imperviousness = 33 percent**
- **33 of 34 crossings have "minor to moderate" impacts, one has a "severe to extreme" impact.**
- **There are 52 BMPs in this watershed.**
- **The majority of the habitat quality is fair with inadequate buffers.**
- **Most of the stream is actively widening and the impact of erosion was observed as "minor to moderate" at 12 locations and "moderate to severe" at the other three locations.**
- **One obstruction had "minor to moderate" impact and the other five had**

"moderate to severe" impacts.

- **Two utility locations had "minor to moderate" impacts.**
- **No trash dumps were observed in the SPA.**

5.1.1 Watershed Characteristics

The headwaters of Scotts Run begin at a storm drain system outfall located on the east side of Interstate 495, just southeast of the Tysons Corner Shopping Center. The stream flows in a northerly direction through Scotts Run Stream Valley Park, Westgate Park, Timberly Park, and Scotts Run Nature Preserve until it discharges to the Potomac River. The length of Scotts Run from its headwaters to its confluence with the Potomac River is approximately 4.5 miles.

The Scotts Run Watershed consists of several major unnamed tributaries that contribute significant runoff and drainage area to Scotts Run. The only named tributary of Scotts Run is Bradley Branch, which has a length of approximately 3,750 feet. Numerous smaller tributaries emerge from storm drain outfall pipes and natural springs that convey flows into Scotts Run along its length. We have also included several small perennial streams that drain directly to the Potomac River, to facilitate planning. The terrain in the watershed is moderate with land elevations ranging from 300 to 330 feet in the southern part to elevations of 60 to 80 feet in the northern part.

5.1.2 Existing and Future Land Use

Land use in the watershed is predominantly low intensity commercial and low density residential. Commercial land uses, such as Tysons Corner, are to the southwest, and low-density residential and forested land uses are located in the northern portions of the watershed. The existing and future land uses in the Scotts Run Watershed are described in Table 5.1. It is important to note that the Tysons Corner Urban Center portion of the Comprehensive Plan is undergoing study at this time, and changes to the Plan may be pursued according to the recommendations of this study. Tysons Corner Stormwater Strategy SC9845 is a policy project to address providing additional stormwater management controls due to the redevelopment caused by the expansion of the metrorail in this area. This project is described in further detail in Chapter 9.

Road rights-of-way currently comprise 24 percent of the Scotts Run Watershed area. There are currently 554 acres of open space, parks, and recreational areas in the Scotts Run Watershed, which account for approximately 14 percent of the existing land use. The parks and recreational areas in the Scotts Run Watershed include McLean Hamlet Park, Scotts Run Stream Valley Park, Westgate Park, Timberly Park, and Scotts Run Nature Preserve. There are 165 acres that are currently vacant or undeveloped and 445 acres that are currently underutilized. Undeveloped and underutilized parcels comprise 12 percent of the watershed area. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 1.77 acres of wetlands in this watershed.

Table 5.1 Scotts Run Watershed Land Use

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Upper Scotts Run[2]				
Open space, parks, and recreational areas	58	3%	67	3%
Estate residential	19	1%	2	0%
Low-density residential	33	2%	20	1%
Medium-density residential	266	13%	292	15%
High-density residential	254	13%	266	14%
Low-intensity commercial	481	24%	281	14%
High-intensity commercial	161	8%	375	19%
Industrial	8	1%	60	3%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	83	4%	0	0%
Road right-of-way (including shoulder areas)	619	31%	619	31%
TOTAL	1,982	100%	1,982	100%
Lower Scotts Run				
Open space, parks, and recreational areas	255	19%	266	20%
Estate residential	172	13%	37	2%
Low-density residential	534	39%	677	50%
Medium-density residential	128	9%	174	13%
High-density residential	0	0%	0	0%
Low-intensity commercial	12	1%	12	1%
High-intensity commercial	0	0%	0	0%
Industrial	3	0%	3	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	65	5%	0	0%
Road right-of-way (including shoulder areas)	184	14%	184	14%
TOTAL	1,353	100%	1,353	100%
Potomac Tributaries				
Open space, parks, and recreational areas	241	46%	243	46%
Estate residential	13	3%	0	0%
Low-density residential	132	25%	162	31%
Medium-density residential	5	1%	5	1%
High-density residential	0	0%	0	0%
Low-intensity commercial	6	1%	4	1%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	17	3%	0	0%
Road right-of-way (including shoulder areas)	111	21%	111	21%

Land Use Description[1]	Land Use Existing Area (Acres)	%	Future Area (Acres)	%
TOTAL	525	100%	525	100%
TOTAL Scotts Run	**3,860**	**100%**	**3,860**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

[2] The Tysons Corner Urban Center portion of the Comprehensive Plan is undergoing study at this time, and there is a potential for mixed use and/or a variety of land use options in this area. The future land use presented here is representative of the impervious cover in the area and is for watershed planning purposes only.

The current impervious area in this watershed is 30 percent of the total area. In the future, under ultimate build out conditions in Lower Scotts Run, estate residential land use may be replaced by low-density residential development. For future build out conditions in Upper Scotts Run, the low intensity commercial land use may be replaced with high intensity commercial land use. Also, the future imperviousness may increase to 33 percent. The proposed land use for the vacant and underutilized parcels is low density residential in Lower Scotts Run and low intensity commercial for Upper Scotts Run. In addition to the predicted changes in land use, mansionization will increase the impervious area in the watershed by 11.5 acres.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The Fairfax County Comprehensive Plan for land use in the Scotts Run Watershed includes the installation of mass transit rail. The mass transit rail is a planned 23+ mile extension, which will originate from the Washington Metropolitan Area Transit Authority Orange Line between the East and West Falls Church Metro stations and will pass through the Tysons Corner area to Dulles Airport and into Loudoun County. The rail line will be located in the Upper Scotts Run Subwatershed along the Dulles Toll Road and Chain Bridge Road. Along Chain Bridge Road in the Upper Scotts Run Subwatershed, there are two proposed Metro stations, Tysons East and Tysons Central 123. They will be located near the intersection of Chain Bridge Road and Tysons Boulevard and near the intersection of Chain Bridge Road and Colshire Drive. Other future transportation improvements include widening roadways, improving interchanges, and installing new trails. The improvements are described in more detail below.

The roadway and interchange improvements planned for the Scotts Run Watersheds include:

- Widening the Capital Beltway (I-495) to at least ten lanes, including an HOV facility providing peak period service from both directions to the Tysons Corner area.
- Widening the Dulles Toll Road to eight lanes, including an HOV facility providing peak

period service from the west to the Tysons Corner area.

- Widening Leesburg Pike (Route 7) to six lanes from Towlston Road to the Dulles Toll Road.
- Widening Leesburg Pike (Route 7) to eight lanes between the Dulles Toll Road and the Capital Beltway and providing other access improvements in conjunction with the Leesburg Pike design plans.
- Widening Leesburg Pike (Route 7) to six lanes between the Capital Beltway (I-495) and I-66.
- Widening Chain Bridge Road (Route 123) to six lanes from Old Courthouse Road to Route 7.
- Widening Chain Bridge Road (Route 123) to eight lanes between Route 7 and the Capital Beltway.
- Widening Chain Bridge Road/Dolley Madison Boulevard to six lanes from the Capital Beltway to the Dulles Toll Road.
- Widening Gallows Road to six lanes from Old Gallows Road to at least Idylwood Road.
- Widening Spring Hill Road to four lanes between Route 7 and International Drive.
- Widening International Drive to six lanes between Route 7 and Route 123.
- Widening Magarity Road to four lanes between Lisle/Route 7 and Great Falls Street.
- Improving Swinks Mill Road between Lewinsville Road and Old Dominion Drive.
- Improving Old Courthouse Road to a standard two-lane section west of Gosnell Road.
- Improving Route 7 interchanges at Westpark Drive/Gosnell Road, Route 7/Gallows Road/International Drive, Route 7/Route 123 interchange, and Route 7/Dulles Toll Road interchange
- Improving Capital Beltway (I-495) interchanges at Dulles Toll Road, Route 123, Route 7, Georgetown Pike, and the George Washington Memorial Parkway.
- Improving Route 123 interchanges at the Dulles Toll Road and International Drive.

The planned trails for the Scotts Run Watershed include:

- The Potomac Heritage National Scenic Trail with a six-foot- to eight-foot-wide natural surface or stone dust trail along the end of the George Washington Memorial Parkway, I-495, and Georgetown Pike.
- A stream valley trail with a six-foot- to eight-foot-wide natural surface or stone dust trail along the Potomac River and Scotts Run.
- A major eight-foot-wide asphalt or concrete trail along a small portion of Georgetown Pike, Chain Bridge Road, Old Dominion Drive, Swinks Mill Road, International Drive, Magarity Road, Route 7, Anderson Road, and Lewinsville Road.
- A new bike lane along Old Dominion Drive, Jones Branch Drive, and Westpark Drive.
- A minor four- to eight-foot-wide asphalt or concrete trail through Westgate Park.

5.1.3 Existing Stormwater Management

The highly commercialized area of Westgate, located east of Interstate 495, is drained through an extensive network of storm drainpipe systems, which have their outfall on the west side of Interstate 495 creating the headwaters of Scotts Run. Numerous large storm drain systems convey runoff from the highly developed areas of Upper Scotts Run to the main stem of the stream. Runoff in Lower Scotts Run is conveyed by means of minor storm drain systems, which collect runoff from local street networks. These storm drain systems outfall to ditches and minor tributaries that eventually discharge into Scotts Run. The outfalls in this watershed vary in size, ranging from an ten-inch diameter pipe to a ten- by 25-foot box culvert. Most segments of the outfall channels have been altered with concrete lining or with riprap bed and bank protection. The stream is experiencing "minor to moderate" erosion due to discharges from the pipes. The locations of all pipe impacts are shown on Maps 5.1 and 5.2.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Maps 5.1 and 5.2 show the location of the crossings and their erosional impacts on the streams. Thirty-three of the 34 crossings evaluated in the SPA had a "minor to moderate" impact and the other crossing had a "severe to extreme" impact on the stream as described below:

- Unnamed crossing: A private culvert crossing of unknown size between the Dulles Toll Road and Old Springhouse Road has a "severe to extreme" impact on an unnamed tributary to Scotts Run due to debris and sediment at the upstream and downstream sides of the structure.

The county's list of master plan drainage projects shows that there are ten identified projects in this watershed. Table 5.2 summarizes the type of master plan drainage project, project name/location, cost, and also shows the current project status. Cost information was not available for the project with N/A in the cost column.

Table 5.2 Scotts Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/Location	Old Project Number	Cost	Status
Flood protection	Timberly Lane	E00015	$85,243	Keep as CIP project.
Stream restoration and stabilization	Potomac River Road	SC201	$320,124	Keep as CIP project.
Stream stabilization	Bridle Path Lane	SC213	$450,947	Incorporated into SC9219.
Stream restoration and stabilization	Sconset Lane/Saigon	SC215	$359,791	Incorporated into SC9206.
Stream restoration and stabilization	Colshire Drive	SC232	$414,637	Keep as CIP project.
Stream bank stabilization	The Colonies (near Provincial Drive)	SC234	$349,000	Keep as CIP project.
Floodwall	919 Swinks Mill Road	SC612	$212,731	Incorporated into SC9672.
Floodwall	935 Swinks Mill Road	SC613	$184,920	Incorporated into SC9672.
Flood protection	Box Elder Court	SC614	$85,086	Incorporated into SC9475.
Lower channel invert	Swinks Mill Road (near Georgetown Court)	N/A	$216,839	Incorporated into SC9204.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According to the MSMD data, 22 drainage complaints regarding flooding and erosion were registered with the county. The locations of these complaints are shown on Maps 5.1 and 5.2. Projects were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the county's MSMD BMP inspection database, there are 39 private and 13 public stormwater management facilities located in the watershed. The majority of private facilities are located in the southern part of the watershed in Upper Scotts Run. Public facilities are located throughout the watershed. The drainage area served by stormwater management facilities in this watershed is 743 acres out of the total area of 3,860 acres, or 19% of the watershed. The types of facilities listed in the MSMD database are described in Table 5.3. The facilities in the table are shown on Maps 5.1 and 5.2 along with some additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these additional sites.

Table 5.3 Scotts Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities	
	Privately owned	Publicly owned
Bioretention	2	-
Dry pond	9	13
Manufactured BMP	-	-
Parking lot	-	-
Roof top detention	8	-
Sand filter	5	-
Infiltration Trench	1	-
Underground	9	-
Wet pond	5	-
Total	**39**	**13**

Note: The source of data for this table was the MSMD database.

5.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil group B. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups.

The geomorphology of the stream segments of Upper Scotts Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrate in the majority of stream segments is gravel; however, some of the reaches have a combination of cobbles and gravel.
- The majority of reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.

The geomorphology of the stream segments of Lower Scotts Run and its tributaries can be summarized as follows:

- The dominant substrate along 1.5 miles of the downstream reaches to the Potomac River is cobble; however, the rest of Lower Scotts Run consists of a combination of sand and gravel.

- The majority of reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.

Maps 5.3 and 5.4 show the stream segment CEM type in the watershed. Fallen trees and debris obstructing the flow were observed at several locations along Scotts Run. The impact of this debris on the stream is minor, except for one location where it is moderate. No dumpsites were identified during the SPA.

5.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality (DEQ) does not have any monitoring stations located on Scotts Run. There is one volunteer water quality monitoring site located on Scotts Run which is coordinated by the Northern Virginia Soil and Water Conservation District. The data collected from this site generally support the findings of the Fairfax County Stream Protection Strategy Baseline Study and indicates significant biological impairment at the site.

The Virginia DEQ's 2004 305(b)/303(d) Water Quality Assessment Integrated Report lists Scotts Run as a Water of Concern for benthics, while citizen monitoring stations revealed a medium probability of adverse conditions for biota. The Fairfax County Health Department monitored stream water quality at one sampling site in the Scotts Run Watershed, Site 07-01, located at Georgetown Pike. In 2002, water samples were collected from this site and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. For 2002, 47 percent of the samples had fecal coliform counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 2100/100ml. Approximately 363 acres of Scotts Run Watershed, or nine percent, are served by on-site sewage disposal systems. The areas served by on-site systems are located mostly in Lower Scotts Run in the River Oaks, Potomac Overlook, Swinks Mill, Saigon, Timberly, and McLean Knolls Neighborhoods. Properties with on-site sewage systems are shown on Maps 5.3 and 5.4, but this information is based on the best available data only and may not be completely accurate.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Scotts Run received a "very poor" composite site condition rating. The ratings were based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. In the *SPS Baseline Study*, Scotts Run was classified as a Watershed Restoration Level II area with the goals of maintaining areas to prevent further degradation and implementing measures to improve water quality and comply with Chesapeake Bay initiatives, TMDL regulations, and other water quality initiatives and standards.

The stream reaches of Upper and Lower Scotts Run have high gradient slopes and are classified as the riffle/run prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The habitat assessment for Upper Scotts Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- In less than 50 percent of the stream reaches, four of the possible habitat types such as fallen trees, large woody debris, deep pools, large rocks, undercut banks, thick root mats, and dense macrophyte beds were common.
- The dominant substrate in stream reaches is a mixture of bedrock, gravel stones or stable woody debris.
- Sediment deposition is mainly fine sediment and silt with 40 to 50 percent of the stream bottom affected. However, 70 to 80 percent of the stream bottom is affected in two segments of tributaries to Scotts Run.
- Forty to 70 percent of the stream segments have alteration of the channel or banks. A major tributary located close to the Dulles Airport Access Road has high channel disturbance with signs of dredging and artificial embankments.
- For most of Upper Scotts Run, the water fills approximately 85 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- A majority of the channel banks are highly unstable with approximately 80 percent of the banks covered by thin vegetated cover with a few barren areas present.
- Flows were observed in the stream channel for the majority of Upper Scotts Run and no head cuts were observed. The stream segments along the Upper Scotts Run main stem are good candidates for stream restoration projects because each individual project would have adequate stream length, would not involve easement acquisition, and would have good access for construction.
- The majority of the stream buffer is inadequate and consists mainly of lawn grass with a width of 25 to 50 feet. Fifteen to 30 percent of the banks have erosional areas. The locations of deficient buffer areas along the stream corridor are shown on Map 5.3.

The habitat assessment for Lower Scotts Run and its tributaries can be summarized as follows:

- In most of the downstream reaches, six of the possible in-stream habitat types such as fallen trees, large woody debris, deep pools, large rocks, undercut banks, thick root mats, and dense macrophyte beds were common. However, in half of the upstream reaches of Lower Scotts Run, only four habitat types were common.
- Half of the major tributary reaches of Lower Scotts Run exhibited four common habitat types. Having less than four common habitat types signifies that the stream's habitat structures are becoming monotonous, thus decreasing the diversity of macroinvertebrates.
- The dominant substrate in the downstream reaches is cobblestones.
- Sediment deposition is mainly fine sediment and silt with ten percent of the stream bottom affected in the downstream segments and 30 to 40 percent of the stream bottom affected in the upstream segments of Lower Scotts Run.
- No alteration of the channel or banks was evident in the downstream segments. Approximately 70 percent of the streams exhibited channel disturbance in the upstream segments.
- For most of the upstream segments of Lower Scotts Run, the water fills approximately 80 percent of the available channel cross section during normal flow periods. This amount of

water filling the channel allows for adequate aquatic habitat. However, the downstream channel segments were only 60 to 65 percent full.

- A majority of the channel banks in the upstream portion of Lower Scotts Run are unstable with approximately 70 percent of the banks covered by thin vegetated cover and scattered grasses, non-grass plants, and shrubs. About 90 percent of the banks in the downstream reaches are covered with a variety of vegetation.
- Flows were observed in the stream channel for the majority of Lower Scotts Run and no head cuts were observed.
- The majority of the stream buffer is inadequate and consists mainly of lawn grass with a width of 50 to 100 feet. The locations of deficient buffer areas along the stream corridor are shown on Map 5.4. On average, 40 to 50 percent of the banks have erosion areas.

5.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the observations are included in the following table. Maps 5.1 and 5.2 show the locations of the problem areas.

Table 5.4 Problem Locations Identified During Public Forums

Map ID	Description
Upper Scotts Run	
SC1	Location: Tysons Corner Problem: Impervious cover Observation: Increased runoff from development has caused impacts to Scotts Run. This issue is addressed by the Tysons Corner Stormwater Strategy Project SC9845, which is described in Chapter 9.
SC1	Location: Tysons Corner Problem: In the Tysons Corner redevelopment area, the county should ask developers on land that contains Resource Protection Areas (RPAs) to dedicate conservation easements and require green roofs. Observation: The RPA in Tysons Corner totals approximately 16 acres. Project SC9845 recommends LID measures be required for any rezoned parcel in Tysons Corner. There are three parcels with RPAs that have substantial development potential as described in the Tysons Corner Urban Center Study. The other parcels with RPA are described as open space or as stable.
SC2	Location: Magarity Road at Dolly Madison Apartments Problem: Residents change oil in parking lot and contribute other sources of non-point source pollution. Observation: It is estimated that less than 15 percent of do-it-yourself oil changers properly dispose of their oil. The remaining majority dump the oil into sewers, on the ground, and into the trash. One quart of improperly disposed oil can ruin two million gallons of freshwater. This issue will be addressed by Public Education Project SC9976.
None – watershed wide	Location: Watershed-wide Observation: Provide incentives for homeowners to connect to the municipal sanitary sewer system by providing matching funds from the county. This issue will be addressed by Fecal Coliform Source Study SC9781.
None – watershed wide	Location: Watershed-wide Observation: Provide all homeowner’s associations/neighborhoods/PTA’s with stencil and spray paint for identifying storm drain inlets draining into Chesapeake Bay/Potomac River/other watershed designation. This will be addressed by Community Outreach Project SC9977.

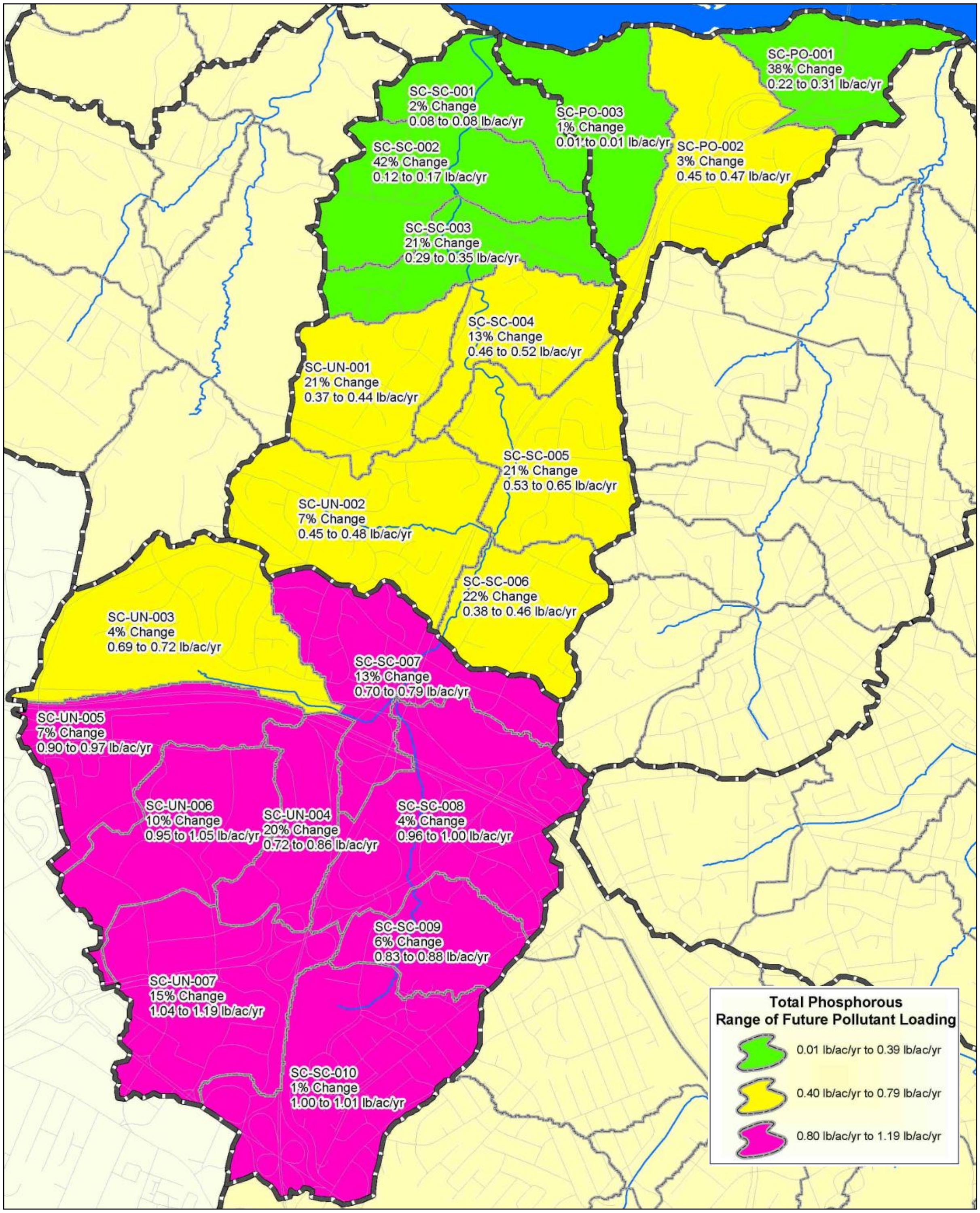
Map ID	Description
SC12	Location: Along Dolley Madison Boulevard inside the Capital Beltway near the Mitre parking lot Problem: There is potential for building larger stormwater detention ponds serving to reduce flows. Observation: BMP Retrofit Project SC9156 is at this location, but the pond will not be made bigger. Vacant land in this area is in the RPA, so it should not be used for new BMPs.
Lower Scotts Run	
SC3	Location: Scotts Run at Scotts Run Road Problem: Frequent floods at this location have dumped large amounts of debris and sediment on the floodplains. Several in the group felt that this location is important to recognize, because it reflects the impacts of development at Tysons Corner in the headwaters of Scotts Run. Participants also noted that Woolpert's map indicates poor habitat quality at this location. Observation: The county's stream physical assessment shows the stream is actively widening. We observed large sediment deposits in the stream. This issue will be addressed by Stream Restoration Project SC9220.
SC4	Location: 864 Sconsett Lane and the Saigon Road area in Lower Scotts Run. Problem: Resident would like to do some stormwater remediation and will pay for it if he needs to, but he needs to get the okay from the county. There is severe erosion occurring at an unnamed tributary to Scotts Run at this location. Banks are eroding, trees are falling, and stream banks are being eroded from under the trees. The volume and speed of the water after a rain event is overwhelming. Homeowners would like to know how they could keep the erosion from increasing. The maintenance for the gas, electric, and sewer easements is also a problem in this location. When the utility companies clear the vegetation from the floodplain and leave debris in the channel, the problems are exacerbated. Observation: The increased runoff from existing development is causing the streams to degrade. The county's stream physical assessment shows that the stream is actively widening, has no buffer vegetation, and has severe erosion at one location along the stream. This issue will be addressed by Stream Restoration Project SC9206.
SC5	Location: Fair weather stream crossings of Scotts Run in Scotts Run Nature Preserve Problem: Recently, a sewer easement went in near the main parking lot and a lot of big rip rap was added to the stream. A big flood came along and moved some of the rip rap so that it was caught between two of the 'stepping stones.' Obviously the level of erosion associated with one rock may be somewhat minimal, but at one of the crossings, there are rip rap and 'stepping stones' across 30 percent of the stream. Observation: There was minimal riprap at the crossing at the time of the investigation. However, Stream Restoration Project SC9204 will address moving rip rap as necessary to minimize erosion.
SC6	Location: Scotts Run Road Problem: The floodplain appears to cross Scotts Run Road based on observations over the past 5 years. Observation: Neither Woolpert's floodplain or the county's floodplain for the 100 year storm event show it crossing Scotts Run Road. No further action is required.
SC6	Location: End of Box Elder Court Problem: The massive spring complex, with associated wetlands, feeds a perennial stream that was not discovered during mapping projects. The streams have been redirected and filled. Three houses on north side of Box Elder Court and one house at Windy Hill Courts consistently experience wet basements and flooding due to the insufficient piping system. Observation: Woolpert investigated this site and it appears that a stream was replaced with a pipe system. Infrastructure Improvement Project SC9475 will address the flooding problems in this area.
SC7	Location: Along Dulany Drive, between Selwyn Drive and Balls Hill Road Problem: There is an unstudied minor floodplain that has not been mapped. There is a perennial stream there that has not been included in the buffering plan and also has potential wetlands. Observation: The county performed a field investigation to verify the RPA limit that ends to the east of Coan Street, downstream of Selwyn Drive. No further action is required.

Map ID	Description
SC8	Location: Dulany Drive Problem: This area was identified as a good location for connecting to the municipal sanitary sewer system. Observation: This will be addressed by Fecal Coliform Source Study SC9781.
SC9	Location: At the end of Westerly Lane Problem: Develop a wildlife corridor that connects Scotts Run Nature Preserve on the Potomac River, through Timberly Park, and along Scotts Run main stem to Lewinsville Road. There is an opportunity to capitalize on existing conservation easements. Observation: The county's Comprehensive Plan depicts this stream corridor as a public park from the Scotts Run Nature Preserve south to the Capital Beltway and private open space from Lewinsville Road north for approximately 3,000 feet towards Old Dominion Drive. There is a section of the stream not shown as a public park on the Comprehensive Plan map because it is located in the Capital Beltway right of way owned by the Virginia Department of Transportation (VDOT). Policy Action B3.7 will address this issue.
SC10	Location: Swinks Mill Road Problem: Flooding occurs at Swinks Mill Road near Georgetown Pike and it is likely due to impervious surface in the Upper Scotts Run Watershed. Observation: Many projects in the headwaters of Scotts Run will help address this problem by reducing the amount of runoff produced in Upper Scotts Run.
SC11	Location: Scotts Run adjacent the Capital Beltway Problem: Projects SC9206 and SC9220 should be high priority areas for stream restoration. With the proposed Capital Beltway expansion, there will be a loss of floodplain and increased need to restore the stream. Observation: Although stream restoration is important, stream restoration projects should be implemented after upstream projects have been completed which will help to reduce both the velocity and the amount of water coming downstream. Waiting to implement the stream restoration will ensure that the work is most effective and does not have to be redone after a short period of time.

5.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Scotts Run Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Scotts Run Watershed, which consists of the area draining to Scotts Run and a smaller area draining directly to the Potomac River. Twenty subbasins were created for the model in order to provide more detail for the modeling results. The subbasins with the future total phosphorus loading are shown in Figure 5.1.

Figure 5.1 Scotts Run Future Total Phosphorous Loading



5.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model, the current watershed imperviousness is 30 percent, which generates moderate to high peak runoff flows. Additional residential imperviousness caused by adding on to existing houses was added to the future land use conditions for the hydrologic model. The predicted increase in runoff volumes for future development conditions may be attributed to the change from estate residential land use to low density residential land use in the Lower Scotts Run Subwatershed and the change from low intensity commercial land use to high intensity commercial land use in the Upper Scotts Run Subwatershed. The projected future development of vacant parcels also contributes to the increase in runoff volumes. Table 5.5 shows the cumulative peak runoff flows and the comparison between the runoff volumes for the existing and future land use conditions for the two and ten-year rainfall events.

Table 5.5 Scotts Run Peak Cumulative Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
SC-PO-001	74	79	7%	153	162	6%
SC-PO-002	175	178	2%	328	333	2%
SC-PO-003	6	6	0%	79	78	-1%
SC-SC-001	1,590	1,640	3%	3,240	3,340	3%
SC-SC-002	1,600	1,660	4%	3,220	3,320	3%
SC-SC-003	1,590	1,660	4%	3,190	3,290	3%
SC-SC-004	1,600	1,660	4%	3,140	3,240	3%
SC-SC-005	1,600	1,660	4%	3,040	3,140	3%
SC-SC-006	1,680	1,730	3%	3,180	3,270	3%
SC-SC-007	1,700	1,750	3%	3,100	3,180	3%
SC-SC-008	1,640	1,690	3%	3,020	3,110	3%
SC-SC-009	950	962	1%	1,780	1,790	1%
SC-SC-010	386	389	1%	725	732	1%
SC-UN-001	83	84	1%	152	154	1%
SC-UN-002	167	169	1%	314	318	1%
SC-UN-003	226	235	4%	418	435	4%
SC-UN-004	654	690	6%	1,180	1,230	4%
SC-UN-005	375	393	5%	642	674	5%
SC-UN-006	195	195	0%	326	326	0%
SC-UN-007	448	452	1%	826	832	1%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the high intensity commercial areas such as the Tysons Corner area in the Upper Scotts Run and low-density residential areas in the Lower Scotts Run watershed. Some of the subbasins have a slight decrease in the annual pollutant load for a few of the metals from the existing to future land use conditions. This decrease can be attributed to the lower pollutant loading factors for the proposed future land use. Table 5.6

shows the comparison of the existing and future pollutant loading rates for the Scotts Run Watershed.

5.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Scotts Run from the confluence of its main stem with its southwestern tributary to its confluence with the Potomac River. The hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for the majority of the modeled length of Scotts Run. The model results showed overtopping for all storm events at a driveway box culvert near Swinks Mill Road. The model results also showed overtopping at a small bridge at Swinks Mill Road for the ten- and 100-year storm events. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor overtopping where there are adjacent and connected floodplains. Scotts Run Watershed has been heavily developed over the years, resulting in higher imperviousness. Hence, the upcoming changes due to redevelopment in this watershed will not significantly affect the future overall imperviousness of the watershed but instead, presents an opportunity to improve existing stormwater controls. Due to this, the future conditions hydraulic modeling results are consistent with the existing conditions results.

The majority of the 100-year event is contained within the current main channel banks as the main channel has become more incised in response to increased runoff from greater imperviousness as a result of development in the watershed. However, the floodplains are utilized where they are connected to the stream channel. These results are consistent with the SPA findings which document that Scotts Run is widening to accommodate existing flows. This can be seen along the southwest tributary of Scotts Run and downstream of its junction with the main stem. Five properties had buildings located in the 100-year floodplain and these properties are described in the Flood Protection Project described in Section 5.2.6.

The velocities produced by the hydraulic model for the two-year rainfall event in the Scotts Run Watershed average approximately 7.9 ft/sec. The average velocity at the southwest tributary is 6.3 ft/sec while the upper portions of the main stem have an average velocity of 7.1 ft/sec. The average velocity throughout the main channel is causing erosion and changes in the stream channel geometry. The model indicates higher and much more erosive velocities of approximately 10.0 ft/sec immediately upstream and downstream of the I-495 bridge crossing.

According to the county's SPA from 2001, over 1,300 linear feet of erosion along the stream banks was observed in the bends and meanders in the headwaters of Scotts Run. The SPA characterized Scotts Run as CEM Type 3, which means it is actively widening. These observations and characterization are further supported by the results of the stream's hydraulic model. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

Table 5.6 Scotts Run Pollutant Loads

Pollutants		Upper Scotts Run Subbasins									Lower Scotts Run Subbasins								Potomac Tributary Subbasins		
		SC SC 007	SC SC 008	SC SC 009	SC SC 010	SC UN 003	SC UN 004	SC UN 005	SC UN 006	SC UN 007	SC SC 001	SC SC 002	SC SC 003	SC SC 004	SC SC 005	SC SC 006	SC UN 001	SC UN 002	SC PO 001	SC PO 002	SC PO 003
BOD5	Existing (lb/ac/yr)	46	74	45	68	30	53	68	57	84	2	3	8	12	15	11	11	16	7	13	1
	Future (lb/ac/yr)	55	83	58	71	31	76	73	80	107	3	5	10	15	23	15	12	17	9	13	1
	% Load Increase	20%	12%	29%	4%	3%	43%	7%	40%	27%	50%	67%	25%	25%	53%	36%	9%	6%	29%	0%	0%
COD	Existing (lb/ac/yr)	204	380	281	398	170	266	367	337	352	17	23	47	67	86	65	66	94	45	77	5
	Future (lb/ac/yr)	240	398	313	416	180	327	401	419	418	17	29	58	80	129	84	70	100	54	78	5
	% Load Increase	18%	5%	11%	5%	6%	23%	9%	24%	19%	0%	26%	23%	19%	50%	29%	6%	6%	20%	1%	0%
TSS	Existing (lb/ac/yr)	151	256	229	229	107	213	239	256	330	10	13	25	38	51	39	30	51	26	46	3
	Future (lb/ac/yr)	162	262	253	230	111	258	248	296	374	10	16	31	45	74	49	32	54	31	46	3
	% Load Increase	7%	2%	10%	0%	4%	21%	4%	16%	13%	0%	23%	24%	18%	45%	26%	7%	6%	19%	0%	0%
TDS	Existing (lb/ac/yr)	202	332	260	311	136	264	317	287	345	22	26	41	53	68	53	45	76	54	68	5
	Future (lb/ac/yr)	224	353	283	321	142	314	330	336	388	22	29	46	60	98	66	46	78	56	69	5
	% Load Increase	11%	6%	9%	3%	4%	19%	4%	17%	12%	0%	12%	12%	13%	44%	25%	2%	3%	4%	1%	0%
DP	Existing (lb/ac/yr)	0.50	0.73	0.61	0.72	0.49	0.57	0.71	0.76	0.75	0.06	0.09	0.24	0.35	0.37	0.28	0.35	0.35	0.15	0.33	0.02
	Future (lb/ac/yr)	0.59	0.75	0.64	0.73	0.51	0.74	0.76	0.87	0.89	0.06	0.12	0.28	0.39	0.46	0.34	0.37	0.37	0.21	0.34	0.02
	% Load Increase	18%	3%	5%	1%	4%	30%	7%	14%	19%	0%	33%	17%	11%	24%	21%	6%	6%	40%	3%	0%
TP	Existing (lb/ac/yr)	0.71	1.01	0.86	1.03	0.70	0.81	0.98	1.03	1.08	0.08	0.12	0.33	0.50	0.53	0.40	0.46	0.50	0.22	0.48	0.03
	Future (lb/ac/yr)	0.80	1.04	0.91	1.04	0.72	0.98	1.03	1.15	1.23	0.08	0.17	0.39	0.56	0.65	0.49	0.49	0.53	0.31	0.49	0.03
	% Load Increase	13%	3%	6%	1%	3%	21%	5%	12%	14%	0%	42%	18%	12%	23%	23%	7%	6%	41%	2%	0%
TKN	Existing (lb/ac/yr)	3.6	5.3	5.0	5.5	4.0	4.3	5.3	6.1	5.3	0.4	0.7	1.8	2.6	2.9	2.2	2.5	2.7	1.2	2.5	0.1
	Future (lb/ac/yr)	4.2	5.3	5.0	5.5	4.2	5.2	5.6	6.4	5.9	0.4	0.9	2.1	2.9	3.6	2.6	2.7	2.9	1.6	2.6	0.1
	% Load Increase	17%	0%	0%	0%	5%	21%	6%	5%	11%	0%	29%	17%	12%	24%	18%	8%	7%	33%	4%	0%
TN	Existing (lb/ac/yr)	6.40	9.63	7.83	9.19	5.51	7.66	9.26	9.52	10.55	0.58	0.89	2.36	3.60	3.94	3.01	3.29	3.65	1.59	3.42	0.18
	Future (lb/ac/yr)	7.33	10.10	8.49	9.33	5.73	9.86	9.76	11.11	12.46	0.59	1.22	2.77	4.00	4.85	3.56	3.50	3.86	2.18	3.50	0.18
	% Load Increase	15%	5%	8%	2%	4%	29%	5%	17%	18%	2%	37%	17%	11%	23%	18%	6%	6%	37%	2%	0%
Cadmium	Existing (lb/ac/yr)	2.6	3.5	4.4	4.5	4.0	3.0	3.7	4.7	4.7	1.1	1.4	2.3	2.8	3.1	2.5	2.5	3.3	2.7	3.2	0.3

Pollutants		Upper Scotts Run Subbasins									Lower Scotts Run Subbasins								Potomac Tributary Subbasins		
		SC-SC-007	SC-SC-008	SC-SC-009	SC-SC-010	SC-UN-003	SC-UN-004	SC-UN-005	SC-UN-006	SC-UN-007	SC-SC-001	SC-SC-002	SC-SC-003	SC-SC-004	SC-SC-005	SC-SC-006	SC-UN-001	SC-UN-002	SC-PO-001	SC-PO-002	SC-PO-003
(x 10^{-4})	Future (lb/ac/yr)	2.6	3.2	4.6	4.6	4.1	3.0	3.7	4.7	4.5	1.1	1.6	2.5	2.9	3.7	2.8	2.6	3.3	2.9	3.3	0.3
	% Load Increase	0%	-9%	5%	2%	2%	0%	0%	0%	-4%	0%	14%	9%	4%	19%	12%	4%	0%	7%	3%	0%
Copper (x 10^{-3})	Existing (lb/ac/yr)	55.4	119.6	107.6	113.0	25.8	97.0	120.8	115.2	90.3	2.5	3.1	5.0	7.7	10.7	9.0	5.7	8.9	6.4	10.9	0.6
	Future (lb/ac/yr)	61.7	118.9	99.3	114.1	26.0	98.7	126.9	115.2	90.2	2.6	3.5	5.7	8.7	14.4	10.7	5.9	9.3	6.7	10.3	0.6
	% Load Increase	11%	-1%	-8%	1%	1%	2%	5%	0%	0%	4%	13%	14%	13%	35%	19%	4%	4%	5%	-6%	0%
Lead (x 10^{-3})	Existing (lb/ac/yr)	11.9	17.7	9.3	14.8	5.4	13.2	15.7	11.0	21.2	1.2	1.4	1.9	2.4	2.8	2.3	1.8	3.4	3.0	3.1	0.3
	Future (lb/ac/yr)	13.2	20.4	13.2	15.9	5.7	18.2	16.4	16.4	25.8	1.3	1.5	2.1	2.7	4.1	2.7	1.8	3.5	3.0	3.2	0.3
	% Load Increase	11%	15%	42%	7%	6%	38%	4%	49%	22%	8%	7%	11%	13%	46%	17%	0%	3%	0%	3%	0%
Zinc (x 10^{-2})	Existing (lb/ac/yr)	34.4	59.2	48.3	46.4	14.1	50.7	56.9	52.7	51.4	1.1	1.4	2.6	4.4	5.8	4.8	3.2	5.0	2.9	5.6	0.3
	Future (lb/ac/yr)	38.9	61.2	45.7	46.0	14.3	58.6	58.8	55.6	55.7	1.2	1.7	3.1	5.0	8.1	5.8	3.3	5.3	3.3	5.3	0.3
	% Load Increase	13%	3%	-5%	-1%	1%	16%	3%	6%	8%	9%	21%	19%	14%	40%	21%	3%	6%	14%	-5%	0%

5.2 Management Plan Strategy

This section outlines proposed projects for the Scotts Run Watershed. The locations of the projects in this section are shown on Maps 5.5 and 5.6. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Dead Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit option numbers from the list above are provided in the following project descriptions.

Public BMP Retrofits

Upper Scotts Run

- Publicly owned dry detention SWM facility located to the east of the Timberly South subdivision behind 1319 Timberly Lane. Possible retrofit options include 2 and 6. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9126)
- Publicly owned dry detention SWM facilities located at 7401 Windy Hill Court and 1355 Windy Hill Road. Possible retrofit options include 2, 6, and 7. For the downstream pond, modifying the riser structure will allow for extended detention storage. For the upstream pond, adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9127)
- Publicly owned dry detention SWM facility located in the VDOT Dulles Toll Road right of way in the northeast cloverleaf at the intersection of the Dulles Toll Road and Dolley Madison Boulevard. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9147)
- Publicly owned dry detention SWM facility located in the VDOT Dulles Toll Road right of way in the southwest cloverleaf at the intersection of the Dulles Toll Road and Dolley

Madison Boulevard. Possible retrofit options include 1 and 6. Increasing the storage volume by expanding the surface area of the pond will allow for additional runoff to be stored. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9150)

- Publicly owned wet BMP located in the VDOT Interstate 495 right of way in the southeast cloverleaf at the intersection of I-495 and Route 7. Possible retrofit options include 2, 6, and 7. Adding an aquatic bench will remove approximately 15% of the phosphorus, improving water quality. (BMP Retrofit Project SC9165)

Lower Scotts Run

- Publicly owned dry detention BMP located at 7410 Georgetown Court. Possible retrofit options include 2, 3, and 7. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will improve water quality. (BMP Retrofit Project SC9105)
- Publicly owned dry detention BMP located at 914 Helga Place. Possible retrofit options include 2, 6, and 7. The riser structure is filled with trash and debris and should be cleaned out. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will improve water quality. (BMP Retrofit Project SC9108)
- Publicly owned dry detention SWM facility located at 1106 Mill Ridge. Possible retrofit options include 2, 6, and 7. This pond was designed to minimize the post-development peak flows and does not have water quality controls. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will improve water quality. (BMP Retrofit Project SC9114)
- Publicly owned dry detention SWM facility located at 1165 Old Stage Court. Possible retrofit options include 2 and 6. The pond is very small and the existing riser only has a small opening, which is causing flooding in both of the neighboring properties. One option to prevent flooding would be to retrofit the riser to allow for greater peak discharges, but this may affect the condition of the downstream channel. Adding a bioretention area near the pond as well as replacing the eroded ditch with a bioswale will help reduce the flows and improve water quality. (BMP Retrofit Project SC9117)
- Publicly owned dry detention SWM facility located at Timberly Park with access from 1160 Old Gate Court. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended detention storage. Improving water quality by adding a shallow wetland will directly benefit downstream restoration of an unnamed tributary to Lower Scotts Run. (BMP Retrofit Project SC9118)
- Publicly owned dry detention SWM facility located to the east of the Timberly South subdivision behind 7601 Timberly Court. Possible retrofit options include 2 and 6. This pond was designed to minimize the post development peak flows and does not have water quality controls. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9123)
- Publicly owned dry detention SWM facility located to the north of Hooking Road in the McLean Station subdivision. The facility is accessed from Coan Street and is located behind 7309 Dulany Drive. Possible retrofit options include 2 and 6. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9124)

Potomac Tributaries

- Publicly owned dry detention SWM facility located at 889 Linganore Drive. Possible retrofit options include 2, 6, and 7. This facility detains the runoff from surrounding areas before releasing it directly into the Scotts Run Nature Preserve and was not designed with water quality controls. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9107)

Private BMP Retrofits

Upper Scotts Run

- Privately owned dry detention SWM basin located near 8121 Dunsinane Court. Possible retrofit options include 2, 6, and 7. (BMP Retrofit Project SC9135)
- Privately owned wet SWM facility located at 7980 Jones Branch Drive. This facility is owned by Westpark Associates, LP and was designed to store the runoff from the Tysons Corner area. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended detention storage. Adding an aquatic bench will also improve water quality. (BMP Retrofit Project SC9138)
- Privately owned wet SWM facility located at 7927 Jones Branch Drive. This facility is owned by West Group Properties, LLC. The Tysons Corner area has large amounts of impervious surfaces which increase runoff and contribute to poor water quality. Adding water quality controls such as an aquatic bench to this facility will help improve the runoff quality from Tysons Corner. Possible retrofit options include 2, 6, and 7. (BMP Retrofit Project SC9139)
- Privately owned wet SWM facility located at 1517 Westbranch Drive. This facility is owned by Avalon Properties, Inc. Possible retrofit options include 2, 6, and 7. This facility was designed to handle the post development peak flows from the surrounding Tysons Corner area and not for water quality control. Modifying the riser structure will allow for extended detention storage. Adding an aquatic bench will also improve water quality. (BMP Retrofit Project SC9140)
- Privately owned wet SWM facility located at 8003 Westpark Drive. This facility is owned by Avalon Properties, Inc. Possible retrofit options include 2, 6, and 7. During a county inspection, silt and debris was noticed in the control structure. The control structure should be cleaned out and the pond should be retrofitted for water quality treatment. (BMP Retrofit Project SC9141)
- Privately owned wet SWM pond located at the intersection of Jones Branch Drive and Park Run Drive. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended detention storage. Adding an aquatic bench will also improve water quality. (BMP Retrofit Project SC9143)
- Privately owned dry detention SWM facility located near the intersection of Tysons McLean Drive and Farm Credit Drive behind 1501 Farm Credit Drive. Possible retrofit options include 2 and 6. The bottom of the pond should be retrofitted with vegetation for greater filtering of runoff which will improve water quality. Also, the picnic tables located in the pond should be moved to the bank. (BMP Retrofit Project SC9146)
- Privately owned wet SWM pond located behind 1820 Dolley Madison Boulevard. Possible retrofit options include 1, 2, and 6. This facility collects runoff from I-495 and the Tysons Corner area and then releases it into an unnamed tributary to Upper Scotts Run. Retrofitting this facility for greater water quality treatment will benefit downstream water quality. Increasing the storage volume by increasing the depth will allow for extended

storage. Adding an aquatic bench will also improve water quality. The pond is within the RPA and this property is also subject to proffers which should be reviewed with DPZ before planning this project. (BMP Retrofit Project SC9149)

- Privately owned wet detention SWM facility located near 1820 Dolley Madison Boulevard. Possible retrofit options include 1, 6, and 7. This facility collects runoff from I-495 and the Tysons Corner area and then releases it into Upper Scotts Run. Increasing the storage volume by increasing the depth will allow for extended storage. Adding an aquatic bench will improve water quality for Upper Scotts Run. (BMP Retrofit Project SC9154)
- Privately owned dry detention SWM facility located at 1749 Old Meadow Road. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended storage. Adding a shallow wetland will also improve water quality. The pond is located within the RPA. (BMP Retrofit Project SC9155)
- Privately owned wet BMP facility located at 7525 Colshire Drive. Modifying the riser structure will allow for extended storage. Adding an aquatic bench will also improve water quality. Possible retrofit options include 2 and 6. (BMP Retrofit Project SC9156)

Lower Scotts Run

- Privately owned dry detention SWM facility located at 1009 Swinks Mill Road. Possible retrofit options include 2, 6, and 7. This location drains the runoff from Swinks Mill Road and the surrounding neighborhoods and then discharges it into Lower Scotts Run. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9111)
- Privately owned dry detention SWM facility located at 1033 Swinks Mill Road with access from Gelston Circle. Possible retrofit options include 2, 6, and 7. A weir wall could be installed to allow for a limited amount of detention storage to build up before overflowing into the existing culvert which leads to another dry detention facility located downstream at 1009 Swinks Mill Road. (BMP Retrofit Project SC9112)
- Privately owned dry detention SWM facility located at 1219 Swinks Mill Road. This facility is owned by Korean United Methodist Church. Possible retrofit options include 2, 6, and 7. This facility consists of a fenced-in basin with a riprap-lined bottom and a detention riser. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9122)
- Privately owned dry detention SWM basin located at the McLean Presbyterian Church property at 1020 Balls Hill Road. The basin captures the runoff from the parking lot. Possible retrofit options include 2, 6, and 7. Modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project SC9174)

The size of the proposed drainage areas and the benefits from the proposed BMP retrofits that will be implemented first are included in Table 5.7.

Table 5.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
SC9105	SC-SC-003	7410 Georgetown Court	42.7	2.8	0.4
SC9107	SC-PO-003	889 Linganore Drive	9.0	2.0	0.3
SC9108	SC-SC-004	914 Helga Place	20.8	1.4	0.2
SC9111	SC-SC-004	1009 Swinks Mill Road	5.8	1.3	0.5
SC9112	SC-SC-004	1033 Swinks Mill Road	7.6	1.7	0.4
SC9114	SC-UN-001	1106 Mill Ridge	17.0	3.7	0.4
SC9117	SC-UN-002	1165 Old Stage Court	5.0	0.5	0.2
SC9118	SC-UN-002	1160 Old Gate Court	2.7	0.6	0.1
SC9122	SC-UN-002	1219 Swinks Mill Road	4.5	2.0	0.2
SC9123	SC-UN-002	7601 Timberly Court	4.4	2.2	0.2
SC9124	SC-SC-006	Behind 7309 Dulany Drive	13.0	6.5	0.9
SC9126	SC-SC-007	1319 Timberly Lane	6.1	3.0	0.3
SC9127	SC-SC-007	7401 Windy Hill Court	29.1	4.4	1.2
SC9135	SC-UN-003	8121 Dunsinane Court	25.0	12.5	1.0
SC9138	SC-UN-004	7980 Jones Branch Drive	48.9	13.7	4.4
SC9139	SC-UN-006	7927 Jones Branch Drive	27.9	7.8	6.0
SC9140	SC-UN-006	1517 Westbranch Drive	26.6	7.4	2.4
SC9141	SC-UN-006	8003 Westpark Drive	71.5	17.8	15.5
SC9143	SC-UN-005	Intersection of Jones Branch Drive and Park Run Drive	43.7	8.8	2.9
SC9146	SC-SC-008	1501 Farm Credit Drive	65.1	18.1	2.3
SC9147	SC-SC-008	Northeast cloverleaf at the intersection of Dulles Toll Road and Dolley Madison Boulevard	3.7	1.9	0.3
SC9149	SC-SC-008	1820 Dolley Madison Boulevard	21.0	9.8	1.4
SC9150	SC-SC-008	Southwest cloverleaf at the intersection of Dulles Toll Road and Dolley Madison Boulevard	26.0	31.2	2.5
SC9154	SC-SC-008	1820 Dolley Madison Boulevard	26.2	12.8	1.9
SC9155	SC-SC-009	1749 Old Meadow Road	4.0	3.7	0.3
SC9156	SC-SC-009	7525 Colshire Drive	16.5	4.8	1.3

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
SC9165	SC-SC-010	Southeast cloverleaf at the intersection of I-495 and Route 7	4.5	0.9	0.3
SC9174	SC-SC-005	1020 Balls Hill Road	10.5	9.8	0.9

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.
The new BMP projects have been grouped into public or privately owned land and conventional BMPs or LID methods. The proposed new BMP locations are described below and are shown on Maps 5.5 and 5.6.

New Public BMPs

Upper Scotts Run

- A new one-year extended detention BMP could be constructed on Fairfax County Park Authority property located at 7717 Falstaff Road. The BMP should be installed near the yard inlet which collects runoff from Falstaff Road. The estimated buildable area at this location is 41,000 square feet. (New BMP Project SC9128)
- A new one-year extended detention BMP could be constructed in the McLean Hamlet Park; the entrance is next to 8005 Falstaff Road. A dry detention BMP should be installed at the outfall of the pipe in this location. The estimated buildable area at this location is 5,000 square feet. (New BMP Project SC9132)
- Four new one-year extended detention BMPs could be constructed within the VDOT right of way near the Dulles Toll Road. All of the sites have dense tree cover and should be designed to minimize tree loss. According to the topographic information, the sites located southwest and southeast of the intersection of I-495 and Dulles Toll Road are in naturally low areas and have estimated buildable areas of 20,000 square feet and 10,000 square feet, respectively. The site to the southwest is also in the RPA. The site to the northeast is in a floodplain and the RPA, and has an estimated buildable area of 25,000 square feet. The site to the northwest has an estimated buildable area of 40,000 square feet. (New BMP Project SC9137)
- A new one-year extended detention BMP could be constructed within the Freddie Mac campus at 8000 Jones Branch Drive. The site has dense cover and the estimated buildable area is 12,000 square feet. (New BMP Project SC9142)
- A new one-year extended detention BMP could be constructed in the VDOT Dulles Toll Road right of way in the southeast cloverleaf at the intersection of Dulles Toll Road and Dolley Madison Boulevard. The proposed location has open land where a BMP could be constructed. The estimated buildable area at this location is 8,000 square feet. (New BMP Project SC9153)
- A new one-year extended detention BMP could be constructed in the VDOT I-495 right of way in the southeast cloverleaf at the intersection of I-495 and Chain Bridge Road. This location may be suitable for a dry detention basin because there is a large amount of open space and a storm drainage network nearby. The estimated buildable area at this location is 8,000 square feet. (New BMP Project SC9157)
- A new one-year extended detention BMP could be constructed in the VDOT I-495 right of way in the southwest cloverleaf at the intersection of I-495 and Chain Bridge Road.

This area has dense tree cover, and the estimated buildable area is 8,000 square feet. (New BMP Project SC9158)

- Construct a new one-year extended detention BMP in the VDOT I-495 right of way in the northwest cloverleaf at the intersection of I-495 and Route 7. Tree removal should be limited to the embankment area. The estimated buildable area at this location is 12,500 square feet. (New BMP Project SC9162)
- A new one-year extended detention BMP could be constructed in the VDOT Interstate 495 right of way in the northeast cloverleaf at the intersection of intersection of I-495 and Route 7. This location may be suitable for a dry detention basin because there is open space and a storm drain network in the vicinity. The estimated buildable area at this location is 8,000 square feet. (New BMP Project SC9164)
- Construct a new one year extended detention BMP at the vacant lot located west of 1500 Westbranch Drive. This area has dense tree cover, so the BMP should be designed to minimize tree loss. There is nearby access to the storm drainage network. The estimated buildable area at this location is 13,000 square feet. (New BMP Project SC9167)

Public LID Projects

Schools were targeted for LID projects because the properties are owned by the county, usually have large impervious areas, most have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues.

Upper Scotts Run

- New LID methods could be constructed at the Spring Hill Elementary School located at 8201 Lewinsville Road as demonstration projects. Four bioretention areas could be constructed in the landscaped areas near the school building and a bioswale could be constructed on the northeast side of the property, next to the parking lot. Also, a curb inlet in the parking lot could be replaced by tree box filter. (New LID Project SC9836)
- New LID methods could be constructed at the Westgate Elementary School located at 7500 Magarity Road. This school has large amounts of impervious surfaces and implementing LID methods would help decrease the peak runoff from the school. A bioswale could be constructed adjacent to the asphalt playground area and three curb drop inlets could be replaced by tree box filters. Two bioretention areas could be constructed in the landscaped areas near the school building. (New LID Project SC9859)

Private LID Projects

LID projects are recommended for the following privately owned commercial developments. The commercial LID sites were chosen because they have large impervious areas and do not have existing stormwater management controls.

Upper Scotts Run

- New LID methods could be constructed at the Tysons Westpark Transit Station located at 8300 Jones Branch Drive. Four bioretention areas could be constructed in the medians and landscaped areas. Three curb drop inlets could be replaced with tree box filters. (New LID Project SC9844)
- Construct a LID project at the Pimmit Hills Center located at 7510 Lisle Avenue. Bioretention areas could be constructed near the building and in the parking lot medians. The parking lots do not have curbs so bioswales or infiltration trenches should be constructed adjacent to the parking lots to capture and treat the runoff. (New LID Project

SC9860)

Lower Scotts Run

- Construct a LID project at the McLean Presbyterian Church at 1020 Balls Hill Road. The landscaped areas near the church could be converted into bioretention areas. Porous pavement or pavers could be used in the outlying parking areas. Bioswales could be constructed adjacent to the parking lot and curb cuts placed to allow runoff to drain to the bioswales. (New LID Project SC9813)
- Construct a LID project at the Church of the Latter Day Saints located at 1325 Scotts Run Road. The curb drop inlets could be replaced by tree box filters and bioretention areas could be constructed in the parking lot medians and in the landscaped areas near the building. Porous pavement or pavers could be used in the outlying parking areas. (New LID Project SC9825)

The pollutant removal benefit for the proposed BMP and LID projects that will be implemented first are shown in Table 5.8.

Table 5.8 Benefits of New BMPs and LID Projects

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
SC9128	SC-SC-007	7717 Falstaff Road	46.7	23.3
SC9132	SC-UN-003	8005 Falstaff Road	5.6	2.8
SC9137	SC-SC-007, SC-UN-004	Intersection of I-95 and Dulles Toll Road	109.0	54.5
SC9142	SC-UN-005	8000 Jones Branch Drive	6.0	5.5
SC9153	SC-SC-008	Southeast cloverleaf at the intersection of Dulles Toll Road and Dolley Madison Boulevard	9.0	3.5
SC9157	SC-UN-007	Southeast cloverleaf at the intersection of I-495 and Chain Bridge Road	6.1	6.0
SC9158	SC-UN-007	Southwest cloverleaf at the intersection of I-495 and Chain Bridge Road	6.1	6.0
SC9162	SC-SC-010	Northwest cloverleaf at the intersection of I495 and Route 7	9.4	4.2
SC9164	SC-SC-010	Northeast cloverleaf at the intersection of I495 and Route 7	4.4	1.9
SC9167	SC-UN-006	West of 1500 Westbranch Drive	9.7	2.0
SC9813	SC-SC-005	1020 Balls Hill Road	N/A	N/A
SC9825	SC-SC-006	1325 Scotts Run Road	N/A	N/A
SC9836	SC-UN-003	8201 Lewinsville Road	4.9	4.8
SC9844	SC-UN-005	8300 Jones Branch Drive	3.1	3.0
SC9859	SC-SC-009, SC-SC-010	7500 Magarity Road	3.7	2.9
SC9860	SC-SC-010	7510 Lisle Avenue	N/A	N/A

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.

The neighborhoods selected for neighborhood stormwater improvements do not have existing stormwater management controls and the runoff from these neighborhoods contributes to downstream erosion problems. Targeting these neighborhoods for LID methods will help to mitigate the effects of the impervious surfaces and to improve the effectiveness of stream restoration projects downstream. The neighborhood stormwater improvement areas are described below and are shown on Maps 5.5 and 5.6.

Upper Scotts Run

- Conduct a storm drain study in the McLean Hamlet neighborhood located between the Dulles Toll Road and Lewinsville Road. Flooding in this neighborhood may be a result of inadequate capacity in the storm drain system. The study should be accompanied by LID measures that will reduce the peak flows. Currently this neighborhood has concrete sidewalks, curb and gutter, storm drain inlets, and many cul-de-sacs. Fifteen small bioretention areas could be added throughout the neighborhood in existing open space areas, in the area between the sidewalk and the curb and in cul-de-sacs. Also, sixteen tree box filters could replace existing curb drop inlets.(Neighborhood Stormwater Improvement Area SC9834)
- Tysons Corner Stormwater Strategy SC9845 is described in Chapter 9.
- New LID methods could be constructed in the Scotts Hills neighborhood located between Magarity Road and Lisle Avenue. There are concrete sidewalks, curb and gutter, and storm drain inlets. Four small bioretention areas could be constructed around storm drain inlets located in low area behind the houses, as well as in existing open space areas. Eight storm drain inlets could also be replaced with tree box filters to improve the water quality. (Neighborhood Stormwater Improvement Area SC9861)

The pollutant removal benefit for the proposed neighborhood stormwater improvement areas is shown in Table 5.9.

Table 5.9 Benefits of Neighborhood Stormwater Improvement Areas

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
SC9834	SC-SC-007, SC-UN-003	McLean Hamlet neighborhood	14.5	13.5
SC9861	SC-SC-010	Scotts Hills neighborhood	6.0	5.6

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.

There are no floodplain restoration projects in this watershed.

Action A1.5: Remove detrimental channel obstructions.

Channel obstructions that block stream flow, like the ones listed below, should be removed. Obstructions in the watershed will vary over time. It may be necessary to clean up future obstructions that are not listed below or shown on any of the watershed maps. Some of the obstructions shown on Maps 5.3 and 5.4 have been cleaned up since the SPA was conducted, so projects were not needed at those locations.

Lower Scotts Run

- Remove five obstructions identified in the SPA that consist primarily of tree debris. The locations are in the vicinity of Timberly Park, Coan Street, Woburn Court, Saigon Road, and Potomac River Road. (Dumpsite/Obstruction Removal SC9903)

Action A1.6: Stabilize eroding streambanks using bioengineering methods.
The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.
Improve the existing stormwater infrastructure at the following location:

Lower Scotts Run

- Improve the deficient storm drain system in the vicinity of Box Elder Court that has caused house and yard flooding in the past. There is a natural spring here which has been piped and the existing pipes are not sufficient to contain the flow. The outfall at Scotts Run Road frequently backs up and some of the pipes at Box Elder Court are clogged. A portion of this project is in the county's list of master plan drainage projects (SC614). (Infrastructure Improvement SC9475)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.
Improve the existing stormwater infrastructure at the following location:

Upper Scotts Run

- Improve the existing fair weather crossing located near Old Springhouse Road. (Infrastructure Improvement SC9451)

Action A2.3: Protect structures located in the 100-year flood limit from flooding.
Table 5.10 lists the number of properties in the watershed that are located in the 100-year floodplain or are recommended for flood protection (Flood Protection Project SC9672).

Table 5.10 Recommended Flood Protection Locations

Street	# Properties
Dolley Madison Boulevard	1
Scotts Run Road	1
Swinks Mill Road	3

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.

Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Scotts Run Watershed using E. coli as the indicator bacteria and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced (Fecal Coliform Source Study SC9781).

Scotts Run has been identified by the Virginia Department of Environmental Quality as an impaired stream due to high levels of bacteria. Fecal coliform sampling of Scotts Run in 2002 by the county showed an improvement in the bacteria levels from the previous year. However, Scotts Run did not meet the state's current instantaneous fecal coliform standard that no more than 10% of the samples collected in a month shall exceed 400 fecal coliform per 100 milliliter of water. The ultimate goal of the study action plan would be to remove Scotts Run from Virginia's list of impaired waters.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.

The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.

The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.

Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities. The deficient buffer location described below was found during the 2002 SPA or was identified as a potential location for buffer restoration during the watershed planning process. This reach length will be further evaluated to determine what portions require restoration work. The location of this project is shown on Map 5.5. Steps to protect existing vegetated buffers are included in Public Education Project SC9976 described later in this chapter.

Upper Scotts Run

- Evaluate the 1,800 feet of Upper Scotts Run from Dolley Madison Boulevard to the Dulles Toll Road to determine if buffer restoration work is required. (Buffer Restoration SC9352)

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
There are no land conservation projects in this watershed.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.
A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project SC9980)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.
Utilize bioengineering to restore and stabilize stream banks, restore natural stream geometries, and remove concrete from stream banks and beds. Scotts Run is actively widening along the majority of its length and the steam protection strategy composite site condition rating was "very poor." Restoring the stream and its tributaries will improve the condition of the aquatic habitat and should be carefully coordinated with the previously described objectives of reducing the quantity and improving the quality of runoff in order to prevent further erosion and channel widening. The locations of proposed stream restoration activities are described below and shown on Maps 5.5 and 5.6. It should be noted that the stream reaches identified in the following project descriptions and on the maps designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

Upper Scotts Run

- Approximately 6,500 linear feet of two tributaries to Scotts Run that run parallel to the Dulles Toll Road will be evaluated to determine locations for stream restoration. The longer of the two tributaries is west of the main channel and the shorter is to the east. The channels in this area appear to have been straightened to accommodate the Dulles Toll Road. The streams are classified in the habitat assessment as having poor habitat quality. Proposed activities will include removing the riprap along the channel, reconfiguring the stream banks, connecting the stream with its floodplain and/or installing soft structural stream bank measures such as fascines or root wads. The new channel, with some restrictions, should be designed as close as possible in dimension, pattern, and profile to a reference stream in the watershed. Proposed activities will also include channel riparian vegetation planting, trash/debris removal, and installation of some in-stream habitat improvement structures, such as small log cross vanes. All natural materials should be used in the construction of the in-stream structures. Additional activities will include culvert replacement or adjustment where the pipe outlet elevation is not the same as the stream channel bottom. Stable inlet and outlet protection must be installed at all stream crossings. Cross vanes or "W" weirs may be constructed to help eliminate scour and redirect the stream flow through culverts or bridges. (Stream Restoration SC9230)

Lower Scotts Run

- Evaluate 5,500 linear feet of Scotts Run for stream restoration locations beginning at the northern end of Timberly Park and flowing northward, and a minor tributary joining the main channel from the west and paralleling Georgetown Pike. This stream is in a transitional phase of stream bank evolution from a stable stream to an eroding/widening stream. This type of stream channel incision usually is an indication of a change in stream slope. But this stream is limited in the amount of slope change and downcutting due to the large amounts of bedrock found along the stream channel bottom. In order to stop stream bank erosion, gabions and concrete walls have been constructed along the outside of some of the meanders of the stream. Approximately 40 to 70 percent of the channel has been disturbed and the banks are 40 to 60 percent eroded. Proposed activities include channel reconfiguration of the stream banks, connecting the stream with its floodplain, riparian vegetation planting and some installation of in-stream habitat improvement structures and trash/debris removal. Natural materials will be used in the construction of all in-stream structures. Proposed activities will also include repair of existing gabions and concrete walls or construction of new structural stream bank protection measures and some bioengineering of the stream banks. This project will also include replacement of the Swinks Mill Road bridge because it is undersized and extensive flooding has occurred at this location in the past. (Stream Restoration SC9204)
- Evaluate three tributaries located on the east side of Scotts Run near Saigon Road for a total of approximately 3,700 linear feet for stream restoration locations. These three tributaries to Scotts Run are all in a transitional phase of stream bank evolution and exhibit the eroding and vertical banks of an incising/widening stream. Proposed activities include channel reconfiguration, riparian vegetation planting and some installation of in-stream habitat improvement structures along with bioengineering of the stream banks. The channel reconfiguration of these tributaries should help to minimize the contributory erosional forces to the main stem. A portion of this project is in the county's list of master plan drainage projects (SC215). (Stream Restoration SC9206)
- Evaluate approximately 4,100 linear feet of two tributaries to Scotts Run located to the west of Scotts Run and running parallel to Swinks Mill Road for stream restoration locations. The upper portion of the longest unnamed tributary flows between several

houses through a concrete channel. The homeowners should be encouraged to create a vegetated buffer zone along the length of the concrete ditch. The second of the two tributaries is in a transitional phase of stream bank evolution and exhibits the eroding and vertical banks of an incising/widening stream. Proposed activities include channel reconfiguration, reconnecting the stream with its flood plain, riparian vegetation planting and some installation of in-stream habitat improvement structures along with some bioengineering of the stream banks. All natural materials should be used in the construction of the in-stream structures. All of the culverts should be provided proper inlet and outlet protection against erosion. (Stream Restoration SC9210)

  - Evaluate Bradley Branch for approximately 3,650 linear feet flowing west along the southern border of Timberly Park for stream restoration locations. The channel evolution model has indicated that this stream is evolving from a stable stream to a widening stream. Approximately 40 percent of the stream has been altered and 60 to 70 percent of the stream has eroded banks. Proposed activities will include channel reconfiguration, floodplain creation, bioengineering of stream banks, selective placement of in-stream habitat structures, and removal of debris and unstable trees. A portion of this project is in the county's list of master plan drainage projects (SC213). (Stream Restoration SC9219)
  - Evaluate approximately 7,800 of Scotts Run and one minor tributary for stream restoration locations. The tributary flows north along the Capital Beltway beginning at the Dulles Toll Road and ends in the vicinity of Old Dominion Drive. The stream banks in the upstream portion of the restoration area are undercut and eroded with many trees along the bank falling into the stream. Woody debris accumulation in the stream has inhibited any defined riffle and pool development. Irregular point bars of sand and gravel are seen along this stream length and bank full flow (1.5 to 2 year storm) is predicted to be at the top of the streams banks. Proposed activities will include removal of woody debris and trash, stream channel and bank reconfiguration, selective placement of in-stream habitat structures and riparian vegetation planting. The downstream portion of the evaluation reach begins near the intersection of the Capital Beltway and Old Dominion Drive. The stream flows along the embankment fill for the Capital Beltway for the majority of the evaluation reach. The channel has been lined with riprap to protect the roadway fill embankment. Much of the riprap can be found in the stream and along some of its banks. Proposed activities will include removal of the riprap channel lining and replacing it with a stream channel equal to an identified reference reach stream in the same watershed. The new channel will be equal in dimension, pattern and profile to the reference stream and will include the placement of in-stream structures to promote good riffle and pool habitat. Outlet protection should be placed at the downstream end of the I-495 box culvert and woody debris and trash should be removed. (Stream Restoration SC9220)

- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not included in the SPA will be evaluated in this project. (Stream Assessment Project SC9982)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.
Public Education Project SC9976 will include the following actions:

- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.
- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.
- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.
- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.
- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.
- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.
- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.
- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.
Community Outreach Project SC9977 will include the following actions:

- Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects.
- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.
- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project SC9979 will include the following actions:

- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact

Development (LID) practices.

LID Promotion Project SC9978 will include the following actions:

- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries.

5.3 Benefits of Plan Actions

Thirty-three BMP retrofit projects, six LID projects, two Neighborhood Stormwater Improvement Areas, and eleven new BMP projects have been proposed for the Scotts Run Watershed to help improve the quality of the stream. The channel erosion control volume to be provided by twenty-eight of the BMP retrofit projects will serve approximately 83 percent of the required channel erosion control volume for the 628 acres controlled by the BMP retrofit locations. The channel erosion control volume to be provided by ten of the new BMP projects will serve all of the required channel erosion control volume for the 212 acres of drainage area. For the forty-three BMP Retrofit, LID, Neighborhood Stormwater Improvement Areas, and new BMP projects with benefit calculations, the total additional phosphorus removal is estimated to be 328 lbs/year upon successful implementation of these projects.

Approximately 31,250 linear feet of Scotts Run will be restored as part of the proposed stream restoration projects. These projects will help minimize the velocity of the stream, provide nutrient reduction, and reduce the erosion of the stream banks. Approximately 1,800 linear feet of stream buffers will be restored by implementing the buffer restoration project. The project will increase the amount of habitat and provide nutrient reduction for Scotts Run. The storm drain study project will help to evaluate the storm drain system deficiencies and construct recommended drainage system improvements for the McLean Hamlet neighborhood.

5.4 Implementation of Plan Actions

The recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The initial implementation schedule was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. Detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Scotts Run is $7,520,000. The priority projects are summarized in Table 5.11 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 5.11 Summary of Scotts Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
SC9157	New BMP Project	VDOT[1]	$110,000	4.30	**
SC9158	New BMP Project	VDOT[1]	$110,000	4.30	**
SC9147	BMP Retrofit Project	VDOT[1]	$40,000	4.20	**
SC9128	New BMP Project	Fairfax County Park Authority (FCPA)	$430,000	4.15	A
SC9137	New BMP Project	VDOT[1]	$940,000	4.15	**
SC9126	BMP Retrofit Project	Timberly South HOA[1]	$70,000	4.05	A
SC9132	New BMP Project	FCPA	$80,000	4.05	A
SC9117	BMP Retrofit Project	Private Residential[1]	$40,000	4.00	A

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
SC9142	New BMP Project	Commercial Development[1]	$130,000	4.00	A
SC9167	New BMP Project	Commercial Development[1]	$130,000	4.00	A
SC9845	Tysons Corner Stormwater Strategy	VDOT and Commercial Development[1]	$200,000[2]	4.00	A
SC9114	BMP Retrofit Project	Private Residential and Reserve HOA[1]	$80,000	3.95	A
SC9141	BMP Retrofit Project	Residential Development[1]	$100,000	3.90	A
SC9352	Buffer Restoration	VDOT, Residential Development and Commercial Development[1]	$90,000	3.15	A
SC9124	BMP Retrofit Project	McLean Station HOA[1]	$130,000	3.95	B
SC9138	BMP Retrofit Project	Commercial Development[1]	$590,000	3.95	B
SC9861	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$280,000	3.95	**
SC9154	BMP Retrofit Project	Commercial Development[1]	$120,000	3.90	B
SC9118	BMP Retrofit Project	FCPA	$30,000	3.85	B
SC9139	BMP Retrofit Project	Commercial Development[1]	$180,000	3.85	B
SC9153	New BMP Project	VDOT[1]	$110,000	3.85	**
SC9162	New BMP Project	VDOT[1]	$130,000	3.85	**
SC9164	New BMP Project	VDOT[1]	$110,000	3.85	**
SC9165	BMP Retrofit Project	VDOT[1]	$60,000	3.85	**
SC9834	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$870,000	3.85	**
SC9836	New LID Project	Fairfax Count Public Schools (FCPS)	$260,000	3.85	B
SC9844	New LID Project	Fairfax County Board of Supervisors	$160,000	3.85	B
SC9859	New LID Project	FCPS	$160,000	3.85	B
SC9150	BMP Retrofit Project	VDOT[1]	$280,000	3.75	**
SC9135	BMP Retrofit Project	Spring Hill Road HOA[1]	$140,000	3.60	B
SC9143	BMP Retrofit Project	Residential Development[1]	$210,000	3.60	B
SC9140	BMP Retrofit Project	Commercial Development[1]	$130,000	3.35	B
SC9155	BMP Retrofit Project	Commercial Development[1]	$60,000	3.75	C
SC9156	BMP Retrofit Project	Commercial Development[1]	$120,000	3.75	C
SC9127	BMP Retrofit Project	Windy Hill HOA and Maplewood HOA[1]	$170,000	3.65	C
SC9174	BMP Retrofit Project	Private Organization[1]	$80,000	3.45	C
SC9123	BMP Retrofit Project	Timberly South HOA[1]	$50,000	3.40	C
SC9149	BMP Retrofit Project	Residential Development[1]	$110,000	3.35	C
SC9146	BMP Retrofit Project	Commercial Development[1]	$120,000	3.25	C
SC9108	BMP Retrofit Project	Private Residential and Beaufort Park HOA[1]	$60,000	3.15	C
SC9122	BMP Retrofit Project	Private Organization[1]	$40,000	3.10	C
SC9111	BMP Retrofit Project	Private Residential[1]	$90,000	3.00	C

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
SC9112	BMP Retrofit Project	Urquhart Subdivision Association[1]	$40,000	3.00	C
SC9105	BMP Retrofit Project	Private Residential[1]	$60,000	2.90	C
SC9107	BMP Retrofit Project	Private Residential[1]	$70,000	2.90	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

[2]Cost shown is an estimated cost for a study, not for implementation of the projects from the study.

** These projects will be coordinated directly with VDOT.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 5.12 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 5.12 Summary of Scotts Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
SC9976	Public Education Project	Watershed-wide Project	N/A	A*
SC9977	Community Outreach Project	Watershed-wide Project	N/A	A*
SC9978	LID Promotion Project	Watershed-wide Project	N/A	A*
SC9979	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
SC9982	Stream Assessment Project	Watershed-wide Project	N/A	A*
SC9903	Dumpsite/Obstruction Removal	FCPA, Private Residential, and Timberly South HOA[1]	2.05	A
SC9825	New LID Project	Private Organization[1]	3.10	D
SC9860	New LID Project	FCPS	3.10	D
SC9813	New LID Project	Private Organization[1]	3.00	D
SC9220	Stream Restoration	VDOT and Private Residential[1]	2.85	D
SC9219	Stream Restoration	VDOT, FCPA, Private Residential, McLean Hunt HOA, and Timberly South HOA[1]	2.75	D
SC9230	Stream Restoration	VDOT, FCPA, and Private Organization[1]	2.75	D
SC9980	Wetland Assessment Project	Watershed-wide Project	2.75	D
SC9475	Infrastructure Improvement	VDOT and Private Residential[1]	2.65	**
SC9451	Infrastructure Improvement	VDOT and Residential Development[1]	2.55	**

Project Number	Type	Land Owner	Score	Year Group
SC9204	Stream Restoration	VDOT, FCPA, Private Residential, Reserve HOA, and Scotts Run HOA[1]	2.75	E
SC9206	Stream Restoration	VDOT and Private Residential[1]	2.75	E
SC9210	Stream Restoration	VDOT and Private Residential[1]	2.65	E
SC9672	Flood Protection Project	Private Residential[1]	2.40	E
SC9781	Fecal Coliform Source Study	Watershed-wide Project	1.50	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.

**These projects will be coordinated directly with VDOT.

Chapter 6

Dead Run

6.1 Watershed Condition

The Dead Run Watershed has an area of approximately 1,922 acres as shown on Map 6.1. Of this 1,922 acres, there are 186 acres draining directly to the Potomac River via an unnamed tributary, which has been added to the Dead Run watershed area to facilitate planning. It is bounded to the west by Balls Hill Road and I-495; to the east by Old Chain Bridge Road and Ridge Drive; to the south by Chain Bridge Road; and to the north by the Potomac River.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Dead Run Watershed Condition Summary

- **Current imperviousness = 25 percent for the area draining to Dead Run and to the Potomac River Tributary, with a majority being medium density residential land use.**
- **Future imperviousness = 29 percent for the area draining to Dead Run and to the Potomac River Tributary.**
- **All 24 crossings have "minor to moderate" impacts.**
- **There are 48 BMPs in this watershed.**
- **The majority of the habitat quality is fair with inadequate buffers.**
- **The entire assessed stream length is actively widening and the impact of erosion was observed as "moderate to severe" at three locations.**
- **Two obstruction locations have "moderate to severe" impacts.**
- **One trash dumpsite was observed.**

6.1.1 Watershed Characteristics

The headwaters of the Dead Run main stem begin near Pathfinder Lane and the stream continues through the McLean Central Park, which is located near the intersection of Old

Dominion Drive and Dolley Madison Boulevard. The stream then passes through the Dead Run Stream Valley Park and continues until it discharges to the Potomac River. The headwaters for a major tributary of Dead Run are located near the Dominican Retreat and Evans Farm pond and flow into Dead Run at McLean Central Park. Dead Run flows from south to north throughout the watershed. The length of Dead Run from its headwaters to its outfall at the Potomac River is approximately three miles.

Several major unnamed tributaries contribute significant runoff and drainage area to Dead Run. One small 1,100-foot stream drains directly to the Potomac River and is included in the watershed for planning purposes. The terrain in the watershed is moderate with land elevations ranging from 260 to 270 feet in the southern part to elevations of 55 to 85 feet in the northern part. Dead Run has a low-gradient slope of 1.20 percent.

6.1.2 Existing and Future Land Use

Land use in the watershed is predominantly medium-density residential, with low-density residential and low-intensity commercial throughout the downstream portions of the watershed. The existing and future land use in the Dead Run Watershed are described in Table 6.1. Medium-density residential land use currently comprises 28 percent of the watershed area. There are currently 265 acres of open space, parks, and recreational areas in the Dead Run Watershed, which account for approximately 14 percent of the existing land use. The parks and recreational areas in the Dead Run Watershed include Langley Oaks Park, Churchill Road Park, Dead Run Stream Valley Park, and McLean Central Park. There are 53 acres that are currently vacant or undeveloped and 42 acres that are currently underutilized. Undeveloped and underutilized parcels comprise five percent of the watershed area and vacant parcels are primarily zoned as low-density and medium-density residential land use. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 0.62 acres of wetlands in this watershed.

Table 6.1 Dead Run Watershed Land Use

	Land Use			
	Existing		Future	
Land Use Description[1]	Area (Acres)	%	Area (Acres)	%
Dead Run				
Open space, parks, and recreational areas	125	7%	123	7%
Estate residential	85	5%	15	1%
Low-density residential	438	25%	428	25%
Medium-density residential	521	30%	661	38%
High-density residential	80	5%	91	5%
Low-intensity commercial	156	9%	125	7%
High-intensity commercial	21	1%	36	2%
Industrial	2	0%	1	0%
Other	0	0%	0	0%
Unknown	2	0%	2	0%

Land Use Description[1]	Land Use Existing Area (Acres)	Existing %	Future Area (Acres)	Future %
Vacant/Undeveloped	53	3%	0	0%
Road right-of-way (including shoulder areas)	254	15%	254	15%
TOTAL	1,737	100%	1,737	100%
Unnamed Tributary to the Potomac River				
Open space, parks, and recreational areas	140	75%	140	75%
Estate residential	12	6%	0	0%
Low-density residential	20	11%	32	17%
Medium-density residential	10	6%	10	6%
High-density residential	0	0%	0	0%
Low-intensity commercial	0	0%	0	0%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	0	0%	0	0%
Road right-of-way (including shoulder areas)	4	2%	4	2%
TOTAL	186	100%	186	100%
TOTAL for Dead Run Watershed	**1,922**	**100%**	**1,922**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

The current impervious area in this watershed is 25 percent of the total area. In the future, under ultimate build out conditions, it is anticipated that estate residential land use will be replaced by low-density and medium-density residential development and the future imperviousness is predicted to increase to 28 percent. In addition to the predicted changes in land use, mansionization will increase the amount of impervious area in the watershed by 18.3 acres, increasing total future imperviousness to 29 percent.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The *Fairfax County Comprehensive Plan* for land use in the Dead Run Watershed calls for the redevelopment of the McLean Community Business Center (CBC), which is a large community shopping, service, and residential area centered at the intersection of Chain Bridge Road and Old Dominion Drive. The *Comprehensive Plan* also includes future transportation improvements such as widening roadways, improving interchanges, and adding new trails throughout the Dead Run Watershed. The improvements are described in more detail below.

The planned roadway and interchange improvements for the Dead Run Watershed include:

- Improving Balls Hill Road between Lewinsville Road and Georgetown Pike.
- Widening and improving Elm Street and Beverly Road to four lanes.

The planned trails for the Dead Run Watershed include:

- The extension of the Potomac Heritage Trail along the George Washington Memorial Parkway along or close to the Potomac River.
- A major eight-foot-wide asphalt or concrete trail along Georgetown Pike, Old Dominion Drive, Chain Bridge Road, and Dolley Madison Boulevard.
- A bike lane along Old Dominion Drive and Balls Hill Road, connecting Georgetown Pike to Dolley Madison Boulevard.
- A minor four-foot- to eight-foot-wide asphalt or concrete trail along Balls Hill Road, Churchill Road, Pine Hill Road, Mackall Avenue, Kensington Road, Ingleside Avenue, and adding trails to McLean Central Park and Churchill Road Park.

6.1.3 Existing Stormwater Management

The headwaters of Dead Run originate from several storm drain pipe outfalls that drain the areas south of Old Dominion Drive. Storm drain systems that collect runoff from local street networks convey runoff from the majority of the watershed directly to Dead Run and its several small tributaries. The outfalls of these storm drain systems vary in size, ranging from ten inches to 48 inches in diameter. There are also several minor culverts and a 12-foot circular concrete culvert. Most segments of the outfall channels have been altered with concrete lining or with riprap bed and bank protection. The stream has minor to moderate erosion due to pipes with outfalls into the stream system. The locations of all pipe impacts are shown on Map 6.1.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Map 6.1 shows the location of the crossings and their erosional impacts on the streams. None of the 24 crossings evaluated in the SPA had a "severe to extreme" impact on the stream and one crossing had a "moderate to severe" impact as described below:

- Old Dominion Drive: Two four- by five-foot concrete box culverts located on an unnamed tributary to Dead Run cause a "moderate to severe" impact to the stream.

The county's list of master plan drainage projects shows that there are 11 identified projects in this watershed. Table 6.2 summarizes the type of master plan drainage project, project name/location, project cost and current project status.

Table 6.2 Dead Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/Location	Old Project Number	Cost	Status
Stream stabilization	Whann Avenue	DE201	$196,700	Incorporated into DE9204.
Stream stabilization	Hampshire Avenue	DE202	$526,471	Partially incorporated into DE9303.
Stream restoration and stabilization	Kyleakin Court	DE203	N/A	Incorporated into DE9244.
Stream stabilization	The Cloisters (near Holsing Lane)	DE211	$345,958	Incorporated into DE9244.
Replace culvert	Ingleside Avenue (near Churchill Road) Phase II	DE214	$270,952	Incorporated into DE9244.
Replace culvert, stream stabilization	Mackall Avenue	DE401	$272,595	Incorporated into DE9204.
Replace culvert	West McLean Subdivision at Georgetown Pike	DE402	$266,403	Incorporated into DE9204.
Add culvert	Georgetown Pike	DE411	$679,553	Keep as CIP project.
Replace culvert	Capital View Court	DE412	$138,785	Keep as CIP project.
Replace culvert	Earnestine Street	DE413	$96,064	Keep as CIP project.
250' storm sewer	Enterprise Avenue	N/A	$35,270	Neighborhood Stormwater Improvement Area DE9836 will determine if this work is necessary. Keep as CIP project.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According the MSMD data, 25 drainage complaints from 24 households regarding flooding and erosion were registered with the county. The locations of these complaints are shown on Map 6.1. Projects were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the county's MSMD BMP inspection database, there are 41 private and seven public stormwater management facilities located in the Dead Run Watershed. The majority of private facilities are located in the southern part of the watershed, while public facilities are located mostly in the northern part. The area served by stormwater management facilities in this watershed is 294 acres out of the total area of 1,922 acres, or 15 percent of the watershed. The types of facilities listed in the MSMD database are described in Table 6.3. The facilities in the table are shown on Map 6.1 along with some additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these additional sites.

Table 6.3 Dead Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities	
	Privately owned	Publicly owned
Bioretention	-	1
Dry pond	2	5
Manufactured BMP	-	-
Parking lot	-	-
Roof top detention	16	-
Sand filter	1	-
Infiltration Trench	8	-
Underground	13	1
Wet pond	1	-
Total	**41**	**7**

Note: The source of data for this table was the MSMD database.

6.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil group B. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups.

The geomorphology of the stream segments of Dead Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrate in the majority of stream segments is gravel; however, the stream beds of the downstream reaches of Dead Run consist mainly of bedrock.
- The majority of reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.

Map 6.2 shows the stream segment CEM type in the watershed. Fallen trees and debris obstructing the flow were observed at two locations along Dead Run. The impact of this debris on the stream was moderate to severe. Only one dumpsite was identified during the SPA and it has a severe to extreme impact on the stream. The dumpsite is located east of Kyleakin Court and consists of lawn waste such as leaves and grass.

6.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality does not perform water quality monitoring of Dead Run and there are no volunteer water quality monitoring sites in the Dead Run Watershed.

The Fairfax County Health Department monitored stream water quality at one sampling site in the Dead Run Watershed, located approximately 0.5 mile upstream of the George Washington Memorial Parkway. In 2002, water samples were collected from this site and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. The sample testing found that for fecal coliform, 67 percent of the samples had fecal coliform counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 1300/100 ml. The dissolved oxygen was an average of 8.8 mg/l, which was lower than the values for Scotts Run, Bull Neck Run, Turkey Run, and Pimmit Run. The average nitrate nitrogen was 1.5 mg/l and the average total phosphorus was 0.1 mg/l. The pH value was close to 7.0 for the samples. The heavy metals were found to be at acceptable levels and well below contaminant levels. Approximately 190 acres of Dead Run Watershed, or ten percent, are served by on-site sewage disposal systems. Most of these areas are in the northern part of the watershed in the Langley Forest, Park View Hills and River Oaks Neighborhoods. Properties with on-site sewage systems are shown on Map 6.2, but this information is based on the best available data only and may not be completely accurate.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Dead Run received a "very poor" composite site condition rating. The rating was based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. In the *SPS Baseline Study*, Dead Run was classified as a Watershed Restoration Level II area with the goals of maintaining areas to prevent further degradation and implementing measures to improve water quality and comply with Chesapeake Bay initiatives, TMDL regulations, and other water quality initiatives and standards.

The stream reaches of Dead Run have high gradient slopes and are classified as the riffle/run prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The habitat assessment for Dead Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- For less than 50 percent of the upstream reaches, at least four types of habitat such as cobble, large rocks, logs, and pool substrate were common
- In 50 percent of the downstream reaches and some portions of the upstream reaches, at least seven habitat types were common.
- Dominant substrate in the stream reaches is a mixture of gravel stones and bedrock.
- Sediment deposition is mainly gravel, sand and silt with 40 percent of the stream bottom affected in the downstream segments and 60 to 70 percent of the stream bottom affected in the upstream segments.
- Approximately 30 to 40 percent of the stream segments have minor alterations of the channel or banks. The downstream portions of Dead Run and the tributary that discharges directly to the Potomac River exhibit no channel disturbance.
- For most of Dead Run, the water fills approximately 70 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- A majority of the channel banks have approximately 70 percent vegetated cover with few barren or sparsely vegetated areas.
- Sixty-one percent of Dead Run exhibits fair habitat quality and 20 percent exhibits good

habitat quality as depicted on Map 6.2. Flows were observed in the stream channel for the majority of Dead Run and no head cuts were observed.

- The majority of the stream buffer is inadequate and consists of mainly lawn grass with a width of 50 to 100 feet. The locations of deficient buffer areas along the stream corridor for Dead Run are shown on Map 6.2. Thirty to fifty percent of the banks have erosional areas.

6.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the observations are included in the following table. Map 6.1 shows the locations of the problems identified.

Table 6.4 Problem Locations Identified During Public Forums

Map ID	Description
DE1	Location: Dead Run at Pathfinder Lane Problem: Participants noted frequent and significant flooding of residential property at this location. Observation: We could not determine which property had significant flooding. Rock gabion baskets and concrete walls line the majority of the channel near Pathfinder Lane. There is some buffer vegetation adjacent to the channel on the east side. An unused street right-of-way upstream of this channel and owned by the county is proposed new BMP Project DE9132, which will help alleviate flooding.
DE2	Location: Downtown McLean Problem: Inadequate pipe infrastructure, pre-1993 development, no BMPs in place. Observation: Demonstration LID projects should be installed with the redevelopment of property. Neighborhood Stormwater Improvement Area DE9828 is in this location.
DE3	Location: McLean Central Park at the McLean Community Center. Problem: Trail erosion from overuse. Trail is in the floodplain. Observation: The trail is in the floodplain and some areas of the trail had erosion but it was not significant. The Frisbee golf area had ponded water. This issue will be addressed by Stream Restoration Project DE9244.
DE4	Location: Dead Run at Churchill Road Elementary School Problem: Impervious surface and pollution from the parking lot. Observation: The parking lot area did not look excessive. Churchill Road Park is located between the Churchill Road Elementary School and the Cooper Middle School. There are large areas of grass with no other vegetation such as shrubs and trees. This issue will be addressed by New LID project DE9814. A new parking area and addition were recently added that may have increased the problems at this location. The issues will still be addressed by the new LID project.
DE5	Location: Dead Run at Cooper Middle School. Problem: Impervious surface and pollution from parking lot impacting stream. Observation: There is a large parking lot at the school. Churchill Road Park is located between the Churchill Road Elementary School and the Cooper Middle School. There are large areas of grass with no other vegetation such as shrubs and trees. This issue will be addressed by New LID Project DE9813. Also a new addition has been recently added at this location, but the solution remains the same.

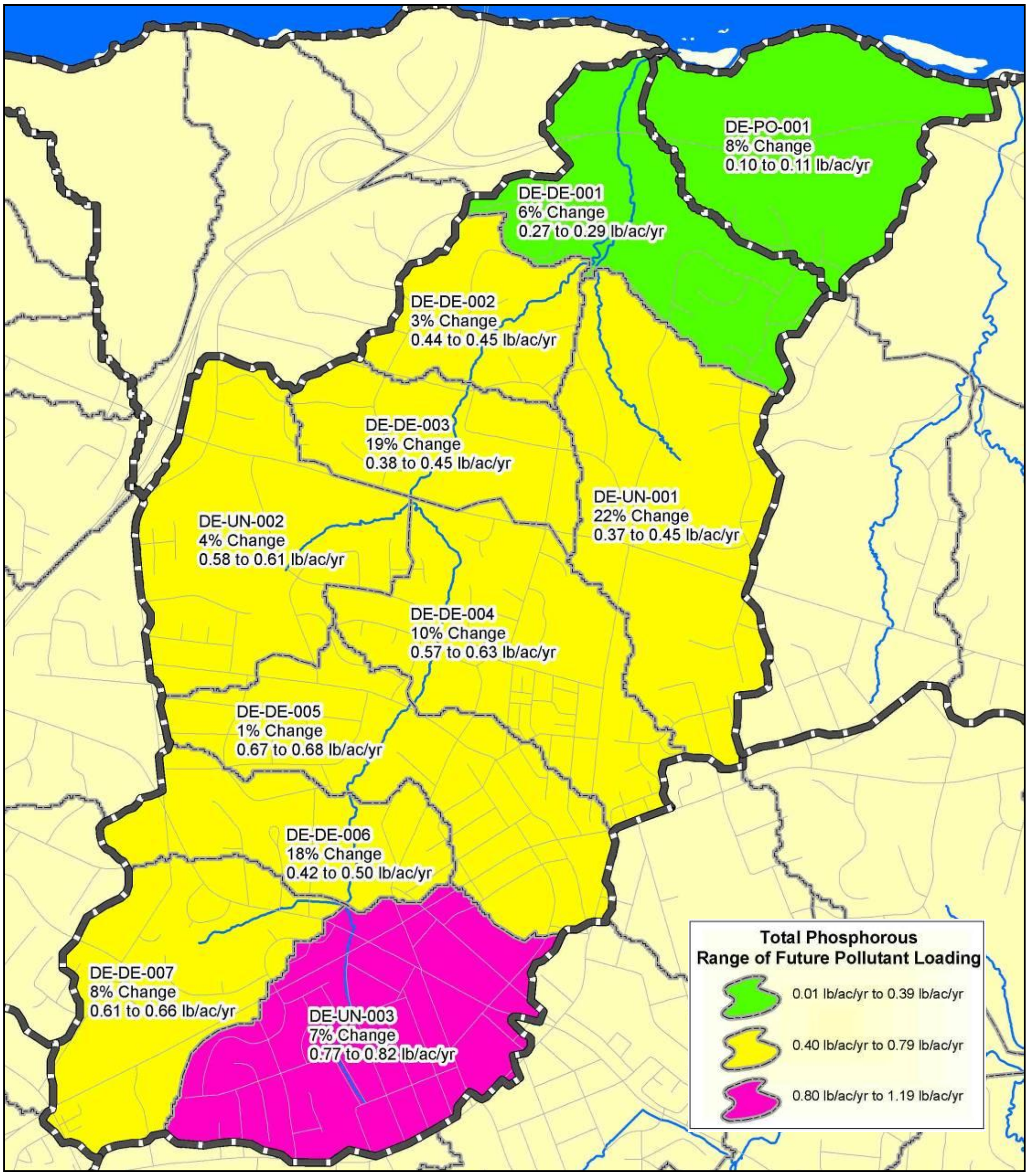
Map ID	Description
DE6	Location: Georgetown Pike near Dead Run Problem: Non-functioning storm drain. Observation: The ditches and pipes along Georgetown Pike that drain to Dead Run have some blockages with plant debris. This issue will be addressed by Project DE9408.
None – watershed wide	Location: Watershed wide Problem: Road expansions by the Virginia Department of Transportation are a source of excessive runoff in Dead Run. Observation: Roadway expansion with an increase of one acre or more of impervious surface is required to have a stormwater management facility.
None – watershed wide	Location: Evans Farm Development on Dolley Madison Boulevard at Evans Farm Drive Problem: Recent townhouse development at this site has created impacts downstream in Dead Run. Observation: Increases in runoff from the development are part of the larger problem within the watershed. These impacts should be helped by BMP Retrofit Project DE9130 at this location.
DE7	Location: Pond on the north side of Dolley Madison Boulevard adjacent to Evans Mill Road Problem: Brown color and excessive siltation in this pond could be the result of runoff from the Evans Farm Development. Observation: The pond is functioning as intended by trapping sediment. The sediment will need to be dredged in the future. This issue will be addressed by BMP Retrofit Project DE9130.
DE8	Location: Dead Run on Dominican Retreat property north of Dolley Madison Boulevard Problem: Erosion, sedimentation and channel instability are found throughout this stretch of Dead Run. One participant suggested that these problems are the result of runoff from Evans Farm, Dolley Madison Boulevard and other development in downtown McLean. Observation: The county's stream physical assessment determined that this portion of Dead Run is actively widening. This issue will be addressed by Stream Restoration Project DE9244.
None – watershed wide	Location: Watershed wide Problem: New development on Earnestine Street is a good example of old lots that have been redeveloped with much larger homes. Several homes on this street have been built right up to the lot lines, increasing the imperviousness on the sites significantly. Observation: The new larger houses are increasing the amount of imperviousness in the watershed. The average imperviousness for medium density single family homes is 24 percent.
DE9	Location: McLean Central Park Problem: Recent flooding in Dead Run seems to be coming from Earnestine Street rather than from the stream channel itself. Perhaps this is the result of recent build out on several residential properties. Observation: The cumulative effects of increased runoff from development were observed for all of Dead Run. Increases in runoff from the development along Earnestine Street are part of the larger problem within the watershed. This will be taken into account in Stream Restoration Project DE9244.
DE10	Location: Near the intersection of Churchill Road and Dead Run Drive, on the west side of the stream Problem: There is a lack of vegetated buffer between the houses and the stream. Observation: Stream Restoration Project DE9244 will help to restore the vegetated buffer next to the stream.

Map ID	Description
DE11	Location: 6952 Kyleakin Court, project DE9901 Problem: The homeowner is experiencing flooding and has a collection of court orders for their neighbor to cleanup or cease dumping in the RPA. Additional gabions plus bioengineering for higher volume runoff and greater attention to enforcement of violations were suggested. The participant noted fifteen years of personal records and court orders on violations, but has received no response from the county. Observation: Action C2.4 recommends better enforcement of anti-dumping regulations.
DE12	Location: Near project DE9204, at 847 Whann Avenue Problem: There is consistent and serious uncontrolled stormwater runoff and flow from culverts into the yard. The homeowners have spent money to try to mitigate this problem without success. Observation: Infrastructure Improvement Project DE9438 will address this problem.

6.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Dead Run Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Dead Run Watershed, which consists of the area draining to Dead Run and a smaller area draining directly to the Potomac River. Eleven subbasins were created for the model in order to provide more detail for the modeling results. The subbasins with the future total phosphorus loading are shown in Figure 6.1.

Figure 6.1 Dead Run Future Total Phosphorous Loading



6.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model, the current watershed imperviousness of 25 percent generates moderate peak runoff flows. Additional residential imperviousness caused by adding on to existing houses was added to the future land use impervious area in the hydrologic model. The predicted increase in peak flows for future development conditions may be attributed to the potential change from estate residential land use to medium-density residential land use. The projected future development of vacant parcels also contributes to the increase in flow volumes. Table 6.5 shows the cumulative peak runoff flows and the comparison between the peak flows for the existing and future land use conditions for the two- and ten-year rainfall events.

Table 6.5 Dead Run Cumulative Peak Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
DE-DE-001	361	392	9%	722	780	8%
DE-DE-002	358	389	9%	694	752	8%
DE-DE-003	348	378	9%	635	690	9%
DE-DE-004	347	375	8%	625	677	8%
DE-DE-005	322	345	7%	580	625	8%
DE-DE-006	273	291	7%	482	515	7%
DE-DE-007	96	97	1%	169	172	2%
DE-PO-001	24	27	13%	59	63	7%
DE-UN-001	81	91	12%	141	158	12%
DE-UN-002	110	114	4%	194	203	5%
DE-UN-003	254	266	5%	458	482	5%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the large amount of open space. The subbasins that drain to Dead Run have a predominant land use of medium density residential for both existing and future land use conditions. The predicted increase in pollutant loads can be attributed to the projected development of vacant parcels and the projected change in land use from estate residential land use to medium-density and low-density residential land use. However, not all of the pollutant loads increase in the future. For example, in Subbasin DE-DE-007, four parcels that are currently low-intensity commercial land use are predicted to change to medium-density residential land use, which causes a decrease in the copper and zinc pollutant loadings. Table 6.6 shows the comparison of the existing and future pollutant loading rates in pounds per acre per year for the Dead Run Watershed.

Table 6.6 Dead Run Pollutant Loads

Pollutants		Dead Run Subbasins										Potomac Tributary
		DE-DE-001	DE-DE-002	DE-DE-003	DE-DE-004	DE-DE-005	DE-DE-006	DE-DE-007	DE-UN-001	DE-UN-002	DE-UN-003	DE-PO-001
BOD5	Existing (lb/ac/yr)	8.5	10.7	10.5	25.8	30.4	16.7	29.3	10.2	23.8	37.1	3.4
	Future (lb/ac/yr)	9.2	11.2	14.1	30.2	31.5	21.0	32.6	12.5	25.5	42.7	3.7
	% Load Increase	8%	5%	34%	17%	4%	26%	11%	23%	7%	15%	9%
COD	Existing (lb/ac/yr)	50.3	60.0	59.5	166.3	178.7	96.8	196.2	57.8	137.8	204.4	21.2
	Future (lb/ac/yr)	54.1	62.5	79.7	192.8	183.6	120.9	215.3	70.1	147.4	239.5	23.1
	% Load Increase	8%	4%	34%	16%	3%	25%	10%	21%	7%	17%	9%

Pollutants		Dead Run Subbasins										Potomac Tributary
		DE-DE-001	DE-DE-002	DE-DE-003	DE-DE-004	DE-DE-005	DE-DE-006	DE-DE-007	DE-UN-001	DE-UN-002	DE-UN-003	DE-PO-001
TSS	Existing (lb/ac/yr)	29.3	32.3	32.6	90.1	102.5	61.2	100.1	32.5	101.9	133.3	12.3
	Future (lb/ac/yr)	31.4	33.6	43.4	105.1	104.6	74.7	98.2	38.9	107.7	141.1	13.4
	% Load Increase	7%	4%	33%	17%	2%	22%	-2%	20%	6%	6%	9%
TDS	Existing (lb/ac/yr)	46	44	45	122	134	82	137	45	119	162	23
	Future (lb/ac/yr)	49	45	58	140	138	99	141	51	126	178	26
	% Load Increase	7%	2%	29%	15%	3%	21%	3%	13%	6%	10%	13%
DP	Existing (lb/ac/yr)	0.19	0.31	0.27	0.41	0.48	0.30	0.44	0.26	0.41	0.54	0.07
	Future (lb/ac/yr)	0.20	0.32	0.32	0.45	0.48	0.35	0.48	0.32	0.43	0.59	0.07
	% Load Increase	5%	3%	19%	10%	0%	17%	9%	23%	5%	9%	0%
TP	Existing (lb/ac/yr)	0.27	0.44	0.38	0.57	0.67	0.42	0.61	0.37	0.58	0.77	0.10
	Future (lb/ac/yr)	0.29	0.45	0.45	0.63	0.68	0.50	0.66	0.45	0.61	0.82	0.11
	% Load Increase	7%	2%	18%	11%	1%	19%	8%	22%	5%	6%	10%
TKN	Existing (lb/ac/yr)	1.5	2.3	2.0	3.3	3.8	2.4	3.5	2.0	3.4	4.4	0.5
	Future (lb/ac/yr)	1.6	2.4	2.4	3.6	3.8	2.9	3.9	2.4	3.5	4.7	0.6
	% Load Increase	7%	4%	20%	9%	0%	21%	11%	20%	3%	7%	20%
TN	Existing (lb/ac/yr)	1.99	3.09	2.72	4.58	5.33	3.30	4.97	2.69	4.73	6.31	0.72
	Future (lb/ac/yr)	2.09	3.19	3.27	5.10	5.38	3.92	5.30	3.25	4.94	6.78	0.78
	% Load Increase	5%	3%	20%	11%	1%	19%	7%	21%	4%	7%	8%
Cadmium (x 10^{-4})	Existing (lb/ac/yr)	2.1	2.4	2.1	3.3	3.7	2.8	3.5	2.2	3.1	4.0	1.1
	Future (lb/ac/yr)	2.1	2.4	2.5	3.6	3.9	3.1	3.7	2.4	3.2	4.3	1.2
	% Load Increase	0%	0%	19%	9%	5%	11%	6%	9%	3%	8%	9%
Copper (x 10^{-3})	Existing (lb/ac/yr)	6.3	5.4	5.9	34.1	28.9	15.1	43.5	6.2	32.5	36.4	2.7
	Future (lb/ac/yr)	6.6	5.6	7.4	38.1	29.1	17.3	38.4	7.0	33.6	38.6	3.0
	% Load Increase	5%	4%	25%	12%	1%	15%	-12%	13%	3%	6%	11%
Lead (x 10^{-3})	Existing (lb/ac/yr)	2.2	1.9	1.9	4.7	5.6	3.5	5.2	1.9	4.3	7.0	1.2
	Future (lb/ac/yr)	2.3	1.9	2.4	5.4	6.0	4.1	5.5	2.1	4.6	7.9	1.4
	% Load Increase	5%	0%	26%	15%	7%	17%	6%	11%	7%	13%	17%
Zinc (x 10^{-2})	Existing (lb/ac/yr)	3.3	3.1	3.3	12.9	13.1	8.0	14.9	3.4	16.9	18.7	1.3
	Future (lb/ac/yr)	3.5	3.2	4.3	14.8	13.2	9.4	12.7	4.0	17.5	18.3	1.4
	% Load Increase	6%	3%	30%	15%	1%	18%	-15%	18%	4%	-2%	8%

6.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Dead Run from the confluence of the main stem with the southern and southwestern tributaries to the confluence of the main stem with the Potomac River. The existing conditions hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for most of the modeled length of Dead Run and that all three modeled crossings are overtopped by the 100-year rainfall event, but not the ten-year rainfall event. Also there is minor overtopping of the banks where there are adjacent and connected floodplains. The future land use conditions are nearly the same as the existing land use conditions, so the hydraulic modeling results for the future conditions are fairly consistent with the model results for the existing conditions. However, the ten and 100-year rainfall events overtop the two circular culverts at Benjamin Street and the one circular culvert at Georgetown Pike under the future land use conditions. The bridge at Churchill Road is still only overtopped by the 100-year rainfall event.

The majority of the 100-year event is not contained within the main channel banks indicating that the floodplains are utilized where they are connected to the stream channel. Floodplains play an important role in reducing flow velocities and it is important that streams remain connected with them wherever possible. Three crossings were included in the hydraulic model and the model results show flooding at the crossings during the 100-year storm event. The majority of the 100-year floodplains in the modeled portions of Dead Run are smaller when compared to the county's 100-year floodplains, which indicates that the stream is experiencing downcutting due to increased flows. The hydraulic modeling results are consistent with the SPA findings that Dead Run is actively widening to establish a geometry that can accommodate existing increased flows. However, four properties have buildings that are located in the county's 100-year floodplain as described in the Flood Protection Project DE9637, described in Action A2.3 later in the chapter.

The velocities produced by the model for the two-year rainfall event in the Dead Run Watershed average approximately 4.9 ft/sec. The velocities are somewhat lower through the stream's upper portions and increase as the stream flows north to its confluence with the Potomac River. According to the county's SPA from 2002, no significant erosion was found along the stream banks in the bends or meanders of the entire modeled reach, which corresponds to the low velocities shown in the hydraulic model results. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

6.2 Management Plan Strategy

This section outlines proposed projects for the Dead Run Watershed and the locations of the projects in this section are shown on Map 6.3. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Dead Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit options in the following project descriptions have been taken from the list above.

Public BMP Retrofits

- Publicly owned dry detention SWM basin between Jill Court and Heather Brook Court with access at 6617 Jill Court. Possible retrofit options for this facility include 1, 2, 6, and 7. This pond was designed to minimize the post development peak flows and does not have water quality controls. Increasing the storage volume and modifying the riser structure will allow for extended detention storage. Adding a shallow wetland will also improve water quality treatment. (BMP Retrofit Project DE9102)
- Publicly owned dry detention SWM basin at the Langley Oaks Subdivision located at 908 Ridge Drive. Possible retrofit options include 2 and 6. This project was previously identified as needing dam repairs and is currently in the design phase. (BMP Retrofit Project DE9106)
- Publicly owned dry detention SWM basin located at 6526 Heather Brook Court. Possible retrofit options for this facility include 2, 6, and 7. Modifying the outlet structure to provide extended detention storage and adding a shallow wetland will improve the water quality treatment. (BMP Retrofit Project DE9115)
- Publicly owned dry detention SWM facility at the McLean Community Center located at 1235 Oak Ridge Avenue. Possible retrofit options include 2 and 6. Modifying the outlet structure to provide extended detention storage and adding a shallow wetland will improve water quality treatment. (BMP Retrofit Project DE9120)
- Publicly owned dry detention SWM facility located at 6859 Chelsea Road. Possible retrofit options include 2 and 6. Modifying the outlet structure to provide extended detention storage and adding a shallow wetland will improve water quality treatment. (BMP Retrofit Project DE9122)

Private BMP Retrofits

- Wet SWM pond in the Langley Forest subdivision located at 926 Douglass Drive. Possible retrofit options include 2 and 7. Modifying the outlet structure will provide storage of the channel erosion control volume for this facility which will help prevent downstream erosion. (BMP Retrofit Project DE9107)
- Dry detention SWM facility at Saint Lukes Catholic Church located at 7001 Georgetown Pike. Possible retrofit options include 2, 6, and 7. The property also consists of Saint Lukes Catholic School where some LID facilities can be installed. Three bioretention facilities could be installed to capture runoff from parking lots and the school buildings. Also, two bioswales could be installed to replace a portion of the paved channel to provide

water quality treatment. (BMP Retrofit/New LID Project DE9109)

- Privately owned bioretention basins at Saint Johns Episcopal Church located at 6801 Georgetown Pike. Possible retrofit options include 5 and 7. The parking lot runoff is bypassing the bioretention basins and it would be redirected to the bioretention area for water quality treatment. More vegetation would be added to the bioretention area in order to improve the filtering capabilities of the BMP and to improve the aesthetics. (BMP Retrofit Project DE9111)
- A privately owned wet BMP pond located north of 1461 Evans Farm Drive and a privately owned wet SWM pond located east of 7220 Evans Mill Road are connected in series. These ponds should be evaluated together to determine the best retrofit options. Possible retrofit options include 2, 4, 6, and 7. Erosion has taken place downstream of these ponds and the outfall structures may need to be modified to prevent excessive peak flows. The upstream pond is in very good condition. An aquatic bench, underwater baffle, and sediment forebays could be added to the downstream pond at 7220 Evans Mill Road. (BMP Retrofit Project DE9130)
- Privately owned dry detention SWM facility located at the Lewinsville Retirement Residence at 1515 Great Falls Street. Retrofit the northern most pond on the site. Possible retrofit options include 2 and 6. (BMP Retrofit Project DE9135)

The size of the proposed drainage areas and the benefits from the proposed BMP retrofits are included in Table 6.7.

Table 6.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Additional Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
DE9102	DE-PO-001, DE-DE-001	6617 Jill Court	24.2	12.1	1.0
DE9106	DE-UN-001	908 Ridge Drive	30.2	15.1	2.9
DE9107	DE-DE-003	926 Douglass Drive	4.9	0	0.1
DE9109	DE-UN-002	7001 Georgetown Pike	6.5	6.1	0.3
DE9111	DE-UN-001, DE-DE-004	6801 Georgetown Pike	2.0	1.9	0
DE9115	DE-PO-001, DE-DE-001	6526 Heather Brook Court	4.1	2.0	0.6
DE9120	DE-DE-006	1235 Oak Ridge Avenue	14.7	9.6	0.5
DE9122	DE-DE-005	6859 Chelsea Road	8.4	3.9	0.7
DE9130	DE-DE-007	7220 Evans Mill Road & 1461 Evans Farm Drive	46.2	7.8	4.2
DE9135	DE-DE-007	1515 Great Falls Street	7.8	5.2	0.7

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.

The new BMP projects have been grouped into public or privately owned land and conventional BMPs or LID methods. The proposed new BMP locations are described below and are shown on Map 6.3.

New Public BMPs

- A new one year extended dry detention BMP could be constructed at Churchill Road Park located at 7098 Thrasher Place. The new BMP could be located on the eastern side of the property where the headwaters of an unnamed tributary to Dead Run begin. Implementing a BMP here will help to detain the runoff from the adjacent neighborhoods and schools before it reaches the stream. This facility may consist of a constructed berm to form the detention area in order to minimize tree loss and tree removal will be limited to the embankment area. The estimated buildable area at this location is approximately 29,000 square feet. (New BMP Project DE9112)
- Two new one year extended dry detention BMPs could be constructed in the road right of way near the southwest corner of Enterprise Avenue and Pathfinder Lane located south of 1417 Pathfinder Lane. These BMPs will be located at the headwaters of Dead Run and would treat the runoff from surrounding neighborhoods. (New BMP Project DE9132)

New Private BMPs

- A new one year extended dry detention BMP could be constructed on a privately owned vacant lot located at 1005 Pine Hill Road. In order to minimize tree loss, tree removal would be limited to the embankment area. A storm drain pipe located at Malta Lane discharges to this vacant property. The estimated buildable area at this location is approximately 104,000 square feet. (New BMP Project DE9116)
- Two new one year extended dry detention BMPs could be constructed on the Dominican Retreat property located at 7103 Old Dominion Drive. One of the facilities could be located at the southwest corner of the property and receive runoff from the pipe system located at 7112 Merrimac Drive. The second BMP could be constructed to treat the runoff coming from the pipe outfall located at 7130 Merrimac Drive. These proposed BMPs will detain and treat the runoff from Dolly Madison Boulevard and Merrimac Drive before it reaches the stream. (New BMP Project DE9129)

Public LID Projects

County facilities such as libraries, parks and schools were targeted for LID projects because the properties are owned by the county. Projects on school properties will be especially beneficial as they usually have large impervious areas, most have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues.

- New LIDs could be installed at Cooper Middle School located at 977 Balls Hill Road. This school has large amounts of impervious surface and is located adjacent to an unnamed tributary to Dead Run. Six bioretention areas could be constructed around the parking lot and in the landscaped areas in order to reduce the peak runoff and pollutants from the parking lot and buildings. A curb drop inlet in the parking lot could be replaced with a tree box filter to reduce pollutants from the runoff. (New LID Project DE9813)
- New LIDs could be constructed at Churchill Road Elementary School located at 7100 Churchill Road. This school is located adjacent to Dead Run and currently does not have any stormwater BMP controls. Ten bioretention areas could be constructed around the parking lot and one tree box filter could be installed adjacent to the parking lot. (New LID Project DE9814)
- New LIDs could be constructed at McLean Central Park and the McLean Community Center located at 1235 Oak Ridge Avenue. Four tree box filters could be installed in the parking lot to control runoff and pollutants. The grass area located north of the tennis courts could be used to construct one bioretention area to help slow and filter the runoff

from the impervious surfaces. This location is ideal for LID measures because it is adjacent to Dead Run for approximately 2,000 feet. These LID options will directly help benefit the stream by removing the pollutants from the runoff and reducing the peak flow. (New LID Project DE9819)

- New LIDs will be constructed at the Dolly Madison Library located at 1244 Oak Ridge Avenue as part of a capital improvement project. A bioswale and a tree box filter could be installed adjacent to the parking lot to provide water quality treatment and reduce peak flows. Three bioretention areas could also be constructed in the landscaped areas near the building. This location is ideal for LID options because it is located adjacent to Dead Run. These LID methods will directly help to reduce the peak flow which will improve the integrity of the stream. (New LID Project DE9823)

Private LID Projects

LID projects are recommended for the privately owned commercial properties listed below. These LID sites were chosen because they have large impervious areas and do not have existing stormwater management controls.

- Construct LID measures in downtown McLean areas not controlled by existing BMP facilities. These LID measures would add stormwater treatment to already developed properties. Possible locations include the properties located at 6844, 6852, and 6854 Old Dominion Drive; 6841, 6845, and 6850 Elm Street; and 1378 Beverly Road. Tree box filters could replace the existing curb drop inlets and underground manufactured BMPs could be installed in the parking lots as part of parking lot resurfacing projects. Bioretention areas could be incorporated into the landscaping in parking lots and adjacent to buildings. Vegetated roofs could be established on existing buildings. (New LID Project DE9828)
- Construct LID measures in the portions of the McLean Business Center planned for redevelopment in the *Fairfax County Comprehensive Plan*. These areas include the southeastern corner of the block defined by Old Dominion Drive, Beverly Road, and Ingleside Avenue; the area bounded by Old Dominion Drive, Chain Bridge Road, Ingleside Avenue, and Beverly Road; the triangular block bounded by Old Dominion Drive, Elm Street and Beverly Road; the block bounded by Chain Bridge Road, Emerson, Lowell and Laughlin Avenues; the vacant lot at 6860 Old Dominion Drive; and 1330, 1340, 1350, 1354, and 1356 Old Chain Bridge Road. The majority of these areas do not have any existing stormwater management controls. The redevelopment of these properties presents an excellent opportunity to incorporate LID methods as part of the process. LID options for these areas may include the installation of underground manufactured BMPs, tree box filters, bioretention areas, and vegetated roofs. (New LID Project DE9831)
- The LID measures to be constructed in conjunction with a BMP retrofit for Project DE9109 are described with the BMP Retrofit Projects.

The pollutant removal benefits for the proposed BMP and LID projects that will be implemented first are shown in Table 6.8.

Table 6.8 Benefits of New BMPs and LID Projects

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
DE9112	DE-UN-002	7098 Thrasher Place	21.8	10.9
DE9116	DE-UN-001	1005 Pine Hill Road	37.9	19.0
DE9129	DE-DE-007	7103 Old Dominion Drive	10.8	5.4
DE9132	DE-UN-003	1417 Pathfinder Lane	20.8	10.4
DE9813	DE-UN-003	977 Balls Hill Road	3.7	3.5
DE9814	DE-UN-002, DE-DE-005	7100 Churchill Road	2.1	2.0
DE9819	DE-DE-006	1235 Oak Ridge Avenue	2.0	1.8
DE9823	DE-DE-006	1244 Oak Ridge Avenue	1.1	1.0
DE9828	DE-UN-003	Various locations in downtown Mclean	N/A	N/A
DE9831	DE-UN-003	Various locations in downtown McLean	N/A	N/A

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.

The neighborhoods selected for LID implementation do not have existing stormwater management controls and the runoff from these neighborhoods contributes to downstream erosion problems and pollution. Targeting these neighborhoods for LID methods will help to mitigate the effects of the impervious surfaces and to improve the effectiveness of stream restoration projects downstream. The Neighborhood Stormwater Improvement Areas are described below and are shown on Map 6.3.

- New LID methods could be constructed in the Kings Manor and McLean Crest neighborhoods. The Kings Manor townhouse development has concrete sidewalks, curb and gutter, storm drain inlets, and cul-de-sacs. The McLean Crest neighborhood has curb and gutter, grassed ditches in front yards, and storm drain inlets. The sidewalks could be replaced with porous pavement and the area between the sidewalk and the curb could be made into an infiltration strip. Four storm drain inlets could be replaced with tree box filters and bioswales could be constructed to replace paved ditches. A total of fifteen bioretention areas could be constructed throughout the neighborhood in the cul-de-sacs and other open spaces to capture the runoff from the street and the surrounding houses. The two neighborhoods are different in character and may need to be addressed separately during the implementation phase. (Neighborhood Stormwater Improvement Area DE9821)
- New LID methods could be constructed in the Ingleside, Old Dominion Gardens, and Langley Manor subdivisions. These neighborhoods are located adjacent to the main stem of Dead Run and the storm drain system discharges into the stream without any stormwater management controls. The Old Dominion Gardens and Ingleside neighborhoods have curb and gutter, storm drain inlets, grassed ditches in front yards, and cul-de-sacs. The Langley Manor neighborhood has concrete sidewalks, curb and gutter, storm drain inlets, and cul-de-sacs. The grassed ditches could be retrofitted into infiltration trenches or bioswales. A total of fourteen bioretention areas could be constructed in the cul-de-sacs and available open spaces in the neighborhood to capture the runoff from the streets and surrounding houses. Six tree box filters could replace the

existing curb drop inlets. These LID options will help improve the integrity of the stream by reducing pollutants and peak runoff. (Neighborhood Stormwater Improvement Area DE9824)

- New LID methods could be constructed in the Broyhill-McLean Estates neighborhood. The headwaters of Dead Run begin in this area and the stream travels approximately 1,200 feet through the neighborhood. There are many flooding issues in the neighborhood, so a storm drain study should be conducted, along with implementation of the LID methods, to evaluate the current system and construct recommended drainage system improvements. Currently this neighborhood has curb and gutter, storm drain inlets, concrete sidewalks, grassed ditches in front yards, and cul-de-sacs. The grassed ditches could be retrofitted as infiltration trenches or bioswales. A total of eighteen bioretention areas could be constructed in the cul-de-sacs and available open spaces in the neighborhood to capture the runoff from the streets and surrounding houses. Four tree box filters could replace the existing curb drop inlets. (Neighborhood Stormwater Improvement Area DE9836)

The pollutant removal benefits for the proposed Neighborhood Stormwater Improvement Areas are shown in Table 6.9.

Table 6.9 Benefits of Neighborhood Stormwater Improvement Areas

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
DE9821	DE-DE-004 DE-DE-005 DE-DE-006	Kings Manor and McLean Crest	11.9	11.1
DE9824	DE-DE-004 DE-DE-005 DE-DE-006 DE-DE-007 DE-UN-002	Ingleside, Old Dominion Gardens, and Langley Manor	15.3	14.2
DE9836	DE-UN-003	Broyhill-McLean Estates	8.2	7.6

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.

There are no floodplain restoration projects in this watershed.

Action A1.5: Remove detrimental channel obstructions.

Channel obstructions that block stream flow, like the ones listed below, should be removed. Dumpsites should also be cleaned up on a regular basis, if needed. Dumpsites and obstructions in the watershed will vary over time. It may be necessary to clean up future dumpsites and/or obstructions that are not listed below or shown on any of the watershed maps.

- Remove obstructions from two locations in Dead Run. The obstruction located at the north end of Dead Run Stream Valley Park consists of concrete pipe and tree debris and the obstruction located to the east of Wemberly Way consists of tree debris. A resident noted that some of the debris may be a result of beaver activity. (Dumpsite/Obstruction Removal DE9901)
- A dump site consisting of yard waste was found at the east end of Kyleakin Court during the SPA. (Dumpsite/Obstruction Removal DE9901)

Action A1.6: Stabilize eroding streambanks using bioengineering methods.
The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.
Improve the existing stormwater infrastructure at the following locations:

- Improve the storm drain system near the Georgetown Pike culvert crossing of Dead Run located at 6904 Georgetown Pike. The ditches and storm drain pipes near the crossing should be cleared of debris and repaired. This project is in the county's list of master drainage projects as a capital project to replace the culvert, however, the culvert appeared to be in good condition and does not need replacement. (Infrastructure Improvement Project DE9408)

- Clean and/or repair the ditch adjacent to the house at 847 Whann Avenue. The culverts adjacent to this property discharge water into the ditch causing yard flooding because the ditch has not been maintained properly. (Infrastructure Improvement Project DE9438)
- Improve the capacity of the storm drain system near the Dead Run Drive culvert crossing of an unnamed tributary to Dead Run located at 1012 Dead Run Drive. House flooding is occurring at this location and it may be caused by undersized storm pipes under Dead Run Drive. (Infrastructure Improvement Project DE9445)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.
There are no infrastructure projects of this type in this watershed.

Action A2.3: Protect structures located in the 100-year flood limit from flooding.
Table 6.10 lists the number of properties in the watershed that are located in the 100-year flood plain or are recommended for flood protection. (Flood Protection Project DE9637)

Table 6.10 Recommended Flood Protection Locations

Street	# Properties
Benjamin Street	1
Georgetown Pike	1
Wemberly Way	1
Whann Avenue	1

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to *reduce controllable sources.*

Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Dead Run Watershed using E. coli as the indicator bacteria and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced (Fecal Coliform Source Study DE9746).

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.

The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.

The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.

Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities. The SPA found that the condition of existing riparian buffers is poor for 19 percent of the stream bank length assessed in the watershed. The deficient buffer locations described below were found during the 2002 SPA or were identified as potential locations for buffer restoration during the watershed planning process. These reaches will be further evaluated to determine the locations where buffer restoration is required. The locations of these projects are shown on Map 6.3. Steps to protect existing vegetated buffers are included in Public Education Project DE9939 described later in this chapter.

- Evaluate buffer vegetation adjacent to the stream along 1,900 feet of the downstream portions of Dead Run starting at Benjamin Street and ending near Hampshire Road and restore where necessary. A portion of this project is in the county's list of master plan drainage projects. (Buffer Restoration DE9303)
- Evaluate buffer vegetation adjacent to the stream along 1,200 feet of an unnamed tributary to Dead Run in Churchill Road Park and restore where necessary.(Buffer Restoration DE9310)

Action B3.2: Provide landowner education about the importance of stream buffers and how to

manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
There are no land conservation projects in this watershed.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.
A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project DE9943)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.
Utilize bioengineering to restore and stabilize stream banks, restore natural stream geometries, and remove concrete from stream banks and beds. Dead Run is actively widening along the majority of its length and the Stream Protection Strategy (SPS) composite site condition rating was "very poor." Restoring the stream and its tributaries will improve the condition of the aquatic habitat and should be carefully coordinated with the previously described objectives of reducing the quantity and improving the quality of runoff in order to prevent further erosion and channel widening. The locations of proposed stream restoration activities are described below and shown on Map 6.3. It should be noted that the stream reaches identified in the following project descriptions and on the maps designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

- Evaluate approximately 15,200 feet of Dead Run and its tributaries and restore where necessary, including buffer restoration. Proposed activities will include adding in-stream structures, riparian vegetation planting and channel bed and bank reconfiguration. The culvert located at Ingleside Avenue near Churchill Road will be evaluated as part of the project and may need to be replaced. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration DE9244)

- Evaluate approximately 8,400 feet of an unnamed tributary to Dead Run and restore where necessary, including buffer restoration. The stream was assessed as having a "poor" habitat from the SPA and is beginning to widen, evolving from a narrower deeper stream to a wider shallower stream. The banks are becoming steeper and the channel is becoming filled with eroded bank materials. The stream is seeking to reconnect itself with the floodplain in some locations by creating a new flood prone area within the old channel. Proposed activities will include riparian vegetation planting, some channel reconfiguration, and some bioengineering of the stream banks. The new channel will be equal in dimension, pattern and profile of the channel upstream. The culverts at Mackall Avenue and at Georgetown Pike near Mackall Avenue will be evaluated as part of this project and may need to be replaced. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration DE9204)
- Evaluate approximately 1,200 feet of Dead Run starting at Pathfinder Lane and ending at Dolley Madison Boulevard and restore where necessary. Proposed activities will include adding in-stream structures, riparian vegetation planting and channel bed and bank reconfiguration. (Stream Restoration DE9226)
- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not included in the SPA will be evaluated in this project. (Stream Assessment Project DE9947)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.
Public Education Project DE9939 will include the following actions:

- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.
- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.
- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.
- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.
- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.
- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.
- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in

any mailings.

- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.
Community Outreach Project DE9940 will include the following actions:

- Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects.
- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.
- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project DE9942 will include the following actions:

- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact Development (LID) practices.
LID Promotion Project DE9941 will include the following actions:

- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries.

6.3 Benefits of Plan Actions

Ten BMP retrofit projects, six LID projects, three Neighborhood Stormwater Improvement Areas, and four new BMP projects have been proposed for the Dead Run Watershed to help improve the quality of the stream. The channel erosion control volume to be provided by the

BMP retrofit projects will serve approximately 88 percent of the required channel erosion control volume for the 146 acres controlled by the BMP retrofit locations. The channel erosion control volume to be provided by the new BMP projects will serve approximately 88 percent of the required channel erosion control volume for the 92 acres of drainage area. For the 21 BMP retrofit projects, LID projects, Neighborhood Stormwater Improvement Areas, and New BMP projects that had benefit calculations performed, the total phosphorus removal is estimated to be 152 lbs/year upon successful implementation of these projects.

Approximately 3,100 linear feet of stream buffers will be restored by implementing two buffer restoration projects and 24,800 linear feet of stream will be restored by implementing three stream restoration projects. These projects will increase the amount of habitat, reduce erosion and provide nutrient reduction for Dead Run. The storm drain study project will help to evaluate the storm drain system deficiencies and construct recommended drainage system improvements for the Broyhill-McLean Estates neighborhood.

6.4 Implementation of Plan Actions

The recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The initial implementation schedule was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. More detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Dead Run is $6,080,000. The priority projects are summarized in Table 6.11 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 6.11 Summary of Dead Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
DE9120	BMP Retrofit Project	Fairfax County Board of Supervisors (FCBS)	$70,000	4.20	A
DE9836	Neighborhood Stormwater Improvement Area	Private Residential and Virginia Department of Transportation (VDOT) [1]	$1,950,000	4.10	**
DE9112	New BMP Project	Fairfax County Park Authority (FCPA)	$300,000	4.05	A
DE9129	New BMP Project	Private Organization[1]	$130,000	4.00	A
DE9130	BMP Retrofit Project	Evans Mill Pond HOA and Evans Farm HOA[1]	$370,000	4.00	A
DE9106	BMP Retrofit Project	Langley Oaks HOA [1]	$40,000	3.90	A
DE9122	BMP Retrofit Project	Private Residential[1]	$60,000	3.90	A
DE9303	Buffer Restoration	Private Residential[1]	$100,000	3.50	A
DE9226	Stream Restoration	VDOT and Private Residential[1]	$770,000	3.25	A
DE9310	Buffer Restoration	FCPA and Private Residential[1]	$60,000	2.40	A
DE9111	BMP Retrofit Project	Private Organization[1]	$20,000	3.80	B
DE9116	New BMP Project	Private Residential[1]	$410,000	3.80	B
DE9102	BMP Retrofit Project	Langley Oaks HOA[1]	$80,000	3.75	B
DE9823	New LID Project	FCPA and FCBS	$60,000	3.75	B
DE9821	Neighborhood Stormwater Improvement Area	Private Residential and VDOT[1]	$580,000	3.70	**
DE9824	Neighborhood Stormwater Improvement Area	Private Residential and VDOT[1]	$740,000	3.70	**
DE9813	New LID Project	FCPS	$190,000	3.65	B
DE9814	New LID Project	FCPS	$120,000	3.65	B
DE9819	New LID Project	FCPA and FCBS	$100,000	3.55	B
DE9109	BMP Retrofit Project/New LID	Private Organization[1]	$180,000	3.55	C

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
DE9107	BMP Retrofit Project	Private Residential[1]	$30,000	3.50	C
DE9115	BMP Retrofit Project	FCBS	$50,000	3.45	C
DE9132	New BMP Project	VDOT[1]	$170,000	3.40	**
DE9135	BMP Retrofit Project	Residential Development[1]	$40,000	3.40	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

**These projects will be coordinated directly with VDOT.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 6.12 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 6.12 Summary of Dead Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
DE9939	Public Education Project	Watershed-wide Project	N/A	A*
DE9940	Community Outreach Project	Watershed-wide Project	N/A	A*
DE9941	LID Promotion Project	Watershed-wide Project	N/A	A*
DE9942	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
DE9947	Stream Assessment Project	Watershed-wide Project	N/A	A*
DE9901	Dumpsite/Obstruction Removal	National Park Service, Private Residential, and VDOT[1]	1.95	A
DE9445	Infrastructure Improvement	VDOT and Private Residential[1]	3.00	**
DE9943	Wetland Assessment Project	Watershed-wide Project	2.95	C
DE9244	Stream Restoration	VDOT, Private Residential, Private Organizations, FCPA, Evans Mill Pond HOA, and the Cloisters Association[1]	3.40	D
DE9828	New LID Project	Commercial Development[1]	3.35	D
DE9831	New LID Project	Commercial Development[1]	3.35	D
DE9204	Stream Restoration	VDOT, Private Residential, Langley Oaks HOA, FCBS, and National Park Service[1]	3.20	D
DE9408	Infrastructure Improvement	VDOT and Private Residential[1]	2.95	**
DE9438	Infrastructure Improvement	Private Residential [1]	2.95	E

Project Number	Type	Land Owner	Score	Year Group
DE9746	Fecal Coliform Source Study	Watershed-wide Project	2.35	E
DE9637	Flood Protection Project	Private Residential[1]	1.70	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.

**These projects will be coordinated directly with VDOT.

Chapter 7
Turkey Run Watershed

7.1 Watershed Condition

The Turkey Run Watershed has an area of approximately 1,248 acres as shown on Map 7.1. Approximately half of that area, or 704 acres, drains to Turkey Run before discharging into the Potomac; the remaining 544 acres drain directly to the Potomac River through unnamed tributaries, which have been included to the total watershed area to facilitate planning. The entire watershed is bounded to the west by Ridge Drive and Langley Oaks Park; to the east by Savile Lane; to the south by Georgetown Pike; and to the north by the Potomac River.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Turkey Run Watershed Condition Summary

- **Current imperviousness = 15 percent with the majority of land use as low-intensity commercial.**
- **Future imperviousness = 16 percent**
- **The majority of the developed areas are served by on-site sewage disposal.**
- **All of the seven crossings have "minor to moderate" impacts.**
- **Only one publicly owned dry pond is located in this watershed.**
- **The majority of the habitat quality is excellent, but there are several locations with inadequate buffers.**
- **The stream is actively widening and the impact of erosion was observed as "moderate to severe" at four locations.**
- **Two obstruction locations have "moderate to severe" impacts.**
- **No trash dumps were observed.**

7.1.1 Watershed Characteristics

The headwaters of Turkey Run begin at a natural springs located south of Georgetown Pike.

Turkey Run flows under Georgetown Pike, and then flows in a northerly direction until its confluence with the Potomac River. The length of Turkey Run from its headwaters to its mouth at the Potomac River is approximately 1.7 miles.

There is one unnamed tributary, known locally as Deep Creek, that contributes significant runoff and drainage area to Turkey Run. It has a length of approximately 4,100 feet. We have also included several small perennial streams that drain directly to the Potomac River, with the longest being 4,300 feet, to facilitate planning. The terrain in the watershed is moderate with land elevations ranging from 210 to 230 feet in the southern part to elevations of 55 to 75 feet in the northern part. Turkey Run has a low-gradient slope of 0.7 percent.

7.1.2 Existing and Future Land Use

Land use in the watershed is predominantly low-intensity commercial. Low-intensity commercial currently comprises 40 percent of the total watershed area, with 81 percent of that land draining directly to the Potomac River. The offices of the Central Intelligence Agency (CIA) and the Federal Highway Administration to the east occupy land within the low-intensity commercial category. Low-density residential and forested land uses are located throughout the upstream portions of the watershed. There are currently 461 acres of open space, parks, and recreational areas in the Turkey Run Watershed, which account for approximately 37 percent of the existing land use. The parks and recreational areas in the Turkey Run Watershed include Langley Oaks Park, Langley Fork Park, Clemyjontri Park, Turkey Run Recreation Area, and Claude Moore Colonial Farm. There are 27 acres that are currently vacant or undeveloped and 35 acres that are currently underutilized. Combined, undeveloped and underutilized parcels make up five percent of the watershed area. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 0.42 acres of wetlands in this watershed. Table 7.1 summarizes existing and future land use in the Turkey Run Watershed.

Table 7.1 Turkey Run Watershed Land Use

	Land Use			
	Existing		Future	
Land Use Description[1]	Area (Acres)	%	Area (Acres)	%
Turkey Run				
Open space, parks, and recreational areas	387	55%	386	55%
Estate residential	32	5%	0	0%
Low-density residential	152	21%	206	29%
Medium-density residential	26	4%	26	4%
High-density residential	0	0%	0	0%
Low-intensity commercial	48	7%	52	7%
High-intensity commercial	1	0%	1	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	25	3%	0	0%
Road right-of-way (including shoulder areas)	33	5%	33	5%
TOTAL	704	100%	704	100%

Land Use Description[1]	Land Use			
	Existing		Future	
	Area (Acres)	%	Area (Acres)	%
Unnamed Tributaries to the Potomac River				
Open space, parks, and recreational areas	74	14%	74	14%
Estate residential	2	0%	0	0%
Low-density residential	19	4%	23	4%
Medium-density residential	0	0%	0	0%
High-density residential	0	0%	0	0%
Low-intensity commercial	443	81%	443	81%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	2	0%	0	0%
Road right-of-way (including shoulder areas)	4	1%	4	1%
TOTAL	544	100%	544	100%
Total Turkey Run Watershed	**1,248**	**100%**	**1,248**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

The current impervious area in this watershed is 15 percent of the total area. In the future, under ultimate build out conditions, estate residential may be replaced by low-density residential development and the future imperviousness may increase to 16 percent. Undeveloped and underutilized parcels have a proposed future land use of low density residential. In addition to the predicted changes in land use, mansionization will increase the impervious area in the watershed by 1.8 acres.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The Fairfax County Comprehensive Plan for land use in the Turkey Run Watershed calls for compatible residential infill development with a density not exceeding one dwelling unit per acre in the watershed. The Comprehensive Plan also includes future transportation improvements such as adding new trails in the Turkey Run Watershed. The improvements are described in more detail below.

The planned trails for Turkey Run Watershed include:

- The extension of the Mount Vernon Trail along the George Washington Memorial Parkway.
- A stream valley trail with a six-foot- to eight-foot-wide natural surface or stone dust trail along the Potomac River.
- A major eight-foot-wide asphalt or concrete trail along Georgetown Pike, Chain Bridge

Road, and Dolley Madison Boulevard.

- A bike lane at Dolley Madison Boulevard.
- A minor four-foot- to eight-foot-wide asphalt or concrete trail through Claude Moore Colonial Farm from Georgetown Pike to the George Washington Memorial Parkway.

7.1.3 Existing Stormwater Management

Minor storm drain systems collect runoff from the southern portions of the Turkey Run Watershed to form its headwaters at Georgetown Pike. Similarly, other areas of the watershed are drained by small storm drain networks that convey runoff from a few local street networks. The storm drain system outfall pipes range from 15 inches to 42 inches in diameter. Most segments of the outfall channels have been altered with concrete lining or with riprap bed and bank protection. The area surrounding one pipe outfall located at an unnamed tributary to Turkey Run has minor to moderate erosion due to the discharge from the pipe. The composition and extent of the storm drain infrastructure at the CIA facility, which makes up the majority of the drainage area in the watershed, are unknown.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Map 7.1 shows the location of the crossings and their erosional impacts on the streams. None of the seven crossings evaluated in the SPA had a "moderate to severe" or "severe to extreme" erosional impact on the stream.

The county's lists of master plan drainage projects shows that there are four identified projects in this watershed. Table 7.2 summarizes the type of master plan drainage project, project name/location, cost and comments on current project status.

The proposed regional pond project TU101 from the county's list of master plan drainage projects has been evaluated and alternative projects are recommended to take the place of this project. The purpose of the proposed regional pond is to reduce the peak flow of runoff to the stream and to treat the pollutants in the runoff from the upstream development. The proposed location of TU101 is on the east side of Langley High School at the location where two unnamed tributaries to Turkey Run join. The estimated drainage area for TU101 is 127 acres consisting primarily of low density residential land use. Downstream of the proposed location of TU101, Turkey Run has a SCI of 4.0 out of a range from 1.0 to 5.0 with 5.0 being the best condition. From the SPA data, there are two moderate erosion points, one severe erosion point, and approximately 4,750 linear feet of moderate to severe erosion primarily at the stream bends. Constructing TU101 in the stream at this location would destroy the stream habitat without providing substantial water quantity or quality control benefits. We do not anticipate a significant increase in imperviousness in the future due to changes in land use, and the estimated increase in peak flow for the ten-year storm event from existing to future land use conditions is one percent. The alternative projects proposed for the watershed are three LID projects, one BMP retrofit project, three stream restoration projects and one buffer restoration project. The LID and BMP retrofit projects will help to reduce the peak flows and reduce the amount of pollutants in the stream from existing development. The buffer and stream restoration projects will help to remove pollutants from the runoff and the stream restoration projects will reduce the stream flow velocity which will help to reduce the amount of erosion.

Table 7.2 Turkey Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/ Location	Old Project Number	Cost	Status
Regional pond	Turkey Run Mainstem	TU101	$134,460	Recommend replacement by Projects TR9104, TR9201, TR9203, TR9206, TR9308, TR9807, TR9810, and TR9812.
Replace culvert and construct berm	Turkey Run Road	TU401	$170,207	Incorporated into TR9405.
Add culvert and lower invert	Georgetown Pike near Turkey Run Road	TU402	$88,270	Keep as CIP project.
Add culvert	Georgetown Pike	TU403	$41,698	Keep as CIP project.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According the MSMD data, two complaints regarding flooding or erosion were registered with the county. The locations of these complaints are shown on Map 7.1. Projects were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the county's MSMD BMP inspection database, there is one publicly owned dry detention stormwater management facility and no privately owned facilities. This information is shown in Table 7.3. The public facility is located downstream of the Langley Oaks Subdivision on the west side of Turkey Run. The area served by this facility is 61 acres out of the total watershed area of 1,248 acres, or five percent of the watershed. This facility is shown on Map 7.1, along with three additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these three sites.

Table 7.3 Turkey Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities	
	Privately owned	Publicly owned
Bioretention	-	-
Dry pond	1	-
Manufactured BMP	-	-
Parking lot	-	-
Roof top detention	-	-
Sand filter	-	-
Infiltration Trench	-	-
Underground	-	-
Wet pond	-	-
Total	**1**	**-**

Note: The source of data for this table was the MSMD database.

7.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil groups

B and D. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups. Hydrologic soil group D soils have a high potential for runoff, a very low infiltration rate, and consist chiefly of clayey soils or very wet soils.

The geomorphology of the stream segments of Turkey Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrates in all the stream segments are gravel, sand, cobble, boulder and bedrock.
- All the reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening, and accelerated bend migration.

Map 7.2 shows the stream segment CEM type in the watershed. Fallen trees obstructing the flow were observed at two locations along Turkey Run. The impact of this debris on the stream is minor. No dumpsites were identified during the SPA.

7.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality does perform monitoring of Turkey Run and there are no volunteer water quality monitoring sites located in the Turkey Run Watershed.

The Fairfax County Health Department monitored stream water quality at one sampling site in the Turkey Run Watershed, located at the George Washington Memorial Parkway. In 2002, water samples were collected from this site and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. The average dissolved oxygen concentration for the sampling site on Turkey Run was 10.4 mg/l, which is well above the minimum standard of 4.0 mg/l. The nitrate nitrogen was measured at an average of 1.0 mg/l and the total phosphorus was measured to be 0.1 mg/l. The pH was an average of 7.6. The heavy metals were measured to be well below maximum contaminant levels. Forty-seven percent of the fecal coliform samples had counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 1600/100 ml. For fecal coliform, a count less than 200/100 ml is considered good water quality and a count of 250,000/100 ml can be considered a direct sewage discharge. Approximately 810 acres of Turkey Run Watershed, or 65 percent, are served by on-site sewage disposal systems. Because the type of treatment systems at the Central Intelligence Agency (CIA) and the Federal Highway Administration (FHWA) facilities were unknown, they were conservatively assumed to be serviced by on-site sewage disposal systems. The next largest areas with on-site systems were three parks – the Turkey Run Recreational Area, the Claude Moore Colonial Farm and Langley Fork Park. The remainder of the on-site systems are scattered throughout the watershed including the Langley Hill and Jarvis Neighborhoods. Properties with on-site sewage systems are shown on Map 7.2, but this information is based on the best available data and may not be completely accurate.

The stream reaches of Turkey Run have high-gradient slopes and are classified as riffle/run prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Turkey Run received an "excellent" rating. The rating was based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. Turkey Run was classified as a Watershed Protection Area due to high biological integrity and habitat quality.

The habitat assessment for Turkey Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- In most of the stream reaches, less than four habitat types such as cobble, large rocks, logs, and pool substrate were present.
- No enlargements of islands or point bars are present. Less than 20 percent of the stream bottom is affected by sand or silt accumulation in the downstream segments and 40 to 50 percent of the stream bottom is affected in the upstream segments.
- Approximately five percent of reaches have channel disturbance. There was no evidence of recent alteration activities of the channel or banks.
- For most of the Turkey Run, the water fills approximately 90 percent of the available channel cross section during normal flow periods.
- A majority of the channel banks are highly unstable with approximately 70 percent of the banks covered by thin vegetated cover and scattered grasses, non-grass plants, and shrubs. Fifteen to 30 percent of the banks have erosional areas.
- Sixty percent of Turkey Run exhibits excellent habitat quality and 30 percent exhibits fair habitat quality as depicted on Map 7.2. Flows were observed in the stream channel for the majority of the creek and no head cuts were observed.
- The majority of the stream buffer is inadequate and consists mainly of lawn grass with a width of 50 to 100 feet. The SPA found that the condition of existing riparian buffers is poor for 60 percent of the stream bank length assessed in the watershed. Some reaches at the upstream end of Turkey Run exhibit a buffer width of 25 to 50 feet with minimal disturbance. The locations of deficient buffer areas along the stream corridor are shown on Map 7.2.

7.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the observations are included in the following table. Map 7.1 shows the locations of the problems identified.

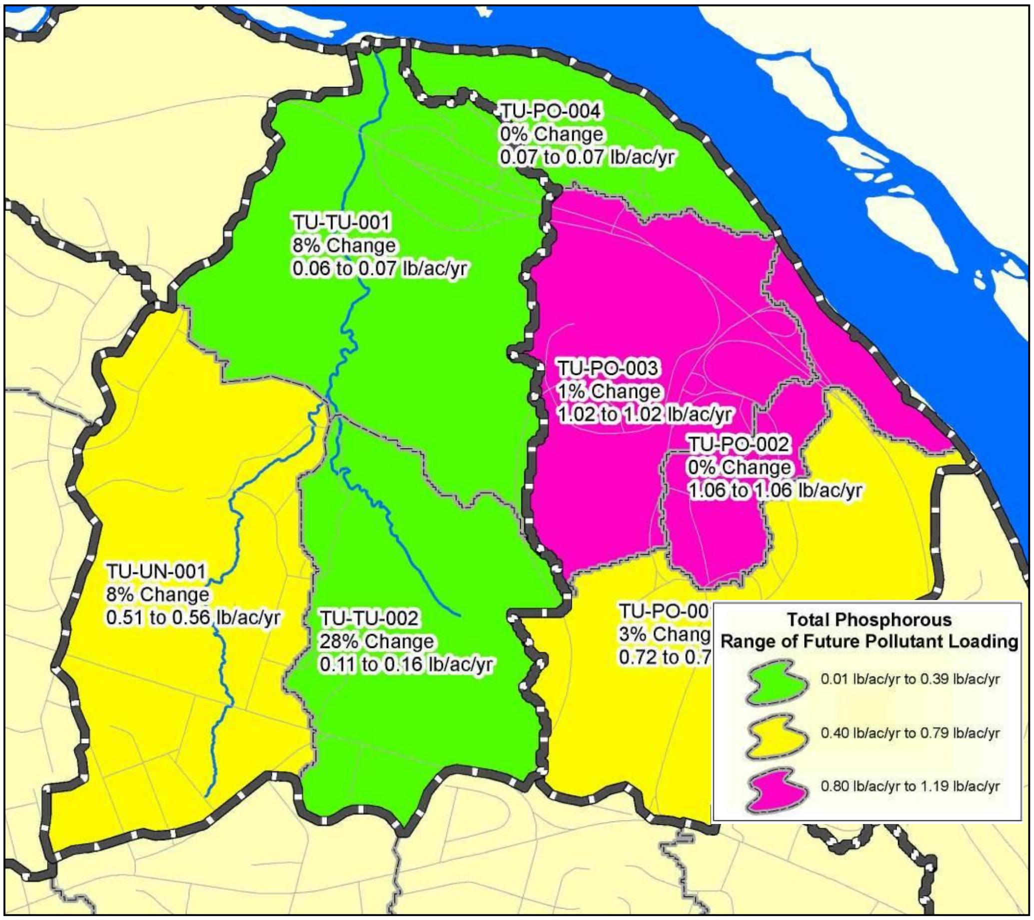
Table 7.4 Problem Locations Identified During Public Forums

Map ID	Description
TR1	Location: Langley High School Problem: The parking lot runoff impacts Turkey Run. There are absolutely no stormwater controls located at this school. The runoff from the school goes into a maintenance yard and then directly into Turkey Run. Trash is also accumulating in this area. Oil slicks are visible in the runoff from the parking lot. Artificial turf is permeable but may not be as permeable as needed so measures of permeability need to be assessed. Artificial turf can contain ground-up old tires and athletic shoes and silica sand, which may run off into the streams. The main thing that leaches out is zinc and this reduces over time but when this goes down, more is added to the top so it continues to leach out. Lead, cadmium, and solvents can also be found in artificial turf. Observation: The parking lot is very large and the runoff goes directly to Turkey Run without any stormwater treatment. A lot of trash has accumulated in the gutter and along the fence line near Turkey Run. There is artificial turf that is environmentally friendly and does not pollute the runoff. An artificial turf subsurface drainage system is usually designed to be more effective at draining surface water than the existing grass and soil substrate. This will be addressed by New LID Project TR9807 at this location.
TR2	Location: Bottom end of the 800 block on Turkey Run Road (locally called "Deep Creek"). Problem: Culvert needs to be replaced with a larger one. Under the road is a typical concrete culvert. It winds around and cuts under again to join the stream. Where it cuts under again, it is too small and gets blocked, which causes flooding, which in turn has caused road deterioration. Observation: The single culvert located downstream was almost completely blocked by silt at its upstream end. The double culverts located upstream were partially blocked by silt. The downstream culvert had less capacity than the two upstream culverts. This will be addressed by Infrastructure Improvement Project TR9405.

7.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Turkey Run Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Turkey Run Watershed, which consists of the area draining to Turkey Run and a smaller area draining directly to the Potomac River. Seven subbasins were created for the model in order to provide more detail for the modeling results. The subbasins with the future total phosphorus loading are shown in Figure 7.1.

Figure 7.1 Turkey Run Future Total Phosphorous Loading



7.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model the current watershed imperviousness is 15 percent, which generates moderate peak runoff flows. The predicted increase in peak flows for future development conditions may be attributed to the potential change from estate residential land use to low density residential land use and the projected future development of vacant parcels. Table 7.5 shows the cumulative peak runoff flows and the comparison between the existing and future land use conditions for the two- and ten-year rainfall events.

Table 7.5 Turkey Run Cumulative Peak Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
TU-PO-001	234	237	1%	622	627	1%
TU-PO-002	200	200	0%	366	367	0%
TU-PO-003	358	361	1%	694	699	1%
TU-PO-004	110	110	0%	239	239	0%
TU-TU-001	402	416	3%	1,100	1,120	2%

Subbasin	Two-Year Rainfall Event Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Ten-Year Rainfall Event Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
TU-TU-002	306	320	5%	814	832	2%
TU-UN-001	192	200	4%	480	486	1%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the large amount of open space. Most of the land in the subbasins that drain directly to the Potomac River (TU-PO-001, TU-PO-002, TU-PO-003 and TU-TU-004) is federally owned. The CIA and FHWA properties are designated as a low intensity commercial land use, whereas the Turkey Run Recreation Park, the Claude Moore Colonial Farm, and Langley Fork Park are designated as open space. The subbasins that drain to Turkey Run have a predominant land use of low density residential for both existing and future conditions. Table 7.6 shows the comparison of the existing and future pollutant loading rates in pounds per acre per year for the Turkey Run Watershed. The pollutant loads increase the most in Subbasin TU-TU-002 because of the many changes from existing to future land use. All of the vacant land in Subbasin TU-TU-002, as well as a portion of the open space and a portion of the estate residential land will be low-intensity residential in the future, which generates more pollutants than the existing land use types.

Table 7.6 Turkey Run Pollutant Loads

Pollutants		Turkey Run Subbasins TU-TU-001	TU-TU-002	TU-UN-001	Potomac Tributaries TU-PO-001	TU-PO-002	TU-PO-003	TU-PO-004
BOD5	Existing (lb/ac/yr)	2.7	3.9	16.5	30.9	47.8	45.7	3.6
	Future (lb/ac/yr)	2.9	5.2	18.1	31.8	47.8	45.9	3.6
	% Load Increase	7%	33%	10%	3%	0%	0%	0%
COD	Existing (lb/ac/yr)	19.9	25.4	96.4	185.2	286.6	274.1	28.0
	Future (lb/ac/yr)	21.2	32.5	105.3	190.2	286.8	275.6	27.8
	% Load Increase	7%	28%	9%	3%	0%	1%	-1%
TSS	Existing (lb/ac/yr)	12.5	15.2	70.4	186.9	295.4	282.6	18.0
	Future (lb/ac/yr)	13.3	19.1	76.0	192.0	295.7	284.2	18.0
	% Load Increase	6%	26%	8%	3%	0%	1%	0%
TDS	Existing (lb/ac/yr)	30	31	86	188	294	281	47
	Future (lb/ac/yr)	32	36	92	192	294	282	47
	% Load Increase	7%	16%	7%	2%	0%	0%	0%
DP	Existing (lb/ac/yr)	0.04	0.08	0.36	0.50	0.74	0.71	0.05
	Future (lb/ac/yr)	0.05	0.12	0.39	0.52	0.74	0.71	0.04
	% Load Increase	25%	50%	8%	4%	0%	0%	-20%
TP	Existing (lb/ac/yr)	0.06	0.11	0.51	0.72	1.06	1.02	0.07
	Future (lb/ac/yr)	0.07	0.16	0.56	0.74	1.06	1.02	0.07

Pollutants		Turkey Run Subbasins			Potomac Tributaries			
		TU-TU-001	TU-TU-002	TU-UN-001	TU-PO-001	TU-PO-002	TU-PO-003	TU-PO-004
	% Load Increase	17%	45%	10%	3%	0%	0%	0%
TKN	Existing (lb/ac/yr)	0.33	0.63	2.83	4.25	6.37	6.09	0.36
	Future (lb/ac/yr)	0.35	0.85	3.06	4.37	6.37	6.13	0.36
	% Load Increase	6%	35%	8%	3%	0%	1%	0%
TN	Existing (lb/ac/yr)	0.44	0.85	3.95	6.44	9.73	9.31	0.50
	Future (lb/ac/yr)	0.48	1.15	4.27	6.61	9.74	9.36	0.49
	% Load Increase	9%	35%	8%	3%	0%	1%	-2%
Cadmium ($x 10^{-4}$)	Existing (lb/ac/yr)	1.46	1.54	2.99	3.08	4.42	4.23	2.26
	Future (lb/ac/yr)	1.54	1.73	3.08	3.13	4.43	4.25	2.24
	% Load Increase	5%	12%	3%	2%	0%	0%	-1%
Copper ($x 10^{-3}$)	Existing (lb/ac/yr)	3.5	4.2	22.5	81.6	130.9	125.2	5.4
	Future (lb/ac/yr)	3.7	4.8	24.2	83.8	131.0	125.9	5.4
	% Load Increase	6%	14%	8%	3%	0%	1%	0%
Lead ($x 10^{-3}$)	Existing (lb/ac/yr)	1.8	1.8	3.3	5.6	8.7	8.3	2.9
	Future (lb/ac/yr)	1.9	2.0	3.5	5.8	8.7	8.3	2.9
	% Load Increase	6%	11%	6%	4%	0%	0%	0%
Zinc ($x 10^{-2}$)	Existing (lb/ac/yr)	1.5	1.9	11.5	40.7	65.3	62.4	2.3
	Future (lb/ac/yr)	1.6	2.3	12.4	41.9	65.3	62.8	2.2
	% Load Increase	7%	21%	8%	3%	0%	1%	-4%

7.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Turkey Run from the confluence of the mainstem with the southeastern tributary to the confluence of the mainstem with the Potomac River. The hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for the entire modeled length of Turkey Run. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor bank overtopping where there are adjacent and connected floodplains. Since the future land use conditions are nearly the same as the existing land use conditions, the future conditions hydraulic modeling results are consistent with the existing conditions results. The model results show no flooding locations for the modeled portion of Turkey Run. There has been roadway flooding at the downstream-most crossing of Turkey Run Road by the unnamed tributary to Turkey Run. This tributary is not included in the hydraulic model.

The majority of the 100-year event is contained within the main channel banks; however, the floodplains are utilized where they are connected to the stream channel. No buildings in the Turkey Run Watershed lie within the 100-year floodplain.

The velocities produced by the model for the two-year rainfall event in the Turkey Run Watershed average approximately 6.5 ft/sec. The velocities are somewhat lower through the upstream portions and increase as the stream flows north to its confluence with the Potomac River. The model indicates higher and much more erosive velocities at the George Washington Memorial Parkway bridge crossing, which is likely caused by the channelization and constriction of Turkey Run in this area.

According to the county's SPA from 2001, over 1,000 linear feet of erosion along the stream banks was observed in the bends and meanders in the portion of the stream immediately upstream and downstream of the confluence of the mainstem and the southeast tributary to Turkey Run. This characterization is further supported by the results of the stream's hydraulic model that show increased velocities and flow downstream of this confluence. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

7.2 Management Plan Strategy

This section outlines proposed projects for the Turkey Run Watershed. The locations of the projects in this section are shown on Map 7.3. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Turkey Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit options in the following project descriptions have been taken from the list above.

Public BMP Retrofits

- Retrofit the dry detention SWM facility located downstream of the Langley Oaks subdivision east of Ridge Drive near 6500 Sunny Hill Court. This pond is located in the Langley Oaks Park and is owned by the Fairfax County Park Authority. The facility was designed to minimize peak flows and detain runoff from the surrounding neighborhoods and does not have water quality controls. Possible retrofits include 1, 2, 6, and 7. Installing a riser structure with water quality controls and adding a shallow wetland will help provide greater removal of pollutants. The SPA indicated that the stream located downstream of the dry pond has a poor habitat rating. The channel downstream of the dry pond has erosion and should be restored. The buffer area around the facility should be restored with native vegetation to provide additional habitat for wildlife and filtering of stormwater runoff. This project was previously identified as needing dam repairs and is currently in the design phase. (BMP Retrofit Project TR9104)

The size of the proposed drainage areas and benefits from these projects are provided in Table 7.7.

Table 7.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
TR9104	TU-TU-001	6500 Sunny Hill Court	53.6	17.4	1.4

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.

Public LID Projects

Schools were targeted for LID projects because the properties are owned by the county, usually have large impervious areas, most have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues. Parks were also targeted for LID projects because the land is owned by the county, greatly facilitating implementation. Showcasing county facilities as examples of environmentally friendly design could inspire residents to implement similar measures on their own properties.

- Install LID methods at Langley High School located at 6502 Georgetown Pike, which was Problem Location TR1 in Table 7.3. Six bioretention areas with underground trench drains could be constructed in grass areas adjacent to the parking lots. Ten tree box filters could replace some of the curb drop inlets. Sections of the curbs will need to be removed to allow water to flow from parking lot to the detention areas. (New LID Project TR9807)
- Install LID methods at Clemyjontri Park located at 6317 Georgetown Pike. Clemyjontri Park will have improvements constructed in the future that include a stormwater management pond. Adding a bioretention area will help further reduce the amount of runoff and provide greater treatment of pollutants. (New LID Project TR9812)

Private LID Projects

LID projects are recommended for the privately owned place of worship listed below. This site was chosen because it has a large impervious area and does not have existing stormwater management controls.

- Install LID methods at the Korean Orthodox Presbyterian Church at 6519 Georgetown Pike. Bioretention areas could be installed in the landscaped areas near the building and parking lot. (New LID Project TR9810)

The proposed drainage areas and estimated pollutant removal for the LID projects is provided in Table 7.8.

Table 7.8 Benefits of New LID Projects

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
TR9807	TU-UN-001	6502 Georgetown Pike	19.5	18.1
TR9810	TU-UN-001	6519 Georgetown Pike	1.5	1.0
TR9812	TU-TU-002	6317 Georgetown Pike	4.2	1.0

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.
There are no neighborhood LID projects in this watershed.

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.
There are no floodplain restoration projects in this watershed.

Action A1.5: Remove detrimental channel obstructions.
Channel obstructions that block stream flow, like the ones listed below, should be removed. Obstructions in the watershed will vary over time. It may be necessary to clean up future obstructions that are not listed below or shown on any of the watershed maps.

- Remove one obstruction located on the main stem of Turkey Run and remove one obstruction located on the southeast tributary to Turkey Run. (Dumpsite/Obstruction Removal TR9902)

Action A1.6: Stabilize eroding streambanks using bioengineering methods.
The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.
Improve the existing stormwater infrastructure at the following locations:

- Improve the two culvert crossings in the 800 block of Turkey Run Road. The downstream-most culvert crossing experiences frequent flooding as noted in Problem Location TR2. The flooding appears to be occurring because the culvert is undersized and is often blocked with debris. This project will also include reconstruction of a berm at the upstream crossing of Turkey Run Road. Reconstruction of the berm is in the county's list of master plan drainage projects as TU401. (Infrastructure Improvement TR9405)
- Improve the culvert crossing at the intersection of Turkey Run Road and Bright Mountain Road. This corrugated metal culvert needs to be replaced and resized. A resident noted that one half of the culvert has already been replaced. (Infrastructure Improvement TR9416)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.
There are no infrastructure projects of this type in this watershed.

Action A2.3: Protect structures located in the 100-year flood limit from flooding.
There are no flood protection projects in this watershed.

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.
Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Turkey Run Watershed using E. coli as the indicator bacteria and prepare an action plan that will describe how the controllable sources, especially human sources, will be reduced (Fecal Coliform Source Study TR9721).

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.
The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.
The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.
Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities. The SPA found that the condition of existing riparian buffers is poor for 60 percent of the stream bank length assessed in the watershed. The deficient buffer location described below was found during the 2002 SPA and is a potential location for a buffer restoration project. The location is shown on Map 7.3. It should be noted that the stream reach identified in the following project description and on the map designate a reach that will be further evaluated. Restoration work will be done in required areas, not necessarily along the

continuous length designated. Steps to protect existing vegetated buffers are included in Public Education Project TR9914 described later in this chapter.

- Evaluate the buffer vegetation adjacent to the stream along 800 feet of the main stem of Turkey Run and determine where buffer restoration is necessary. (Buffer Restoration TR9308).

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
The county should protect Turkey Run from the effects of future development by preserving stream buffers.

- The county should cooperate with the National Park Service to make sure that land under control of the National Park Service is protected from development. Currently the land is leased to the Friends of the Claude Moore Colonial Farm at Turkey Run, Inc. by the National Park Service and is the only privately operated park in the National Park system. The habitat of an unnamed tributary of Turkey Run near the Claude Moore Colonial Farm is in good condition and keeping the Claude Moore Colonial Farm land undeveloped will help ensure future protection of the stream habitat. (Land Conservation Coordination Project TR9913)

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.
A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project TR9915)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.
Turkey Run is actively widening along the majority of its length, but the stream protection strategy composite site condition rating was "excellent". In order to retain this rating, projects should be carefully coordinated with the previously described objectives of reducing the

quantity and improving the quality of runoff in order to prevent further erosion and channel widening. The locations of the proposed stream restoration activities are described below and shown on Map 7.3. It should be noted that the stream reaches identified in the following project descriptions and on the maps designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

- Evaluate the stream banks for a length of approximately 650 linear feet in the vicinity of the George Washington Memorial Parkway Bridge over Turkey Run and determine where stream restoration is necessary. There is severe erosion of the stream bank near one of the bridge pier footings and future erosion may undermine the footing. The county will need to coordinate with the National Park Service on this restoration project. (Stream Restoration Project TR9201)
- Evaluate the stream at the unnamed tributary located on the west side of Turkey Run downstream of the Langley Oaks subdivision and determine where stream restoration is necessary. The stream was assessed as having a poor habitat from the SPA and the restoration will include restoring the habitat for approximately 300 linear feet of stream. (Stream Restoration Project TR9203)
- Evaluate the stream at the southeast branch of Turkey Run for a distance of approximately 4,600 linear feet and determine where stream restoration is necessary. From the SPA, portions of the stream had deficient buffer, erosion locations, and poor habitat. The upstream portion of the stream restoration area is located on federally owned land and the downstream portion is located near Turkey Run Road. The county will need to coordinate with the National Park Service on this restoration project. (Stream Restoration Project TR9206)
- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not evaluated in the SPA will be assessed in this project. (Stream Assessment Project TR9922)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.

Public Education Project TR9914 will include the following actions:

- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.
- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.
- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.

- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.
- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.
- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.
- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.
- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.

Community Outreach Project TR9918 will include the following actions:

- Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects.
- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.
- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project TR9920 will include the following actions:

- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact Development (LID) practices.

LID Promotion Project TR9919 will include the following actions:

- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores,

home improvement stores, and nurseries.

7.3 Benefits of Plan Actions

One BMP retrofit project and three LID projects are proposed for the Turkey Run Watershed to help improve the water quality of the stream. The channel erosion control volume provided by the BMP retrofit projects will serve 87 percent of the required channel erosion control volume for the 54 acres controlled by the BMPs. The total additional phosphorus removal for all of the proposed projects is estimated to be 38 lbs/year upon the successful implementation of these projects.

Approximately 5,550 linear feet of Turkey Run will be restored as part of the proposed stream restoration projects. These projects will help to minimize the velocity of the stream as well as reduce the erosion of the stream banks. Approximately 800 linear feet of stream buffers will be restored by implementing the buffer restoration project. This project will increase the amount of habitat and provide nutrient reduction along Turkey Run. The stream obstruction removal project will help to reduce the flooding of the stream and erosion of the stream banks.

7.4 Implementation of Plan Actions

The recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The initial implementation schedule was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five-year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. Detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Turkey Run is $3,710,000. The priority projects are summarized in Table 7.9 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 7.9 Summary of Turkey Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
TR9807	New LID Project	Fairfax County Public Schools (FCPS)	$940,000	4.20	A
TR9104	BMP Retrofit Project	Fairfax County Park Authority (FCPA)	$190,000	4.10	A
TR9201	Stream Restoration	National Park Service[1]	$500,000	4.00	A
TR9812	New LID Project	FCPA	$60,000	3.95	B
TR9308	Buffer Restoration	FCPS and Private Residential[1]	$40,000	3.90	B
TR9810	New LID Project	Private Organization[1]	$60,000	3.60	C
TR9203	Stream Restoration	FCPA	$260,000	3.45	C
TR9206	Stream Restoration	National Park Service and Private Residential[1]	$2,380,000	3.45	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 7.10 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 7.10 Summary of Turkey Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
TR9914	Public Education Project	Watershed-wide Project	N/A	A*
TR9918	Community Outreach Project	Watershed-wide Project	N/A	A*

Project Number	Type	Land Owner	Score	Year Group
TR9919	LID Promotion Project	Watershed-wide Project	N/A	A*
TR9920	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
TR9922	Stream Assessment Project	Watershed-wide Project	N/A	A*
TR9902	Dumpsite/Obstruction Removal	National Park Service[1]	1.95	A
TR9915	Wetland Assessment Project	Watershed-wide Project	2.95	C
TR9405	Infrastructure Improvement	VDOT and Private Residential[1]	3.55	**
TR9416	Infrastructure Improvement	VDOT and Private Residential[1]	3.50	**
TR9913	Land Conservation Coordination Project	National Park Service[1]	2.60	D
TR9721	Fecal Coliform Source Study	Watershed-wide Project	2.40	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.

**These projects will be coordinated directly with VDOT.

Chapter 8

Pimmit Run Watershed

8.1 Watershed Condition

The Pimmit Run Watershed has an area of approximately 8,083 acres that includes 1,356 acres of Arlington County and 335 acres of land that drain directly to the Potomac River, which were added to the watershed to facilitate planning. It is bounded to the west by Interstate 495; to the north by Chain Bridge Road and Dolley Madison Boulevard; to the northeast by the Potomac River; to the east by Glebe Road in Arlington County; and to the south by Lee Highway and Interstate 66. This watershed drains significant commercial and residential areas located south of Tysons Corner, the largest commercial shopping area in the county. The watershed is divided into five smaller subwatersheds consisting of Upper Pimmit Run, Middle Pimmit Run, Lower Pimmit Run, Little Pimmit Run, and the Potomac River tributaries. These watersheds are shown on Maps 8.1, 8.2, and 8.3.

The major tributaries in the Upper Pimmit Run Subwatershed are Burke's Spring Branch, Darrell Branch and Bridge Branch. The Middle Pimmit Run Subwatershed includes the major tributaries of Bryan Branch and Saucy Branch. The major tributary located in the Lower Pimmit Run Subwatershed is Stromans Branch.

The county initiated a Stream Physical Assessment (SPA), described in detail in Section 2.5.10, for all of its watersheds in August 2002 to systematically characterize the existing conditions of stream corridors. This data has provided invaluable details of the conditions of streams as a "snap-shot" in time. However, it is recognized that conditions are changing and in some cases, may have changed significantly since the initial SPA was conducted. Due to the dynamic nature of streams as they adjust to the continual impact of development, it is believed that reassessment of physical conditions will be needed to determine the exact need before the implementation of any recommended projects.

The overall condition of the watershed, as determined during the SPA, is summarized as follows.

Pimmit Run Watershed Condition Summary

- **Current imperviousness = 27 percent with the majority being medium density residential land use.**
- **Future imperviousness = 30 percent**
- **139 BMPs are located in the watershed.**
- **Three of the 83 road crossings had "moderate to severe" impacts and the rest had "minor to moderate" impacts.**
- **11 utility locations have "minor to moderate" impacts.**

- **One obstruction, located on Little Pimmit Run, has a "severe to extreme" impact. Seven obstructions have "moderate to severe" impacts and three have "minor to moderate" impacts.**
- **The stream has been altered in the upstream reaches and the majority of the downstream reaches (80 percent) are unstable and actively widening.**
- **The majority of the habitat quality is fair with inadequate buffers.**
- **Erosion was observed as "severe to extreme" at two locations, "moderate to severe" at 26 locations, and "minor to moderate" at four locations.**
- **Two dumpsites were observed in Little Pimmit Run.**

8.1.1 Watershed Characteristics

The headwaters of Pimmit Run begin west of Interstate I-495 along Gallows Road and drain into a pond just west of the interstate near Madron Lane and Executive Court. Then the stream outfalls at a storm drain system located on the east side of Interstate 495, just south of John Marshall High School. The stream then enters another pipe and goes underground until it daylights at a pipe outfall at Leesburg Pike. Pimmit Run initially flows east to northeast and then changes direction and flows east to southeast. The length of Pimmit Run from its headwaters to its outfall at the Potomac River is approximately 13.1 miles.

Six major tributaries contribute significant stream flow to Pimmit Run. The longest of these tributaries is Little Pimmit Run, which has a length of approximately 9,080 ft. The shortest is Bryan Branch, with an overall length of approximately 4,074 feet. Numerous small tributaries emerge from storm drain outfalls and natural springs and convey flows into Pimmit Run along its length. Of these smaller tributaries, nine are of significant length ranging from 1,000 to 5,000 feet. The terrain in the watershed is moderate with upstream land elevations ranging from 350 to 400 feet in the southern part to downstream land elevations of 30 to 100 feet in the northern part. The stream has a low-gradient slope of less than 0.50 percent.

8.1.2 Existing and Future Land Use

Land use in the watershed is predominantly medium-density residential with commercial land use in the southwest portion of the watershed and low-density residential and forested land uses located east of the George Washington Memorial Parkway. The Little Pimmit Run and Lower Pimmit Run Subwatersheds include approximately 1,356 acres of Arlington County. This is approximately 17 percent of the total Pimmit Run Watershed area. The Arlington County area consists primarily of medium-density residential land use. Medium-density residential land use currently comprises 40 percent of the total watershed area. The existing and 25-year future land use in the Pimmit Run Watershed are described in Table 8.1.

There are currently 502 acres of open space, parks, and recreational areas in the Pimmit Run Watershed which account for approximately six percent of the existing land use. The parks and recreational areas in the Pimmit Run Watershed are Lewinsville Park, Pimmit Bend Park, Linway Terrace Park, Bryn Mawr Park, Potomac Hills Park, Kent Gardens Park, Falls Church City Park, Olney Park, Mount Royal Park, Haycock Longfellow Park, Pimmit Run Stream Valley

Park, Kirby Park, Fort Marcy Park, and Marie Butler Leven Preserve. There are 188 acres that are currently vacant or undeveloped and 376 acres that are currently underutilized. These parcels comprise more than seven percent of the area and primarily have a future proposed land use of low-density residential. The U.S. Fish and Wildlife Service National Wetlands Inventory shows that there are 4.21 acres of wetlands in this watershed.

Table 8.1 Pimmit Run Watershed Land Use

	Land Use			
	Existing		Future	
Land Use Description[1]	Area (Acres)	%	Area (Acres)	%
Upper Pimmit Run				
Open space, parks, and recreational areas	159	6%	145	5%
Estate residential	39	1%	0	0%
Low-density residential	200	7%	95	4%
Medium-density residential	1,088	40%	1,275	47%
High-density residential	297	11%	307	11%
Low-intensity commercial	239	9%	210	8%
High-intensity commercial	14	1%	19	1%
Industrial	71	3%	96	4%
Other	0	0%	0	0%
Unknown	2	0%	2	0%
Vacant/Undeveloped	40	2%	0	0%
Road right-of-way (including shoulder areas)	553	20%	553	20%
TOTAL	2,702	100%	2,702	100%
Middle Pimmit Run				
Open space, parks, and recreational areas	235	9%	202	8%
Estate residential	204	8%	18	1%
Low-density residential	439	17%	525	20%
Medium-density residential	916	36%	1,145	45%
High-density residential	53	2%	59	2%
Low-intensity commercial	229	9%	200	8%
High-intensity commercial	26	1%	42	2%
Industrial	4	0%	4	0%
Other	0	0%	0	0%
Unknown	2	0%	2	0%
Vacant/Undeveloped	89	4%	0	0%
Road right-of-way (including shoulder areas)	363	14%	363	14%
TOTAL	2,560	100%	2,560	100%
Lower Pimmit Run				
Open space, parks, and recreational areas	23	3%	23	3%
Estate residential	19	3%	7	1%
Low-density residential	80	11%	88	13%
Medium-density residential	323	46%	336	47%
High-density residential	0	0%	0	0%

Land Use Description[1]	Land Use Existing Area (Acres)	%	Future Area (Acres)	%
Low-intensity commercial	3	0%	3	0%
High-intensity commercial	0	0%	0	0%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	9	1%	0	0%
Road right-of-way (including shoulder areas)	253	36%	253	36%
TOTAL	710	100%	710	100%
Little Pimmit Run				
Open space, parks, and recreational areas	76	4%	56	3%
Estate residential	58	3%	13	1%
Low-density residential	238	14%	292	16%
Medium-density residential	939	53%	971	55%
High-density residential	13	1%	13	1%
Low-intensity commercial	108	6%	107	6%
High-intensity commercial	11	1%	12	1%
Industrial	0	0%	0	0%
Other	0	0%	0	0%
Unknown	7	0%	7	0%
Vacant/Undeveloped	21	1%	0	0%
Road right-of-way (including shoulder areas)	305	17%	305	17%
TOTAL	1,776	100%	1,776	100%
Potomac Tributaries				
Open space, parks, and recreational areas	9	3%	6	2%
Estate residential	102	30%	0	0%
Low-density residential	90	27%	224	67%
Medium-density residential	1	0%	1	0%
High-density residential	22	7%	22	7%
Low-intensity commercial	1	0%	1	0%
High-intensity commercial	0	0%	0	0%
Industrial	1	0%	1	0%
Other	0	0%	0	0%
Unknown	0	0%	0	0%
Vacant/Undeveloped	29	9%	0	0%
Road right-of-way (including shoulder areas)	80	24%	80	24%
TOTAL	335	100%	335	100%
TOTAL for Pimmit Run Watershed	**8,083**	**100%**	**8,083**	**100%**

[1]The land use categories presented here are for watershed planning purposes only and were used to determine the impervious cover in the area.

The current impervious area in this watershed is 27 percent of the total area. In the future, with ultimate build out conditions, estate residential land use may be replaced by low-density and medium-density residential development and the future imperviousness may increase to 29 percent. In addition to the predicted changes in land use, mansionization will increase the impervious area in the watershed by 71.3 acres, increasing total future imperviousness to 30 percent.

Impervious area measures the amount of hard surfaces such as roofs, roadways and sidewalks which impede rainwater from percolating into the ground. Increases in impervious area allow runoff to flow directly into the streams in larger quantities, often causing downstream flooding and stream deterioration, including instream erosion. When watershed imperviousness reaches ten percent, stream quality begins to decline with poor water quality, alteration of the stream channel, and degraded plant and animal habitat becoming apparent.

The Fairfax County Comprehensive Plan for land use in the Pimmit Run Watershed includes the redevelopment of Chesterbrook Shopping Center in the McLean Community Business Center (CBC). The Plan also includes future transportation improvements such as installing mass transit, widening roadways, improving interchanges, and adding new trails. The mass transit rail will extend through the Tysons Corner area to Dulles Airport and into Loudoun County. The proposed rail line will be located in the Upper Pimmit Run Subwatershed along the Dulles Toll Road. The planned improvements are described in more detail below.

The roadway and interchange improvements planned for the Pimmit Run Watershed include:

- Widening Route 7 to six lanes between Haycock Road and I-495.
- Improving a portion of Idylwood Road between Route 7 and I-495 to two lanes.
- Improving Redmond Drive.

The planned trails for the Pimmit Run Watershed include:

- A stream valley trail with a six- to eight-foot-wide natural surface or stone dust trail along Pimmit Run. Currently, the following easements are needed for this project:
    - Downstream of Old Dominion Bridge on Dominion Hills LLC.
    - Downstream of Bryan Branch.
    - Downstream of Kinyon Place to Kirby road.
    - The two lots downstream of Kirby road located at 1363 Kirby Road and 1361 Kirby Road.
- The extension of the Mount Vernon trail along the George Washington Memorial Parkway.
- The Potomac Heritage National Scenic Trail along I-495.
- An eight-foot-wide asphalt or concrete trail along Great Falls Street, Haycock Road, Idylwood, Road, Kirby Road, Westmoreland Street, Magarity Road, Chain Bridge Road, and Old Dominion Drive.
- A new bike lane along Westmoreland Street and Chain Bridge Road.
- A minor four- to eight-foot-wide asphalt or concrete trail through Kirby Park, Haycock Longfellow Park, and along Bridge Branch.
- A minor four- to eight-foot-wide asphalt or concrete trail along Powhatan Street, Birch

Road, Hillside Drive, Old Chesterbrook Road, Weaver Avenue, Linway Terrace, Potomac School Road, and Colleen Lane.

8.1.3 Existing Stormwater Management

The watershed areas located east of Interstate 495 are drained through a network of drainage ditches and storm drain pipes. The storm drain systems in this area flow into drainage ditches, which then collect additional runoff from an increased drainage area, and eventually flow into the headwaters of Pimmit Run. After daylighting for approximately 2,200 feet, the stream then is conveyed underground by a storm drain system until it daylights again at Leesburg Pike. The stream is conveyed in an open concrete channel from Leesburg Pike to just downstream of the Dulles Toll Road except for a very short section in Olney Park. The storm drain pipe outfalls vary in size, ranging from 12 inches in diameter to a quadruple twelve by twelve-foot box culvert. Most of the channels downstream of the pipe outfalls have been altered with concrete lining or with riprap bed and bank protection. The natural channels are eroding due to the velocity of runoff from the pipe discharges. Similar combinations of storm drain conveyance systems serve the areas draining to Pimmit Run's major tributaries. Smaller networks of storm drain pipe systems and culverts serve the remaining portions of the watershed.

There were 98 storm drain system outfall locations evaluated as part of the SPA. Three of these pipe locations had a "moderate to severe" impact on the stream and the rest of the locations had a "minor to moderate" impact on the stream. The locations of all pipe impacts are shown on Maps 8.1, 8.2, and 8.3. In addition to the pipe outfalls along the streams, there are also two locations in the Pimmit Run Watershed where pipes completely cross the streams. Bryan Branch is traversed by an eight-inch diameter sanitary sewer pipe and Little Pimmit Run is traversed by a 21-inch diameter sanitary sewer pipe. These lines are exposed and are causing some erosion of the streams.

Erosional impacts were also assessed for all roads, footbridges, and driveways that crossed the stream reaches evaluated in the SPA. Maps 8.1, 8.2, and 8.3 show the location of the crossings and their erosional impacts on the streams. Eighty of the 83 crossings evaluated in the SPA had a "minor to moderate" impact and three crossings had a "moderate to severe" impact on the stream as described below:

- Chesterbrook Road: A ten-foot-high bridge with four ten-foot spans crosses Little Pimmit Run has a "moderate to severe" impact on the stream due to bed erosion, debris build-up and sediment deposits at the bridge.
- Park Road: A 2.5-foot diameter culvert along an unnamed tributary to Little Pimmit Run has a "moderate to severe impact" on the stream due to sediment deposits and the poor structural condition of the culvert.
- Unnamed crossing: A private crossing of Pimmit Run just upstream of Kirby Road with six, four-foot circular culverts and one four by four box culvert has a "moderate to severe" impact on the stream due to bed and bank erosion and sediment deposits at the culverts.

In Arlington County, Pimmit Run flows under North Glebe Road just upstream of its confluence with the Potomac River. The impacts of this crossing on the stream were not assessed because it is not in Fairfax County. However, for large storm events in the past, this location has been impassable due to flooding.

The county's list of master plan drainage projects shows that there are 36 identified projects in this watershed. Table 8.2 summarizes the type of master plan drainage project, project name/location, and project cost.

Table 8.2 Pimmit Run Watershed Master Plan Drainage Projects

Type of Work	Project Name/Location	Old Project Number	Cost	Status
750' storm sewer	Great Falls Manor (near Woodgate Lane)	G00048	$458,677	Keep as CIP project.
400' pipe system	Halsey Road	G00052	$202,265	Keep as CIP project.
1000' stream stabilization	Dexter Drive	G00056	$1,755,450	Partially incorporated into PM9232.
Replace 840' storm sewer	Pimmit Hills/Gilson Street	G00059	$833,682	Keep as CIP project.
900' stream stabilization	Noble Drive	G00066	$632,403	Keep as CIP project.
290' stream stabilization	Pimmit Run Main Stream (near Pinetree Road)	PM201	$189,841	Incorporated into PM9208.
675' stream stabilization	Woodacre Drive	PM202	$272,887	Partially incorporated into PM9208.
710' storm sewer pipe	Woodland Terrace	PM212	$945,185	Keep as CIP project.
360' stream stabilization	Old Dominion Drive	PM222	$77,061	Incorporated into PM9203.
1050' stream stabilization	Valley Road and Rhode Island Avenue	PM223	$2,199,857	Incorporated into PM9203.
400' stream stabilization	Little Pimmit Phase II	PM224	$597,600	Partially incorporated into PM9203.
360' stream stabilization	Ramshorn Place	PM231	$151,738	Keep as CIP project.
500' stream stabilization	Potomac School	PM232	$781,949	Partially incorporated into PM9208/PM9209.
1400' stream stabilization	Brookhaven Drive	PM233	$395,741	Partially incorporated into PM9208/PM9209.
340' stream stabilization	Chesterbrook/Divine	PM235	$260,422	Stream flow is piped along half of the project length. Further field verification needed to determine if the remainder of the stream restoration is needed.
1600' channel restoration	McLean Manor Sub	PM241	$747,000	Recommend deletion. Stream is piped along entire project length, so stream restoration is no longer possible.
60' stream stabilization	Old Dominion Drive	PM251	$42,355	Further field verification needed.
525' stream stabilization	Divine Street	PM252	$172,305	Incorporated into PM9209.

Type of Work	Project Name/Location	Old Project Number	Cost	Status
220' stream stabilization	Lemon Road	PM253	$102,131	Incorporated into PM9235.
50' stream stabilization	McKay Street	PM261	$14,544	Incorporated into PM9232.
1300' stream stabilization	Griffith Road	PM272	$1,867,500	Incorporated into PM9232.
350' stream stabilization	Leesburg Pike	PM281	$225,347	Recommend deletion. Stream is piped along entire project length, so stream restoration is no longer possible.
450' stream stabilization	Mohegan Drive	PM282	$95,399	Keep as CIP project.
Floodproof house	6212 Park Road at Old Dominion	PM421	$149,400	Incorporated into PM9663.
Replace culvert at Bryan Branch	Bryan Branch	PM431	$69,772	Incorporated into PM9469.
Add culvert and stream stabilization	Davidson Road	PM442	$526,417	Incorporated into PM9209.
Stabilization/flood control/culvert	Great Falls Street (G00057)	PM451	$265,200	Keep as CIP project.
Raise road and stream stabilization	Kirby Road (near Claiborne Drive)	PM611	$800,732	Partially incorporated into PM9208.
Purchase houses or floodproof	Tucker Avenue (G00062)	PM652	$90,955	Incorporated into PM9663.
Floodproof four homes	Kirkley Ave	PM653	$280,000	Incorporated into PM9663.
Floodproof house	Kirby Road	PM655	$59,484	Incorporated into PM9663.
Add culvert	Ballantrae Lane	N/A	$29,932	Keep as CIP project.
Floodwall	Leonard Road	N/A	$205,542	Incorporated into PM9663.
Olney Reservoir	Olney Reservoir	N/A	$626,531	Recommend deletion. The Dulles Airport Access Road now occupies this space; therefore this project is no longer possible.
Provide bypass	Evers Drive	N/A	$702,143	Keep as CIP project.
Replace culvert	Lorraine Avenue	N/A	$87,408	Keep as CIP project.

The county's Maintenance and Stormwater Management Division (MSMD) tracks storm drainage problems as reported by county residents. According to the MSMD data, 100 drainage complaints regarding flooding and erosion were registered with the county. The locations of these complaints are shown on Maps 8.1, 8.2, and 8.3. Problems were not added for all MSMD complaints; only for the serious complaints where a project was warranted.

According to the MSMD BMP inspection database, there are 107 private and 32 public stormwater management facilities located in the watershed. Approximately 609 acres are served by these stormwater management facilities out of the total area of 8,083 acres, or eight percent of the watershed. The majority of the private facilities are located in the southwestern part of the watershed in Upper Pimmit Run. The types of facilities listed in the MSMD database are described in Table 8.3. The facilities listed in the table are shown on Maps 8.1, 8.2, and

8.3 along with additional stormwater management facilities that are in the county's Stormnet GIS database. The Stormnet database does not have as much detailed information as the MSMD database, so the type of facility could not be determined for these additional sites.

Table 8.3 Pimmit Run Watershed Stormwater Management Facilities

Type of Facility	Number of Facilities Privately owned	Number of Facilities Publicly owned
Bioretention	1	--
Dry pond	13	28
Manufactured BMP	1	--
Parking lot	2	--
Roof top detention	24	--
Sand filter	5	--
Infiltration trench	42	1
Underground	16	3
Wet pond	3	--
Total	**107**	**32**

The source of data for this table was the MSMD database.

8.1.4 Stream Geomorphology

The majority of the soil types in the watershed exhibit characteristics of hydrologic soil groups B and D. The hydrologic soil group classifications of A, B, C, and D describe the soil's runoff potential and are based on the characteristics of soil texture, permeability, and infiltration rate. Hydrologic soil group B soils are classified as having moderate infiltration rates and tend to soak up more water and have less runoff than many of the other soil groups. Hydrologic soil group D soils have a high potential for runoff, a very low infiltration rate, and consist chiefly of clayey soils or very wet soils.

The geomorphology of the stream segments of Pimmit Run and its tributaries can be summarized as shown below. More information about the Channel Evolution Model (CEM) used to classify the watersheds is in Section 2.5.10 of Chapter 2.

- The dominant substrate in the majority of stream segments is gravel; however, the downstream reaches of Pimmit Run consist mainly of cobbles.
- The majority of reaches are of channel evolution model (CEM) type 3, referring to nearly vertical stream bank slopes, active widening and accelerated bend migration.
- The upstream segments are paved with concrete or reinforced with riprap; hence no geomorphic assessment was performed.
- Portions of the upstream- and downstream-most reaches are of CEM type 4, meaning that they are stabilizing with a new channel configuration.

Maps 8.4, 8.5, and 8.6 show the stream segment CEM types in the Pimmit Run subwatersheds. Fallen trees and debris obstructing the flow were observed at several locations along Pimmit Run and its tributaries. The impact of this debris on the stream was "severe to extreme" in one location along Little Pimmit Run, "moderate to severe" in seven locations, and "minor to moderate" in the other three locations. Two dumpsites were identified along Little Pimmit Run during the SPA. These obstruction and dumpsite locations are shown on Maps 8.4, 8.5 and 8.6..

8.1.5 Stream Habitat and Water Quality

The Virginia Department of Environmental Quality's (DEQ's) 2006 305(b)/303(d) Water Quality Assessment Integrated Report (found at www.deq.virginia.gov/wqa/ir2006.html) states that the recreation use goal for Pimmit Run is not supported due to exceedances of the fecal coliform bacteria water quality standard recorded at two DEQ water quality monitoring stations located on this stream. In addition to the bacteria impairment, DEQ's 2006 Integrated Report states that Pimmit Run is also impaired for fish consumption due to polychlorinated biphenyls (PCBs), chlordane, and heptachlor epoxide. These contaminants were found in American Eel specimens collected in 2001 and 2004 at DEQ's downstream Pimmit Run water quality monitoring station, located at the bridge at Glebe Road. The aquatic life use in Pimmit Run is fully supported with observed effects due to exceedances of the sediment screening value at the downstream portion of the stream.

There are three volunteer water quality monitoring sites located in the Pimmit Run Watershed which are coordinated by the Northern Virginia Soil and Water Conservation District. The sites are located along Upper Pimmit Run, Middle Pimmit Run and Little Pimmit Run. The data collected from these sites generally support the findings of the Fairfax County Stream Protection Strategy Baseline Study and indicate significant biological impairment at the sites.

The Fairfax County Health Department monitored stream water quality at four sampling sites in the Pimmit Run Watershed in 2002. Sampling Site 10-04 is along Little Pimmit Run, approximately 1,000 feet upstream from Claiborne Drive. The other three sites are along Pimmit Run. Sampling Site 10-03 is approximately 300 feet upstream of Claiborne Drive, 10-02 is just downstream of Old Dominion Drive and 10-05 is approximately 700 feet upstream of Westmoreland Street. Water samples were collected from each of these sites and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phosphorous, temperature, and heavy metals. These parameters indicate the amount of non-point source pollution contributed from manmade sources and help to evaluate the quality of the aquatic environment. Almost eight percent of samples collected from site 10-02 in the Pimmit Run Watershed showed a dissolved oxygen concentration of less than 4.0 mg/l, which is the minimum standard considered suitable for aquatic life. In 2002, 93 percent of the samples from one site in Pimmit Run had fecal coliform counts greater than 400/100 ml, one site had 67 percent of its samples with fecal coliform counts greater than 400/100 ml, and for the remaining two sites, 53 percent of the samples had fecal coliform counts greater than 400/100 ml. The maximum fecal coliform count of all the samples was 2,100/100ml. For fecal coliform, a count less than 200/100 ml is considered good water quality and a count of 250,000/100 ml can be considered a direct sewage discharge. Approximately 688 acres in the Pimmit Run Watershed, or nine percent, are served by on-site sewage disposal systems. These properties are widely scattered in the watershed, but are concentrated in the Cedarview Manor and Crestwood Neighborhoods, as well as properties along the Potomac River. Properties with on-site sewage systems are shown on Maps 8.4, 8.5 and 8.6, but this information is based on the best available data only and may not be completely accurate. Permits are required from the Health Department for all septic tanks and details about regulations can be found at www.vdh.virginia.gov/onsite/regulations.asp. These systems can discharge untreated sewage contaminated with fecal coliforms when not maintained properly, which may contribute to high fecal coliform counts in the streams.

The *Fairfax County Stream Protection Strategy (SPS) Baseline Study* from January 2001 evaluated the quality of streams throughout the county. Pimmit Run and its tributaries received "very poor" composite site condition ratings. These ratings were based on environmental parameters such as an index of biotic integrity, stream physical assessment, habitat assessment, fish taxa richness, and percent imperviousness. In the *SPS Baseline Study*, Pimmit Run was classified as a Watershed Restoration Level II area with the goal of maintaining this area to prevent further degradation and implementing measures to improve water quality in order to comply with Chesapeake Bay initiatives, TMDL regulations, and other water quality initiatives and standards.

The stream reaches of Pimmit Run and its tributaries have high gradient slopes and are classified as the riffle/run-prevalent stream type. A riffle/run is an area in a stream where the water flow is rapid and usually shallower than the reaches above and below.

The habitat assessment for Upper Pimmit Run and its tributaries, as determined from the *Fairfax County Stream Physical Assessment (SPA)*, can be summarized as follows:

- Approximately 25 percent of the stream reaches had five of the common habitat types such as fallen trees, large woody debris, deep pools, large rocks, undercut banks, thick root mats, and dense macrophyte beds. Macrophyte beds consist of a canopy of aquatic plants.
- Seven reaches in Upper Pimmit Run are concrete-lined, piped, or channelized; hence, habitat was not assessed on these reaches.
- The dominant substrate in the stream reaches is a mixture of cobble and gravel stones. Fine sediment and silt surrounds 50 percent of the living spaces around gravel, cobble and boulders.
- Approximately 40 percent of the stream segments have minor alterations of the channel or banks.
- For most of the stream, the water fills approximately 65 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- The majority of the stream bank surfaces have 60 to 70 percent vegetated cover, typically composed of scattered shrubs, grasses and forbs. A majority of the stream buffers consist of shrubs and few trees with 50 to 100 feet of buffer width. There are also extensive areas of deficient buffer. Thirty percent of the banks have erosional areas. The locations of deficient buffer areas and erosion along the stream corridor are shown on Map 8.4. According to the SPA conducted by Fairfax County, five out of seven areas affected by erosion have moderate restoration potential.

The habitat assessment for Middle Pimmit Run can be summarized as follows:

- More than 25 percent of the stream reaches had less than four of the common habitat types. Less than four common habitat types signifies that the stream's habitat structures are becoming monotonous, thus decreasing the diversity of macroinvertebrates.
- Three reaches in Middle Pimmit Run are concrete-lined, piped, or channelized; hence, habitat was not assessed on these reaches.

- The dominant substrate in the stream reaches is a mixture of cobble and gravel stones. Fine sediment and silt surrounds 50 percent of the living spaces around gravel, cobble and boulders.
- Approximately 20 percent of the stream segments have minor alterations of the channel or banks.
- For most of the stream, the water fills approximately 65 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- The majority of the stream bank surfaces have 60-70 percent vegetated cover, typically composed of scattered shrubs, grasses and forbs. A majority of the stream buffers consist of shrubs and few trees with 50 to 100 feet of buffer width. Thirty percent of the banks have erosional areas. The locations of deficient buffer areas and erosion along the stream corridor are shown on Map 8.5. According to the SPA conducted by Fairfax County, twelve out of fifteen areas affected by erosion have moderate restoration potential.

The habitat assessment for Little Pimmit Run can be summarized as follows:

- The majority of the stream reaches had five of the common habitat types.
- A portion of an unnamed tributary to Little Pimmit Run was concrete-lined, piped or channelized; hence habitat was not assessed along that reach.
- The dominant substrate in the stream reaches is a mixture of gravel stones and boulders. Fine sediment and silt surrounds 40 percent of the living spaces around gravel, cobble and boulders.
- Approximately ten to 20 percent of the stream segments have minor alterations of the channel or banks.
- For most of the stream, the water fills approximately 75 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- The majority of the stream bank surfaces have 70 to 80 percent vegetated cover, typically composed of scattered shrubs, grasses and forbs. A majority of the stream buffers consist of shrubs and few trees with 25 to 50 feet of buffer width. Fifteen to 30 percent of the banks have erosional areas. The locations of deficient buffer areas and erosion along the stream corridor are shown on Map 8.6. According to the SPA conducted by Fairfax County, seven out of eight areas affected by erosion have moderate restoration potential.

The habitat assessment for Lower Pimmit Run can be summarized as follows:

- The majority of the stream reaches had four to five of the common habitat types.
- A portion of Stromans Branch was piped; hence, habitat was not assessed along that reach.
- The dominant substrate in the stream reaches is a mixture of cobble stones and boulders. Fine sediment and silt surrounds 30 to 40 percent of the living spaces around gravel, cobble and boulders.
- Approximately ten percent of the stream segments have minor alterations of the channel or banks.
- For most of the stream, the water fills approximately 80 percent of the available channel cross section during normal flow periods. This amount of water filling the channel allows for adequate aquatic habitat.
- The majority of the stream bank surfaces have 70 to 80 percent vegetated cover, typically composed of scattered shrubs, grasses and forbs. A majority of the stream buffers consist of shrubs and few trees with 25 to 50 feet of buffer width. Five percent of the banks have

erosional areas. The locations of deficient buffer areas and erosion along the stream corridor are shown on Map 8.6. According to the SPA conducted by Fairfax County, one out of two areas affected by erosion has moderate restoration potential.

8.1.6 Problem Locations Identified During Public Forums

Problem locations were provided by the public at the Community Watershed Forum held on April 16, 2005, the Draft Plan Workshop on November 1, 2005, and by the Middle Potomac Watersheds Steering Committee. The problem locations were investigated and the resulting observations are included in the following table. Maps 8.1, 8.2, and 8.3 show the locations of the problems identified.

Table 8.4 Problem Locations Identified During Public Forums

Map ID	Description
Upper Pimmit Run	
PM1	Location: Pimmit Run at Marshall Drive Problem: Pimmit Run has fallen trees, debris, and trash in the channel. There is a noticeable amount of trash and some minor blockages, mainly due to woody debris carried downstream during large storm events Observation: There is no action required for this problem location as a recent stream cleanup effort has occurred and cleared most of the debris.
PM2	Location: George Marshall High School Problem: Impervious cover. Observation: Although there is a significant amount of impervious parking pavement for the high school, it all seems to be utilized and the size of the parking area should not be reduced. This issue will be addressed by New BMP Project PM9155 and New LID Project 9856, both proposed on school property.
PM3	Location: Pimmit Run at Olney Park Problem: Floodplains are disconnected from the stream because streambed erosion has created a deep channel from which floodwaters cannot escape. Observation: It was observed that the floodplains are disconnected from the stream from the Lemon Road Elementary School downstream to the Dulles Toll Road. There is a moderate floodplain to the northwest of the Lemon Road Elementary School, downstream of the school, and from Hillside Drive downstream to the Dulles Toll Road where the floodplain may be reconnected. Reconnecting the stream channel to the floodplains will give the overflow a chance to spread out which will help slow down the velocity and reduce the volume of the flow in the downstream channel. This will reduce the effects of erosion and down cutting in the channel. This issue will be addressed by Floodplain Restoration Project PM9347.
PM4	Location: Pimmit Run upstream of the Dulles Toll Road Problem: A large concrete culvert built in 1978 has increased the water velocity and washed out the stream channel. Observation: Increased runoff velocities from upstream development have caused stream erosion. This issue will be addressed by Stream Restoration Project PM9232.
PM5	Location: Downstream from the Dulles Toll Road on the right side of Pimmit Run Problem: Floodplains are disconnected from the stream. This relates to the flooding problem in Problem Area PM7. Observation: There is a five- to seven-foot high bank just downstream of the Dulles Toll Road and upstream of Old Idylwood Road that significantly decreases the flooding of the floodplain area to the west of Pimmit Run. This issue will be addressed by Floodplain Restoration Project PM9346.

Map ID	Description
PM6	Location: Great Falls Street near Pimmit Run. Problem: Illegal dumping of waste, south of Dominion Power's dump. Observation: There is a minor amount of yard and woody debris deposited in this area. Whenever a major storm comes through the McLean area, the landscape companies dump large amounts of debris in this location. The metal barrier should be reestablished on Great Falls Street in order to prevent people from driving on Old Idylwood Road close to the stream. A "no dumping" sign should be installed at this location. This issue will be addressed by Dumpsite/Obstruction Removal PM9937.
PM7	Location: Great Falls Street on Pimmit Run near the intersection of Lemon Road. Problem: A residence at this location is frequently flooded as reported by several Steering Committee members. Observation: The primary flooding of the stream is in the floodplain to the east of Pimmit Run at this location. The solution is to lower the high bank on the west side of the run located at PM5. This issue will be addressed by Floodplain Restoration Project PM9346. Another problem is that Pimmit Run is in a concrete channel and travels in a straight line from Leesburg Pike to downstream of the Dulles Toll Road (DTR), it then turns into the streambed just after DTR causing flooding. The flow cannot get around the turns fast enough, so Pimmit Run just keeps going over the east bank into the east floodplain and flooding the house. There is no riparian buffer through this area and the stream channel is significantly degraded with several blockages. This issue will be addressed by Stream Restoration Project PM9232.
PM8	Location: Bridge Branch at its confluence with Pimmit Run Problem: Utility towers, located in stream channel, are obstructing flow. Observation: The utility towers are causing a moderate impact and blockage. This issue will be addressed by Stream Restoration Project PM9232.
PM9	Location: Pimmit Run at McFall Street Problem: Sanitary sewer lines are exposed. Observation: There are no exposed sanitary sewer lines in this area; however, there is an exposed sanitary sewer manhole. There is no action required for this problem location.
PM10	Location: Westmoreland Street at Pimmit Run upstream of the McLean Little League Ballfields. Problem: Utility towers are located in the stream channel. Observation: It was observed that a tower of the high tension electric line sits directly in the middle of Pimmit Run and the second tower is located upstream of the Little League Fields. Debris builds up on these towers regularly. This issue will be addressed by Stream Restoration Project PM9235.
PM11	Location: Sewer line right-of-way adjacent to Pimmit Run Problem: Trees are growing over the sewer lines and are being cut down. Excessive sewer line right of way maintenance. Observation: Trees and vegetation have been removed along the sanitary sewer line from above Great Falls Street downstream to below Old Dominion Drive. In several places, the clearing is directly next to Pimmit Run, especially in the area upstream of the Little League Fields. This issue will be addressed by Stream Restoration Project PM9235.
PM12	Location: Kirby Park Problem: Kirby Park is a skinny park, in which the vegetation is mowed to the edge. The buffer here is all grass and is inadequate. Observation: There is very little buffer and the channel has been straightened. This issue will be addressed by Stream Restoration Project PM9235.

Map ID	Description
PM13	Location: Westmoreland Street and Great Falls Street at the McLean Little League Baseball Field Problem: McLean Little League Baseball Field gets flooded regularly. Every year clean up and maintenance is required. This facility was built in the flood plain and the flooding gets so bad that large objects are carried into the stream. Observation: One problem is that the dumpster in the Little League area is not secured to the ground and when the area floods, the dumpster ends up clogging one of the channels of the Westmoreland Street Bridge. There are rapidly deepening side drainage channels starting at various points on the Little League property draining to Pimmit Run. Drainage swales from the park complex probably back up with flood flows from Pimmit Run. In addition to flooding, there is an inadequate buffer and considerable impervious/compacted surface in the floodplain/RPA. This issue will be addressed by New LID Project PM9826.
None – watershed wide	Location: Hutchison Street and Pimmit Run Problem: Low water quality was revealed by citizen monitoring results. Observation: State and county data have also shown poor water quality. All of the projects proposed in the watershed plan will help improve water quality.
PM14	Location: Corner of Overbrook Street and Crimmins Lane along Darrell Branch Problem: There is erosion on the vacant property across Darrell Branch at 2131 Crimmins Lane that should be addressed. Observation: The property is in the county zoning and site plan approval process. This issue will be addressed by Stream Restoration Project PM9235.
PM15	Location: Burke's Spring Branch near the intersection of Kirby Court and Westmoreland Street at Temple Rodef Shalom Synagogue. Problem: Excess runoff from parking lot. Observation: The synagogue has a dry detention BMP, which does not appear to be functioning properly. This BMP may be retrofitted to provide additional water quality treatment. This issue will be addressed by BMP Retrofit Project PM9134.
PM16	Location: Temple Rodef Shalom located at 2100 Westmoreland Street Problem: Two homeowners' lawns are flooding because of an improperly designed wet pond and the map should be showing a maintenance complaint and it does not. Observation: It is not likely that the BMP is causing all the flooding of the yards at the downstream properties, as it appears that the BMP outfall ditch is inadequate due to sedimentation. This issue will be addressed by Infrastructure Improvement Project PM9464.
PM17	Location: Longfellow Middle School at Westmoreland Street at an unnamed Pimmit Run tributary. Problem: A new basketball court and a mini-soccer field both have gullies going directly into Burke's Spring Branch. These gullies have started over the past few years. Trailers have also added impervious surfaces. Observation: The gullies are a result of poor grading around the basketball court and mini-soccer field. This issue will be addressed by New LID Project PM9829.
PM18	Location: Brooks Square Place above Kirby Road on Burke's Spring Branch Problem: There is inadequate buffer surrounding an on-site stormwater detention pond. This location would be a good opportunity for a BMP retrofit. Observation: There is an existing berm (mound of dirt) with a culvert beneath it at this location with mowed grass upstream of the berm. This issue will be addressed by Buffer Restoration Project PM9317 and BMP Retrofit Project PM9136.
Middle Pimmit Run	
PM19	Location: 6622 Chesterfield Avenue, McLean, VA. Problem: Flooding occurs behind the house. The house under construction behind 6622 Chesterfield Avenue is located along Tucker Avenue in McLean. The storm ditch has filled in over time and now is a flooding hazard to the surrounding homes. Observation: The ditch is significantly degraded, and the channel capacity has been greatly reduced by sediment and debris. The house under construction does not appear to be impacting the ditch. This issue will be addressed by Dumpsite/Obstruction Removal PM9902 and Infrastructure Improvement Project PM9451.

Map ID	Description
PM20	Location: Upstream from Kent Gardens Elementary School at the bridge on Beverly Avenue. Problem: There have been approximately ten trees down in the past few months and significant erosion is occurring in this location. Observation: Increased runoff velocities due to upstream development have caused stream erosion. This issue will be addressed by Stream Restoration Project PM9209.
PM21	Location: Hunting Avenue in the Great Falls area near Saucy Branch Problem: An underground culvert has been overflowing after any type of rain event for the past 25 to 30 years. Observation: There is possibly inadequate drainage at this intersection that could be causing the localized flooding. The upstream private entrance culvert appears to be restricted by overgrown vegetation. This issue will be addressed by Infrastructure Improvement Project PM9465.
PM22	Location: Saucy Branch Problem: There are steep, vertical banks resulting from the new townhouse developments. Also in Lewinsville Park, there are sloping fields that are fertilized for ball fields and community gardens. Observation: The stream is significantly degraded in this area. The county's stream physical assessment observed an actively widening channel. This issue will be addressed by Stream Restoration Project PM9209.
PM23	Location: McLean High School, Westmoreland Street near Saucy Branch Problem: Fields with artificial turf. Observation: No fields with artificial turf were found at the high school. The school has a large parking lot. This issue will be addressed by New BMP Project PM9120 and New LID Project PM9821.
PM24	Location: Lewinsville Park in McLean near Saucy Branch Problem: Locations with artificial turf. Observation: The area with artificial turf is one soccer field at the entrance to the park, which covers approximately 0.75 acres. Artificial turf is typically installed with a subsurface drainage system that allows the runoff to infiltrate into the ground. No fertilizers are applied to an artificial turf field so the amount of pollutants in the runoff should be less. Water quality at this location will be addressed by New LID Project PM9822.
PM25	Location: Dillon Avenue at Saucy Branch Problem: Concrete channelization behind the houses. Channel is falling apart and the culvert is blocked. Observation: The stream is moderately impacted by the blockage and degraded by erosion. This issue will be addressed by Infrastructure Improvement Project PM9466.
PM26	Location: Bryn Mawr Park Problem: Saucy Branch upstream of Bryn Mawr Park is heavily channelized with concrete that dumps water into Bryn Mawr Park. The bank of Saucy Branch at this location is eroding and there are significant problems with invasive species. Kudzu is killing vegetation along the creek and English Ivy is growing up the trees and covering the ground. Observation: This area has the potential for stream restoration. The project should include restoring the stream bank, removing the invasive species as much as possible and planting more vegetation that is native to the watershed. The concrete in the channelized portion cannot be removed because of the proximity of houses along the banks but perhaps the velocity of the flow from the channelized portion can be reduced in conjunction with the Infrastructure Improvement Project PM9466. This issue will be addressed by Stream Restoration Project PM9209.

Map ID	Description
PM26	Location: Tennyson Drive in front of the Bryn Mawr Park near Saucy Branch. Problem: There is a culvert that goes below Tennyson Drive, which overflows in all types of rain events. When the culvert overflows, the water is approximately one foot in depth on Tennyson Drive. The last rain event that resulted in an overflow occurred on April 2, 2005. This is a hazard to drivers and has been occurring for an extended period of time. The solutions enacted by the County have not addressed the road flooding at Tennyson Drive. Observation: The culvert has very little cover (fill material above the pipes) due to the low elevation of the road with respect to the surrounding ground. Flooding is likely caused at this location by the inadequate capacity of the culvert as well as the low elevation of the roadway. This issue will be addressed by Infrastructure Improvement Project PM9417.
PM27	Location: Pimmit Run at Washburn Court upstream from Old Dominion Drive. Problem: Sanitary sewer lines are exposed. Observation: Sanitary sewer lines are not exposed; however, a sanitary sewer manhole is located well away from the stream and should not cause any impacts. This issue requires no action.
PM28	Location: Dominion Woods, A ¼-mile upstream from Old Dominion Drive on Pimmit Run Problem: Debris jams, big trees washing down and blocking Pimmit Run creating a potential for flash flooding. Observation: Increased runoff from development causes increased stream velocities, which erode the stream banks. The trees on the banks have become uprooted and are being carried downstream. This issue will be addressed by Dumpsite/Obstruction Removal PM9902.
PM29	Location: Holmes Place at Pimmit Run Problem: Channelization and major erosion. Observation: There is a moderate amount of channelization and erosion at this location. This issue will be addressed by Stream Restoration Project PM9209.
PM30	Location: Pimmit Run at McLean Court Problem: Sanitary sewer lines are exposed. Observation: Sanitary sewer lines are not exposed; however, a sewer manhole is located well away from the stream and should not cause any impacts. This issue requires no action.
PM31	Location: Bryan Branch near Linway Terrace and Valley Drive, 1603 East Avenue Problem: There are eroding stream banks at Bryans Branch. Multiple new streets and housing construction on Linway Terrace and Valley Drive have increased the runoff into Bryan Branch from where it flows under Old Dominion Drive, thence under Linway Terrace and northeast into Pimmit Run. In the past six years, the streambed has widened threefold and has caused numerous healthy trees and vegetation to erode and wash away. The stream banks have a height of over six feet and the stream floods its banks. There is also a major property loss due to stream erosion to the ten East Avenue homes that border the north bank of Bryan Branch and the two homes that border the south bank. Observation: It is evident that the stream has experienced considerable negative impacts due to continuing development in the surrounding area. The stream's response to increased runoff from development includes down cutting, widening of the channel, and considerable bed and bank erosion. There are also several locations with woody debris buildup and large tree obstructions. The culverts along the stream appear to be in fair condition. This will be addressed by BMP Retrofit Project PM9175 which will reduce the amount of stormwater going to the stream.
PM32	Location: St. John's Catholic School at Linway Terrace and Old Dominion Drive. Problem: Impervious areas cause increased runoff amounts. Observation: Low impact development (LID) techniques may help to decrease the amount of runoff from the school. This issue will be addressed by New LID Project PM9813.
None-watershed wide	Location: 1438 Brookhaven Drive Problem: A participant would like funding for pervious surface pavers at her home. Observation: Residential development creates the most imperviousness in the watershed and LID techniques in residential areas will help reduce the amount of runoff. This issue will be addressed by LID Promotion Project PM9986.

Map ID	Description
PM33	Location: Oakview Drive, Brookhaven Drive (1434 Brookhaven Drive), Forest Villa Lane Problem: Bank erosion and down cutting in Pimmit Run. This location has severely eroding streambeds and banks and debris jams, which produce frequent and high levels of flooding. The floodplains are disconnected from the stream. Floodwater used to spread out beyond the channel at this location, but in the last three to five years, the stream channel seems to be eroding more significantly. Observation: There is considerable stream channel and bank alteration in this area. It is evident that the stream is responding to increased runoff by widening and more frequent flooding. The stream banks have become unstable and there are several fallen trees and several other trees in danger of falling. The floodplain is somewhat disconnected. It was also observed that the portion of the stream located at 1434 Brookhaven Drive has major log jams causing debris to pile up on the steps of this house every time there is a significant flood. These obstructions are the largest and most disruptive obstructions in the entire Pimmit Run stream. The log jams will be will be addressed by Dumpsite/Obstruction Removal PM9902 and the remainder of the problem will be addressed by Stream Restoration Project PM9209.
PM34	Location: Dominion Power line easement that runs adjacent to Pimmit Run in the Brookhaven neighborhood between Brookhaven Road and Old Dominion Drive and from Westmoreland Street to Great Falls Street Problem: Dominion Power line easement has inadequate buffer along stream. The power company mows and cuts back everything every couple of years—right down to the ground. They have become aggressive in expanding the cleared area for the power lines. The trees are losing to right-of-way and there needs to be more balance. Observation: There is mostly grass under the power lines. This issue will be addressed by Buffer Restoration Project PM9315.
None – watershed wide	Location: Hands' property at Ballantrae Court Problem: This location has had clear cutting at the streambed and in the right-of-way for sanitary sewer lines for new development. There should be stronger regulations to preclude anyone from cutting and mowing vegetation down to the stream bank. This should extend to public utility agencies also. Observation: Trees should not be located over sanitary sewer lines; however, other vegetation may be suitable at this location. This is related to PM35, which will be addressed by Buffer Restoration Project PM9311.
PM35	Location: Langley Place near Pimmit Run. Problem: Large clear-cut, all the trees were removed. Observation: No recent clear cut was observed at this location; however, significant portions of the riparian buffer have been cleared in the past. The cleared areas adjacent to the stream while currently stable do not provide an adequate buffer and will certainly degrade further over time. This issue will be addressed by Buffer Restoration Project PM9311.
PM36	Location: Cola Drive at an unnamed tributary to Pimmit Run Problem: A building at this location was damaged from recent flooding and has been condemned. Observation: The house at 1403 Cola Drive was condemned last fall because the bank behind the house had collapsed along the unnamed tributary to such an extent as to threaten the foundation of the rear portion of the house. A retaining wall was constructed to stabilize the bank below this house. This stream stability in this area will be addressed further by Stream Restoration Project PM9209.
PM37	Location: Pimmit Run below the Potomac School near the end of Cola Drive Problem: Bank scour (undercutting) and sediment deposition Observation: There is significant bank degradation and sediment deposition through this area. This issue will be addressed by Stream Restoration Project PM9209.
PM38	Location: Pimmit Run upstream from Kinyon Place Problem: Floodplains are disconnected from the stream. Observation: The floodplains in this location are moderately disconnected from the stream. This issue will be addressed by Stream Restoration Project PM9209. There is also a log jam here which will be addressed by Dumpsite/Obstruction Removal PM9902.

Map ID	Description
None – watershed wide	Location: Pimmit Run near Merchant Lane ▪Problem: Resident is concerned about the fecal coliform bacteria in the stream because her children play in the stream. Observation: Many county streams including Pimmit Run are considered unsafe because of high levels of fecal coliform bacteria. Pimmit Run is on the Virginia Impaired Waters List and is scheduled to have a total maximum daily load established for bacteria in 2014. This issue will be addressed by Fecal Coliform Source Study PM9796.
PM39	Location: Pimmit Run downstream of Merchant Lane (serious erosion begins ¼ mile upstream and stops just downstream of 1331 Merchant Lane where the banks become rockier and more stable) Problem: This section of Pimmit Run has a lot of erosion. Numerous mature trees have come down and some downed trees continue to block flow causing more erosion. The last heavy rain completely flooded the floodplain to a distance of 400 feet across and ripped out large numbers of new plantings the residents have been trying to establish. Observation: This site will be investigated in June. The County's stream physical assessment noted erosion of the banks in this location and the geomorphology was assessed as actively widening. This issue will be addressed by Stream Restoration Project PM9209.
PM46	Location: Pimmit Run near the intersection of Kirby Road and Claiborne Drive where the bridge crosses an unnamed tributary to Pimmit Run. Problem: The stream banks in Pimmit Run and Little Pimmit Run are severely eroded. Trees that have been planted to preserve the streams in this location have been removed by high water velocity and debris flowing downstream. There are exposed tree roots and the hiking trail is washed out. Hikers must scale the stream bank. Observation: Moderate stream degradation and impacts were noted at this location; however, there is no hiking trail at this location. The hiking trail along Pimmit Run south of Kirby Road turns toward Little Pimmit Run and does not go to Kirby Road. The culvert crossing at this location is impacted by alteration of the stream channel, channel obstructions and debris blockages. Little Pimmit Run appears to be more degraded at the confluence with Pimmit Run than the main branch of Pimmit Run itself. There is noticeable bed and bank erosion and channel alteration at this location. This issue will be addressed by Stream Restoration Project PM9208.
PM49	Location: 1362 Kirby Road Problem: The south bank of Pimmit Run just below the house at 1362 Kirby Road has eroded badly and threatens to undermine the foundation of the house Observation: It was observed to be the worst erosion problem in Pimmit Run. This issue will be addressed by Stream Restoration Project PM9208.
PM51	Location: Near Poplar Place Problem: Backyards in the area flood during heavy rainfall due to inadequate pipe drainage. Observation: This issue will be addressed by Stream Restoration Project PM9209, which will stabilize the stream banks. Infrastructure Improvement Project PM9469 in conjunction with BMP Retrofit Project PM9170 will help reduce the flooding in the backyard of 1553 Forest Villa Lane.
PM52	Location: Behind the Potomac School, along Hardy Drive Problem: Natural obstructions (i.e. falling trees) are a problem in this area Observation: This debris will be addressed by Dumpsite/Obstruction Removal PM9902.
PM53	Location: Near Madison Court on Pimmit Run Problem: A special "300 year old" tree is falling in the stream due to significant bank erosion. The stream is located close to the trunk of this tree. Observation: Buffer Restoration Project PM9315 will include stabilizing the area near the tree. The tree may not be able to be saved if the stream bank cannot be stabilized without disturbing the tree.
PM54	Location: At the intersection of Pimmit Run and Old Dominion Drive Problem: Extreme bank erosion, denuded vegetation and sedimentation along this portion of the stream. Observation: This issue will be addressed by Buffer Restoration Project PM9311.

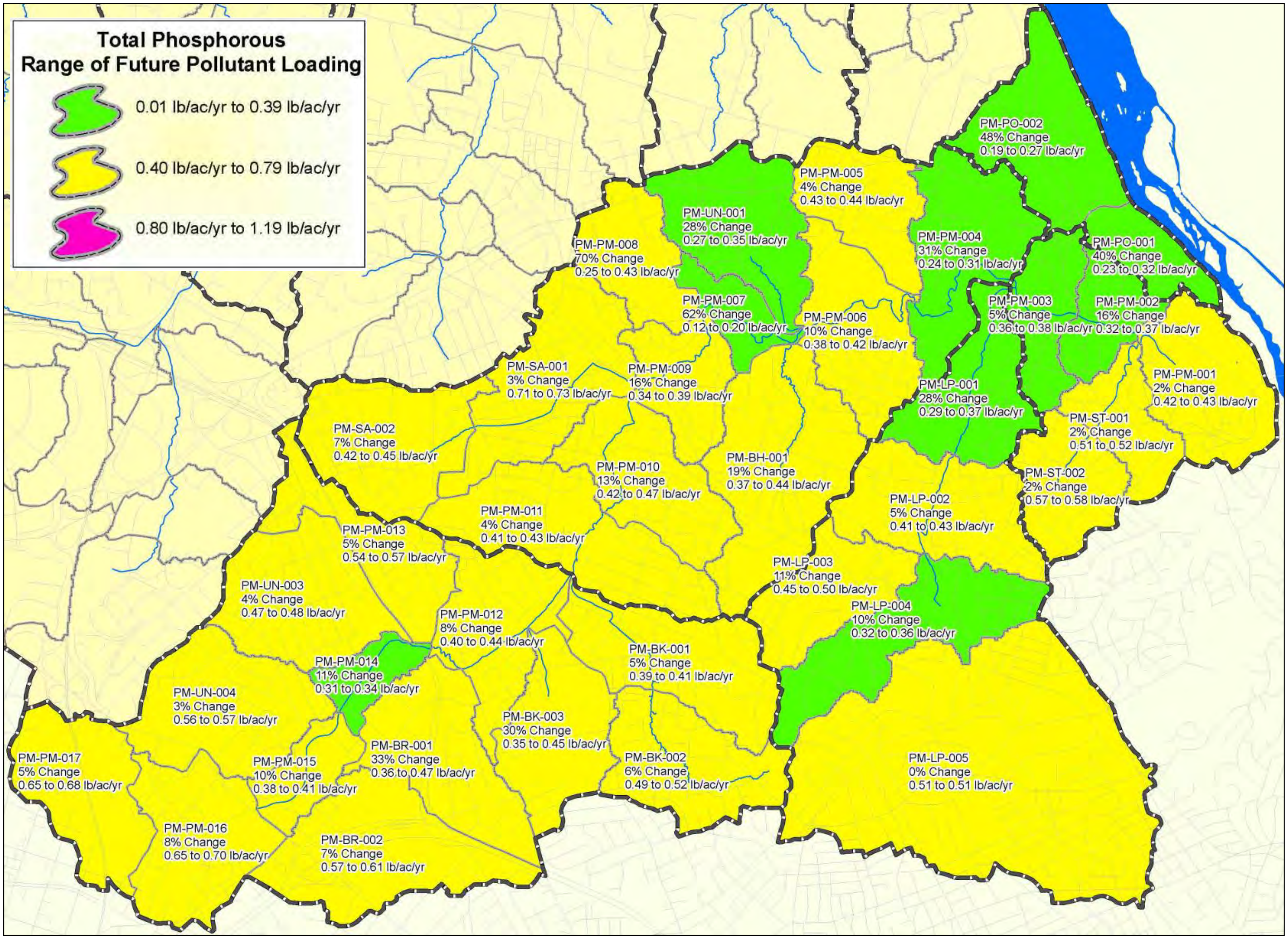
Map ID	Description
PM55	Location: Upstream of Kent Gardens Elementary School, off of Melbourne Drive Problem: Incorporate wetlands by school. Observation: Water quality at the school will be addressed by New LID Project PM9824.
Lower and Little Pimmit Run	
PM40	Location: 1901 Valley Wood Road at an unnamed tributary to Little Pimmit Run Problem: Stream routinely floods Valley Wood Road. When this happens, the water rises eight to ten feet and floods out the lower third of the yard. Observation: The roadside ditch is in poor condition and needs maintenance to alleviate reduced runoff capacity. The roadside ditch discharges into a stream adjacent to the roadway. The stream is also in poor condition, with considerable overgrowth of vegetation blocking the channel and degraded stream banks. This issue will be addressed by Stream Restoration Project PM9203.
PM41	Location: New development near Chesterbrook Elementary School on the north unnamed tributary to Little Pimmit Run. Problem: Erosion problems at this site need to be addressed. Observation: The new development appears to have the proper erosion and sediment control practices in place; however, there is still sediment transport to the adjacent stream. It is important to note that erosion and sediment control practices will not eliminate sediment-laden runoff from entering adjacent streams, but they will reduce it significantly. This issue requires no action.
PM42	Location: Chesterbrook Elementary School in McLean Problem: Impervious surfaces which increase the amount of runoff and contribute pollutants. Observation: LID techniques may help mitigate the effects of impervious surfaces at this site. This issue will be addressed by New LID Project PM9807.
PM43	Location: 6231 to 6241 Park Road, McLean Problem: There is a new development under construction that may not be meeting the requirement of maintaining a 100-foot buffer along the adjacent creek. Maintaining a 100-foot buffer may not be sufficient in all cases and a greater buffer requirement may be needed at particular sites. This site has very steep slopes and the buffer might need to be wider to function effectively. [The distance was checked by a participant after the forum and the building under construction is approximately 40 feet from the stream.] Observation: The development has encroached on the stream buffer. This issue will be addressed by Buffer Restoration Project PM9301.
PM44	Location: Maddux Lane bike path Problem: The fair-weather crossing is diverting water flow and causing stream erosion. Observation: This crossing appeared to be an old and failing stream channel improvement project, which consisted of concrete lining the channel bottom and gabion slope reinforcement. The improvements have failed and are adversely impacting stream flow, including the diversion of flow and accelerated stream bank erosion. The Northern Virginia Soil and Water Conservation District and several homeowners along Maddux Lane are in the design phase of a project to address the erosion problem just downstream of the trail entrance path off Maddux Lane. This issue will be addressed by Stream Restoration Project PM9203.
PM45	Location: Sycamore Falls subdivision at Maddux Lane on Little Pimmit Run Problem: There is a new development 25 feet from the stream with a very steep slope and possible erosion problems. Observation: The new development is on a steep slope and the developer proposes moving the upper third of the lot down onto the middle third of the lot to make the area level enough to build houses on. Erosion of the properties is evident. The site plan has not been approved, but there are lots that are cleared to the stream banks, which are located in the Chesapeake Bay RPA. This issue will be addressed by Stream Restoration Project PM9203.
PM47	Location: Rosamora Court where Stromans Branch enters Lower Pimmit Run Problem: There are inadequate vegetated stream buffers in this location. Observation: Four homeowners in this area mow to the edge of the stream on their land. This issue will be addressed by Buffer Restoration Projects PM9379 and by Public Education Project PM9984.

Map ID	Description
PM48	Location: George Washington Parkway Problem: Significant construction is being planned on the George Washington Parkway. These plans include modifications to the ramps to Route 123 and the CIA. These changes could have a significant impact on Pimmit Run, which is already very degraded. The residents at 1369 Kirby Road have lived there for almost ten years. During the first seven years they lived there, neither Pimmit Run nor Little Pimmit Run ever flooded. In the last three years, the streams have probably flooded five or six times. Unless runoff issues are addressed in the planning stages, additional road surface on the George Washington Parkway will likely make the flooding even worse. Observation: The planning team will talk to the National Park Service regarding BMPs for this roadway improvement.
PM50	Location: End of Briar Ridge Road Problem: The stream becomes a raging torrent every time it rains and it has significant bank erosion. There was speculation that the main source of runoff was coming from the Chesterbrook Shopping Center. Old Dominion Drive was also identified as a potential source of runoff. There was further concern expressed about a proposed "by right" cluster development nearby that will compound the problem of excess stormwater flows. Observation: The New LID Project PM9825 will address this issue at the Chesterbrook Shopping Center to help reduce the amount of runoff.

8.1.7 Modeling Results

Hydrologic, hydraulic, and water quality models were developed for the Pimmit Run Watershed to simulate the generation of runoff, how the runoff is transported downstream, and the amount of pollutants in the runoff and stream flow. The hydrologic and water quality models include the entire Pimmit Run Watershed which also includes the area draining from portions of Arlington County. The Pimmit Run Watershed was divided into five subwatersheds and further divided into thirty-seven subbasins in order to provide more detail for the modeling results. These subbasins are shown in Figure 8.1 below with the future total phosphorus loading.

Figure 8.1 Pimmit Run Future Total Phosphorous Loading



8.1.7.1 Hydrology and Water Quality Modeling

In the hydrologic model the current watershed imperviousness is 27 percent, which generates moderate to high peak runoff flows. Additional residential imperviousness caused by adding on to existing houses was added to the future land use conditions for the hydrologic model. The predicted increase in runoff volumes for future development conditions may be attributed to the potential development of estate residential land use to low and medium density residential land uses. The projected future development of vacant parcels also contributes to the increase in runoff volumes. Table 8.5 shows the cumulative peak runoff flows for the two- and ten-year rainfall events and compares the peak flow between the existing and future land use conditions.

Table 8.5 Pimmit Run Cumulative Peak Runoff Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
PM-BH-001	136	160	18%	288	325	13%
PM-BK-001	168	180	7%	307	328	7%
PM-BK-002	106	114	8%	194	209	8%
PM-BK-003	59	73	24%	108	132	22%
PM-BR-001	198	213	8%	356	382	7%
PM-BR-002	144	147	2%	254	258	2%
PM-LP-001	331	346	5%	801	819	2%
PM-LP-002	333	346	4%	753	776	3%
PM-LP-003	76	82	8%	213	221	4%
PM-LP-004	298	307	3%	658	679	3%
PM-LP-005	187	187	0%	353	353	0%
PM-PM-001	1,080	1,140	6%	2,890	2,980	3%
PM-PM-002	1,030	1,090	6%	2,770	2,860	3%
PM-PM-003	951	1,010	6%	2,600	2,690	3%
PM-PM-004	767	824	7%	2,020	2,110	4%
PM-PM-005	68	70	3%	125	128	2%
PM-PM-006	765	822	7%	1,980	2,060	4%
PM-PM-007	749	807	8%	1,860	1,940	4%
PM-PM-008	45	58	29%	86	108	26%
PM-PM-009	710	765	8%	1,640	1,720	5%
PM-PM-010	695	754	8%	1,550	1,630	5%
PM-PM-011	634	691	9%	1,350	1,430	6%
PM-PM-012	591	656	11%	1,360	1,430	5%
PM-PM-013	93	99	6%	187	199	6%
PM-PM-014	441	470	7%	969	1,000	3%
PM-PM-015	313	333	6%	618	653	6%
PM-PM-016	190	203	7%	346	369	7%
PM-PM-017	88	91	3%	151	156	3%
PM-PO-001	21	27	29%	59	65	10%

Subbasin	Two-Year Rainfall Event Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase	Ten-Year Rainfall Event Existing Peak Flow (cfs)	Future Peak Flow (cfs)	% Peak Flow Increase
PM-PO-002	49	58	18%	136	148	9%
PM-SA-001	227	239	5%	426	447	5%
PM-SA-002	99	105	6%	181	193	7%
PM-ST-001	154	158	3%	334	340	2%
PM-ST-002	97	100	3%	212	216	2%
PM-UN-001	55	62	13%	96	108	13%
PM-UN-003	124	131	6%	286	297	4%
PM-UN-004	118	124	5%	228	239	5%

In the water quality model, the moderate levels of pollutants for both existing and future land use conditions can be attributed to the large amount of open space in the watershed. The subbasins that drain to Pimmit Run and its tributaries have a predominant land use of medium density residential for both existing and future land use conditions. The predicted increase in pollutant loads for future land use conditions can be attributed to the projected development of vacant parcels and the projected development of estate residential areas. Table 8.6 shows the annual pollutant loading rates for each subbasin and shows the comparison of the existing and future pollutant loading rates for the Pimmit Run Watershed.

Table 8.6 Pimmit Run Pollutant Loads

Pollutants		Upper Pimmit													Middle Pimmit												Lower Pimmit					Little Pimmit					Potomac Tributaries	
		PM-BK-001	PM-BK-002	PM-BK-003	PM-BR-001	PM-BR-002	PM-PM-012	PM-PM-013	PM-PM-014	PM-PM-015	PM-PM-016	PM-PM-017	PM-UN-003	PM-UN-004	PM-BH-001	PM-PM-004	PM-PM-005	PM-PM-006	PM-PM-007	PM-PM-008	PM-PM-009	PM-PM-010	PM-PM-011	PM-SA-001	PM-SA-002	PM-UN-001	PM-PM-001	PM-PM-002	PM-PM-003	PM-ST-001	PM-ST-002	PM-LP-001	PM-LP-002	PM-LP-003	PM-LP-004	PM-LP-005	PM-PO-001	PM-PO-002
BOD5	Existing (lb/ac/yr)	16.0	21.6	17.6	14.3	41.5	18.0	23.5	12.4	15.9	38.3	33.8	20.2	26.6	14.5	6.6	14.6	15.4	3.0	9.8	12.6	16.5	17.9	35.6	19.8	7.3	17.7	13.1	12.0	20.8	23.1	9.5	16.9	17.1	11.3	22.0	8.8	4.1
	Future (lb/ac/yr)	17.0	23.0	22.4	21.0	44.5	19.6	25.1	14.8	18.1	42.8	40.4	21.3	27.1	19.0	9.3	15.8	17.2	5.5	15.0	17.3	20.2	18.7	40.1	22.1	9.9	18.4	15.4	12.7	21.3	23.7	12.5	18.0	19.2	12.5	22.0	12.8	6.6
	% Load Increase	6%	6%	27%	47%	7%	9%	7%	19%	14%	12%	20%	5%	2%	31%	41%	8%	12%	83%	53%	37%	22%	4%	13%	12%	36%	4%	18%	6%	2%	3%	32%	7%	12%	11%	0%	45%	61%
COD	Existing (lb/ac/yr)	95	128	117	83	186	106	136	72	90	277	235	115	161	84	38	81	89	18	59	73	93	102	203	126	42	100	75	68	118	130	54	94	102	64	125	65	23
	Future (lb/ac/yr)	102	136	147	121	209	115	144	86	104	305	251	121	164	108	52	88	99	32	87	99	114	107	223	141	56	104	88	72	120	133	71	100	114	70	125	91	37
	% Load Increase	7%	6%	26%	46%	12%	8%	6%	19%	16%	10%	7%	5%	2%	29%	37%	9%	11%	78%	47%	36%	23%	5%	10%	12%	33%	4%	17%	6%	2%	2%	31%	6%	12%	9%	0%	40%	61%
TSS	Existing(lb/ac/yr)	50	70	66	44	139	57	80	42	57	122	140	63	95	52	22	46	63	10	34	39	51	62	140	73	29	55	41	37	66	70	30	56	61	37	75	26	13
	Future (lb/ac/yr)	53	75	83	65	143	62	86	50	65	135	149	67	96	63	30	50	70	18	48	54	62	65	148	80	37	57	48	39	67	72	38	59	68	40	75	38	20
	% Load Increase	6%	7%	26%	48%	3%	9%	8%	19%	14%	11%	6%	6%	1%	21%	36%	9%	11%	80%	41%	38%	22%	5%	6%	10%	28%	4%	17%	5%	2%	3%	27%	5%	11%	8%	0%	46%	54%
TDS	Existing (lb/ac/yr)	70	93	92	61	184	80	102	60	74	178	175	85	121	67	33	61	75	17	50	55	69	81	165	100	36	75	59	50	86	94	43	72	78	49	95	41	19
	Future (lb/ac/yr)	73	99	111	87	192	86	109	70	83	196	193	90	124	83	41	66	83	26	63	75	85	84	177	109	44	78	66	53	88	96	53	76	86	52	95	58	27
	% Load Increase	4%	6%	21%	43%	4%	8%	7%	17%	12%	10%	10%	6%	2%	24%	24%	8%	11%	53%	26%	36%	23%	4%	7%	9%	22%	4%	12%	6%	2%	2%	23%	6%	10%	6%	0%	41%	42%
DP	Existing (lb/ac/yr)	0.28	0.35	0.25	0.25	0.40	0.29	0.38	0.22	0.26	0.45	0.46	0.33	0.40	0.26	0.17	0.30	0.27	0.08	0.18	0.24	0.29	0.29	0.50	0.30	0.19	0.30	0.23	0.26	0.36	0.41	0.20	0.29	0.32	0.23	0.36	0.16	0.13
	Future (lb/ac/yr)	0.29	0.37	0.32	0.34	0.44	0.31	0.40	0.24	0.29	0.50	0.48	0.34	0.41	0.32	0.22	0.31	0.30	0.14	0.30	0.28	0.33	0.30	0.52	0.32	0.24	0.31	0.26	0.27	0.37	0.41	0.26	0.30	0.35	0.25	0.36	0.23	0.19
	% Load Increase	4%	6%	28%	36%	10%	7%	5%	9%	12%	11%	4%	3%	2%	23%	29%	3%	11%	75%	67%	17%	14%	3%	4%	7%	26%	3%	13%	4%	3%	0%	30%	3%	9%	9%	0%	44%	46%
TP	Existing (lb/ac/yr)	0.39	0.49	0.35	0.36	0.57	0.40	0.54	0.31	0.38	0.65	0.65	0.47	0.56	0.37	0.24	0.43	0.38	0.12	0.25	0.34	0.42	0.41	0.71	0.42	0.27	0.42	0.32	0.36	0.51	0.57	0.29	0.41	0.45	0.32	0.51	0.23	0.19
	Future (lb/ac/yr)	0.41	0.52	0.45	0.47	0.61	0.44	0.57	0.34	0.41	0.70	0.68	0.48	0.57	0.44	0.31	0.44	0.42	0.20	0.43	0.39	0.47	0.43	0.73	0.45	0.35	0.43	0.37	0.38	0.52	0.58	0.37	0.43	0.50	0.36	0.51	0.32	0.27
	% Load Increase	5%	6%	29%	31%	7%	10%	6%	10%	8%	8%	5%	2%	2%	19%	29%	2%	11%	67%	72%	15%	12%	5%	3%	7%	30%	2%	16%	6%	2%	2%	28%	5%	11%	13%	0%	39%	42%
TKN	Existing (lb/ac/yr)	2.2	2.8	2.0	2.0	2.9	2.3	3.1	1.8	2.2	3.6	3.8	2.7	3.2	2.1	1.3	2.4	2.2	0.7	1.4	1.9	2.4	2.4	4.0	2.4	1.5	2.5	1.8	2.0	2.9	3.3	1.6	2.3	2.5	1.8	2.9	1.3	1.0
	Future (lb/ac/yr)	2.3	3.0	2.6	2.7	3.2	2.5	3.3	2.0	2.4	3.9	3.8	2.8	3.3	2.6	1.7	2.5	2.4	1.0	2.3	2.3	2.7	2.5	4.1	2.6	1.9	2.5	2.1	2.1	3.0	3.3	2.0	2.4	2.8	2.0	2.9	1.7	1.4
	% Load Increase	5%	7%	30%	35%	10%	9%	6%	11%	9%	8%	0%	4%	3%	24%	31%	4%	9%	43%	64%	21%	13%	4%	2%	8%	27%	0%	17%	5%	3%	0%	25%	4%	12%	11%	0%	31%	40%
TN	Existing (lb/ac/yr)	2.99	3.84	2.88	2.72	5.42	3.15	4.25	2.38	2.97	5.41	5.59	3.60	4.54	2.89	1.74	3.21	3.09	0.89	1.94	2.56	3.17	3.24	5.94	3.40	2.06	3.26	2.43	2.68	3.94	4.36	2.16	3.18	3.48	2.42	3.98	1.80	1.33
	Future (lb/ac/yr)	3.16	4.08	3.71	3.67	5.78	3.41	4.50	2.66	3.27	5.89	5.99	3.76	4.64	3.47	2.27	3.32	3.40	1.40	3.21	3.04	3.62	3.37	6.21	3.66	2.56	3.32	2.83	2.82	4.00	4.45	2.73	3.33	3.88	2.67	3.99	2.42	1.92
	% Load Increase	6%	6%	29%	35%	7%	8%	6%	12%	10%	9%	7%	4%	2%	20%	30%	3%	10%	57%	65%	19%	14%	4%	5%	8%	24%	2%	16%	5%	2%	2%	26%	5%	11%	10%	0%	34%	44%
Cadmium ($x 10^{-4}$)	Existing (lb/ac/yr)	2.3	2.7	2.3	2.1	1.7	2.5	2.9	2.1	2.2	3.7	3.4	2.7	3.0	2.2	1.6	2.4	2.1	1.0	1.8	2.1	2.4	2.4	3.6	2.7	1.6	2.5	2.1	2.1	2.8	3.1	1.9	2.3	2.5	1.9	2.7	1.5	1.2
	Future (lb/ac/yr)	2.4	2.8	2.7	2.6	1.9	2.7	3.0	2.3	2.4	3.9	3.2	2.8	3.1	2.5	1.8	2.4	2.2	1.3	2.3	2.5	2.7	2.4	3.7	2.9	1.8	2.6	2.2	2.2	2.8	3.2	2.1	2.3	2.6	2.0	2.7	1.9	1.4
	% Load Increase	4%	4%	17%	24%	12%	8%	3%	10%	9%	5%	-6%	4%	3%	14%	13%	0%	5%	30%	28%	19%	13%	0%	3%	7%	13%	4%	5%	5%	0%	3%	11%	0%	4%	5%	0%	27%	17%
Copper ($x 10^{-3}$)	Existing (lb/ac/yr)	11.7	17.9	30.3	9.4	58.6	12.4	19.2	8.6	14.0	70.6	72.2	10.9	30.3	12.2	4.9	8.4	19.2	2.0	10.3	7.0	8.0	14.1	47.9	27.7	8.2	8.6	6.7	5.9	11.4	10.7	5.0	13.3	18.3	7.2	16.0	14.9	2.4
	Future (lb/ac/yr)	12.8	19.0	34.1	13.1	62.1	13.2	19.4	9.8	15.0	75.4	72.4	11.5	30.4	12.6	6.1	9.0	21.0	3.4	11.9	9.2	9.6	14.6	47.7	29.5	9.6	8.9	7.6	6.2	11.6	11.0	6.2	13.5	20.1	7.2	16.0	18.9	3.3
	% Load Increase	9%	6%	13%	39%	6%	6%	1%	14%	7%	7%	0%	6%	0%	3%	24%	7%	9%	70%	16%	31%	20%	4%	0%	6%	17%	3%	13%	5%	2%	3%	24%	2%	10%	0%	0%	27%	38%
Lead ($x 10^{-3}$)	Existing (lb/ac/yr)	2.9	3.8	3.7	2.6	10.8	3.4	4.0	2.6	3.0	7.1	6.0	3.6	4.8	2.7	1.5	2.6	2.8	0.8	2.3	2.4	2.9	3.3	6.9	4.1	1.4	3.2	2.6	2.1	3.5	3.9	1.9	3.2	3.0	2.1	3.8	1.7	0.9
	Future (lb/ac/yr)	3.0	3.9	4.2	3.6	11.1	3.6	4.3	3.1	3.4	7.8	8.1	3.7	4.8	3.4	1.8	2.8	3.1	1.2	2.6	3.3	3.6	3.4	7.9	4.4	1.7	3.3	2.9	2.2	3.6	4.0	2.2	3.3	3.3	2.1	3.8	2.3	1.1
	% Load Increase	3%	3%	14%	38%	3%	6%	8%	19%	13%	10%	35%	3%	0%	26%	20%	8%	11%	50%	13%	38%	24%	3%	14%	7%	21%	3%	12%	5%	3%	3%	16%	3%	10%	0%	0%	35%	22%
Zinc ($x 10^{-2}$)	Existing (lb/ac/yr)	5.4	8.4	11.4	4.7	34.0	6.3	10.0	4.7	7.7	18.9	26.1	6.4	13.5	6.6	2.6	4.9	10.1	1.0	4.4	3.8	4.8	7.8	22.2	11.2	4.2	5.2	3.9	3.5	6.7	6.6	2.9	6.8	8.5	4.1	9.0	3.5	1.3
	Future(lb/ac/yr)	5.7	8.8	13.2	6.8	35.0	6.7	10.5	5.5	8.3	20.5	28.7	6.7	13.4	7.2	3.3	5.3	11.0	1.9	5.6	5.2	5.8	8.1	22.0	12.0	5.1	5.3	4.5	3.7	6.9	6.7	3.6	6.9	9.4	4.2	9.0	4.9	1.9
	% Load Increase	6%	5%	16%	45%	3%	6%	5%	17%	8%	8%	10%	5%	-1%	9%	27%	8%	9%	90%	27%	37%	21%	4%	-1%	7%	21%	2%	15%	6%	3%	2%	24%	1%	11%	2%	0%	40%	46%

8.1.7.2 Hydraulic Modeling

The hydraulic model includes the portion of Pimmit Run from the boundary of Arlington County to its headwaters, along with Little Pimmit Run, Stromans Branch, Saucy Branch, Bridge Branch and Darrell Branch. The hydraulic model results show that the peak discharge from the two-year rainfall event is contained within the main channel banks for almost all of the modeled length of Pimmit Run. However, an elliptical culvert across Tennyson Drive, a box culvert and multi-pipe culvert driveway crossing at Ranleigh Road, and a bridge across Kirby Road were found to be overtopped during the ten- and 100-year storm events. The peak discharge from the ten-year rainfall event is generally contained within the main channel banks with a few areas of minor overtopping where there are adjacent and connected floodplains. Pimmit Run Watershed has been heavily developed over the years, resulting in higher imperviousness. Hence, future changes due to redevelopment in this watershed will not significantly affect the overall imperviousness of the watershed but instead, present an opportunity to improve existing stormwater controls. Therefore, the future conditions hydraulic modeling results are consistent with the existing conditions results.

The majority of the 100-year event slightly overtops the main channel banks as well as the tributary banks; however, the floodplains are utilized where they are connected to the stream channel. Sixty properties have buildings that lie within the 100-year floodplain and these locations are listed in the Flood Protection Project PM9663.

The velocities produced by the model for the two-year rainfall event in the Pimmit Run Watershed average approximately 5.3 ft/sec. The velocities are somewhat lower through the stream's upstream portions and increase as the stream flows northeast to its confluence with the Potomac River. The model indicates higher and much more erosive velocities at the stream segment located downstream of the concrete channels on Pimmit Run, which is likely caused by the channelization and constriction of Pimmit Run in this area.

According to the county's SPA, over 5,000 linear feet of erosion along the stream banks was observed in the bends and meanders of the upstream half of Pimmit Run and along most areas of Little Pimmit Run. The 2001 SPA also characterized these portions as CEM Type 3, which means they are actively widening. This characterization is further supported by the results of the hydraulic model because the flow for the two-year storm is contained mostly within the channel banks. The flow volumes are causing erosion and changes in the stream channel geometry in the more sinuous portions of Pimmit Run and its tributaries. Please note that conditions in the stream may have worsened since the SPA was conducted due to new development in the watershed.

8.2 Management Plan Strategy

This section outlines proposed projects for the Pimmit Run Watershed. The locations of the projects in this section are shown on Maps 8.7, 8.8, and 8.9. The projects are organized by goal, objective and action as they were presented in Chapter 3.

Goal A: Reduce stormwater impacts to protect human health, safety and

property.

Objective 1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Action A1.1: Retrofit existing stormwater management facilities and BMPs.

A number of the BMP retrofit options described in Section 3.2.1 may be suitable for implementation in the Pimmit Run Watershed. These options are:

1. Increasing detention storage
2. Modifying or replacing existing riser structures and/or outlet controls
3. Adding infiltration features
4. Modifying basins that are currently "short circuiting"
5. Redirecting runoff from additional drainage area
6. Adding water quality treatment
7. Planting buffer vegetation

Locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described below and grouped by public or private ownership. Retrofit option numbers from the list above are provided in the following project descriptions.

Public BMP Retrofits

Upper Pimmit Run

- Publicly owned dry detention BMP at the southeast corner of Kirby Road and Great Falls Street opposite of 2072 Kirby Road. Possible retrofit options include 2 and 6. Modifying the outlet structure will provide detention of the channel erosion control volume and adding a shallow wetland will increase the removal of pollutants. (BMP Retrofit Project PM9133)
- Publicly owned dry detention SWM basin at Brooks Square Place town home community located at 2035 Brooks Square Place. Adding a riser structure will allow for extended detention storage and adding a shallow wetland will also improve water quality. Possible retrofit options include 2, 6, and 7. (BMP Retrofit Project PM9136)
- Publicly owned dry detention SWM facility at 2225 McLean Park Road at the Churchill Square town homes. Possible retrofit options include 2 and 6. Modifying the riser structure will allow for storage of the channel erosion control volume and adding a shallow wetland will improve water quality. (BMP Retrofit Project PM9148)
- Publicly owned dry detention SWM basin at Tysons Pimmit Regional Library located at 7550 Leesburg Pike. Modifying the riser structure will allow for extended detention storage and storage of the channel erosion control volume. Adding a shallow wetland will also improve water quality. The existing channel located behind the library near the picnic area should be regraded and modified to an infiltration basin or dry detention pond. Possible retrofit options include 2 and 6. (BMP Retrofit Project PM9153)
- Publicly owned dry detention SWM basin at the Marshall Heights multi-family residential property located at 2100 Dominion Heights Drive. Possible retrofit options include 2 and 6. Adding a shallow wetland will help to improve water quality. (BMP Retrofit Project PM9154)

- Publicly owned dry detention BMP at the Courts of Tyson multi-family residential community located at 2117 Madron Lane. Possible retrofit options include modifying the riser structure to allow storage of the channel erosion control volume and adding a shallow wetland to provide greater pollutant removal. (BMP Retrofit Project PM9161)

Middle Pimmit Run

- Publicly owned dry detention SWM basin at Hamptons of McLean, a townhouse community, located at 1473 Hampton Ridge Drive. Possible retrofit options include 2, 6, and 7. (BMP Retrofit Project PM9116)
- Publicly owned BMP in the Brookhaven Neighborhood, located at the corner of Forest Villa Lane and Highland Glen Place. Possible retrofit options include 2, 3, 6, and 7. (BMP Retrofit Project PM9170)
- Publicly owned BMP in the Forest Villa Neighborhood, located at 1619 Linway Park Drive. Possible retrofit options include 2 and 6. (BMP Retrofit Project PM9175)

Lower Pimmit Run

- Publicly owned SWM pond located in the ravine behind 1416 Grady Randall Court. The BMP is currently abandoned due to a breach in the earthen dam. Since the outlet structure is still intact and appears to be in good condition, it may be reasonable to restore the BMP to use. The most important retrofit will be to repair or rebuild the earthen dam. The outlet structure may also need to be cleaned and/or replaced. (BMP Retrofit Project PM9176)

Private BMP Retrofits

Upper Pimmit Run

- Privately owned dry detention BMP at Temple Rodef Shalom located at 2100 Westmoreland Street. Possible retrofit options for this facility include 2 and 6. This dry detention basin is holding water like a wet pond and may also be contributing to flooding downstream. The basin outlet structure should be evaluated to determine the best options for retrofitting to allow it to function as a dry detention basin. Modifying the riser structure may also allow detention of the channel erosion control volume and adding a shallow wetland will help improve the water quality. (BMP Retrofit Project PM9134)
- Privately owned dry detention SWM facility located on Washington Metropolitan Area Transit Authority property located at 7040 Haycock Road. Possible retrofit options for this facility include 2, 6, and 7. The land surrounding the pond is very steep which will make it difficult to enlarge. Adding a shallow wetland will help to provide water quality treatment of runoff. (BMP Retrofit Project PM9140)
- Privately owned dry detention SWM facility located at the Northern Virginia Center of the University of Virginia at 7048 Haycock Road. Possible retrofit options include 2 and 6, and 7. Modifying the riser structure will allow for extended detention storage and storage of the channel erosion control volume. Adding a shallow wetland will also improve water quality. (BMP Retrofit Project PM9142)
- Retrofit the northern-most privately owned dry detention SWM facility located at 2251 Pimmit Drive at the Fairfax Towers Apartments. Possible retrofit options include 2, 6, and 7. On July 7, 2004, the county inspected the ponds and silt was noticed in one of the ponds. The silt should be removed as part of this retrofit project in order to restore capacity to the dry detention facility. Modifying the riser structure will provide extended detention storage and storage of the channel erosion control volume. Adding a shallow

wetland will also help improve the water quality. (BMP Retrofit Project PM9149)

- Dry detention BMP at The Renaissance apartment building located at 2230 George C. Marshall Drive. Possible retrofit options include 2, 6, and 7.(BMP Retrofit Project PM9158)
- Retrofit the southern-most privately owned dry detention SWM facility for the commercial property located at 7990 Science Application Court. Possible retrofit options include 2, 6, and 7. (BMP Retrofit Project PM9160)

Middle Pimmit Run

- Privately owned SWM wet pond located in Lynwood neighborhood at 1239 Aldebaran Drive. The Lynwood Home owners association owns this BMP. Possible retrofits for this facility include options 2, 6, and 7. (BMP Retrofit Project PM9112)

Little Pimmit Run

- Privately owned dry detention BMP at Vinson Hall, a retirement community, located at 1739 Kirby Road. Vinson Hall Corporation owns the BMP. Possible retrofits for this facility include options 2 6, and 7. Modifying the riser structure will allow for storing the channel erosion control volume and adding a shallow wetland will help to improve water quality. This project should be completed in conjunction with New LID project PM9805. (BMP Retrofit Project PM9106)

The size of the proposed drainage areas and the benefits for the BMP retrofits that will be implemented first are included in Table 8.7. The projects that will be implemented later in the watershed plan did not have drainage areas or benefits calculated for them and have an N/A in these columns. These parameters will be computed prior to the implementation of the projects.

Table 8.7 Benefits of Stormwater Management Facility and BMP Retrofits

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
PM9106	PM-LP-002	1739 Kirby Road	17.7	4.9	1.0
PM9112	PM-UN-001	1239 Aldebaran Drive	N/A	N/A	N/A
PM9116	PM-SA-001	1473 Hampton Ridge Drive	5.0	3.4	0.7
PM9133	PM-PM-012	2072 Kirby Road	6.2	1.3	0.3
PM9134	PM-UN-002	2100 Westmoreland Street	6.1	1.2	0.2
PM9136	PM-UN-002	2035 Brooks Square Place	2.0	1.4	0.1
PM9140	PM-BR-002	7040 Haycock Road	21.2	5.9	2.4
PM9142	PM-BR-002	7048 Haycock Road	4.3	2.9	0.3
PM9148	PM-BR-002	2225 McLean Park Road	8.3	1.7	0.1
PM9149	PM-PM-016	2251 Pimmit Drive	18.4	12.4	1.6
PM9153	PM-UN-004	7550 Leesburg Pike	17.5	8.8	1.4
PM9154	PM-PM-016	2100 Dominion Heights Court	4.8	1.0	0.2
PM9158	PM-PM-017	2230 George C. Marshall Drive	7.9	1.6	0.6

Project Number	Subbasin ID	Location	Proposed Drainage Areas (acres)	Total Phosphorus Removal (lbs/yr)	Channel Erosion Control Volume Provided (ac-ft)
PM9160	PM-PM-017	7990 Science Application Court	8.3	7.7	1.8
PM9161	PM-PM-017	2117 Madron Lane	16.2	3.3	0.9
PM9170	PM-BH-001	Highland Glen Place	N/A	N/A	N/A
PM9175	PM-BH-001	1619 Linway Park Drive	2.0	0.3	0.1
PM9176	PM-PM-002	1416 Grady Randall Court	N/A	N/A	N/A

Action A1.2: Construct new BMPs including Low Impact Development (LID) practices.
The new BMP projects have been grouped into public or privately owned land and conventional BMPs or LID methods. The proposed new BMP locations are described below and are shown on Maps 8.7, 8.8, and 8.9.

New Public BMPs

Upper Pimmit Run

- Construct a new one-year extended dry detention BMP at Olney Park located at 1840 Olney Road. There is an open area of approximately 2,400 square feet at the southeast corner of the street that may be appropriate for a BMP site. (New BMP Project PM9144)
- Construct a new one-year extended dry detention BMP at the George C. Marshall High School at 7731 Leesburg Pike. There is an open flat area of land behind the baseball field near the edge of the property adjacent to George C. Marshall Drive that may be used as a new BMP site. The open area is approximately 4,100 square feet and is located near the storm drain network. Another possible location for a linear dry detention BMP may be at the southwest edge of the property. (New BMP Project PM9155)

Middle Pimmit Run

- Construct a new one-year extended dry detention BMP at McLean High School located at 1633 Davidson Road. The BMP should be located in the open area at the northeast corner of the property where it drains to Saucy Branch. The area adjacent to the stream is wooded, but there is an open area near Westmoreland Street with approximately 2,200 square feet of land that may be appropriate for a BMP site. (New BMP Project PM9120)

Public LID Projects

Schools were targeted for LID projects because, with the exception of the Potomac School, the properties are owned by the county, usually have large impervious areas, most have no existing stormwater controls, and the projects are ideally situated to help educate the students on watershed issues. Parks were also targeted for LID projects because the land is owned by the Park Authority and county facilities should be examples of environmentally friendly design.

Upper Pimmit Run

- Construct LID practices at Kirby Park located at 2020 Kirby Road and at the McLean Little League Baseball Fields located at 1836 Westmoreland Street. Current channels along the baseball field should be regraded or modified into infiltration trenches or bioswales. A riparian buffer should be reestablished along the stream. (New LID Project PM9826)

- Construct LID practices at Longfellow Middle School located at 2000 Westmoreland Street. The existing eroded channels near the stream and the side of the school could be regraded and modified into infiltration trenches or bioswales. In addition, bioretention areas could be added in the landscaped areas around the school and around inlets near the track. Also, some of the storm drain inlets in the parking lot may be replaced with tree box filters. (New LID Project PM9829)
- Construct LID practices at Haycock Elementary School located at 6616 Haycock Road. Two bioretention areas could be added, one near the front parking lot and another to capture runoff from the playground in the back of the school. Four storm drain inlets in the parking lots could be replaced with tree box filters. (New LID Project PM9831)
- Construct LID practices at the City of Falls Church George Mason Middle School and High School located at 7124 Leesburg Pike. Bioretention areas could be installed in the parking lot medians and around the building to help detain water and remove pollutants. Ten storm drain inlets in the parking lots could be replaced with tree box filters. (New LID Project PM9843)
- Construct LID practices at Marshall High School at 7731 Leesburg Pike. The school property is located adjacent to a portion of Pimmit Run and implementing LID methods will help improve water quality before the runoff enters the stream. Bioretention areas could be added to the medians in the parking lots, around the buildings, and around the athletic fields. Ten storm drain inlets in the parking lots could be replaced with tree box filters. (New LID Project PM9856)
- Construct LID practices at the Lemon Road School located at 7230 Idylwood Road. The school is located adjacent to a portion of Pimmit Run that will be restored as part of Project PM9232. The LID and stream restoration should be coordinated to maximize the benefits of both projects. Bioretention areas could be added in the landscaped around the school and an existing channel at the rear of the school could be regraded and turned into a bioswale. (New LID Project PM9867)
- Construct LID practices at the Mount Daniel Elementary School located at 2328 North Oak Street. The school is surrounded by open fields, part of which could be used for a bioretention area. Also, an infiltration trench or bioswale could be constructed adjacent to the parking lot to treat the pollutants in the runoff. (New LID Project PM9871)

Middle Pimmit Run

- Construct LID practices at the Potomac School, located at 1301 Potomac School Road, adjacent to Pimmit Run. The existing channel leading to the wet pond can be regraded or modified into an infiltration trench or bioswale. (New LID Project PM9810)
- Construct LID practices at the McLean High School located at 1633 Davidson Road near Saucy Branch. Implementing LID methods at this location will benefit downstream restoration of Saucy Branch, a tributary of Pimmit Run. Currently the school's runoff flows directly into the stream without any stormwater controls. Bioretention areas could be constructed in the grassed areas in order to reduce the peak runoff and pollutants from the parking lot and the building. An existing channel to the west of the school could be regraded and turned into a bioswale and ten tree box filters could be installed in the drop inlets in the parking lots. (New LID Project PM9821)
- Construct LID practices at Lewinsville Park at 1659 Chain Bridge Road. The park is located adjacent to Saucy Branch. The existing eroding ditches along the parking area and soccer field could be regraded and modified to be infiltration trenches or bioswales. (New LID

Project PM9822)

- Construct LID practices at Franklin Sherman Elementary School located at 6630 Brawner Street. Bioswales and infiltration trenches should be installed along the athletic fields to help redirect runoff and reduce peak flows. (New LID Project PM9823)
- Construct LID practices at Kent Gardens Elementary School located at 1717 Melbourne Road. This school is located near Middle Pimmit Run and currently does not have water quality controls. Installing rain gardens near the buildings and in the athletic fields will help improve water quality before the runoff enters the stream. (New LID Project PM9824)
- Construct LID practices at Linway Terrace Park located at 6246 Linway Terrace, near Bryan Branch. Infiltration trenches or bioswales could be constructed adjacent to the parking lot to treat the runoff and help reduce the peak flows. Also, an existing grass swale adjacent to the soccer field can be regraded and turned into a bioswale. (New LID Project PM9872)

Little Pimmit Run

- Construct LID practices at Chesterbrook Elementary School located at 1753 Kirby Road. This school is located adjacent to an unnamed tributary to Little Pimmit Run and has a large amount of impervious surface from the parking lot. Bioretention areas could be installed in the parking lot medians and in the landscaped areas. Replacing the asphalt playground surface with porous pavement will help reduce the peak runoff. An infiltration trench could be constructed adjacent to the parking lot in order to treat the pollutants in the runoff from the parking lot. (New LID Project PM9807)

Private LID Projects

LID projects are recommended for the privately owned commercial properties, multi-family residential developments, and places of worship listed below. These LID sites were chosen because they have large impervious areas and do not have existing stormwater management controls.

Upper Pimmit Run

- Construct LID practices at Temple Rodef Shalom located at 2100 Westmoreland Street near Burke's Spring Branch. There are grassed areas between the parking rows in the parking lot that could be modified into rain gardens or infiltration trenches. (New LID Project PM9830)
- Construct LID practices at the Pavilion condominium complex at 7011 Falls Reach Road. There are numerous landscaped areas around the buildings where bioretention could be added. (New LID Project PM9839)
- Construct LID practices at the West Falls Church Metro station parking lot and parking garage across the street from 7048 Haycock Road. This Metro station has large amounts of impervious surface and currently does not have any water quality controls. Implementing bioretention in the medians of the parking lot, as well as adding tree box filters to the drop inlets in the parking lot, will help to reduce the peak runoff. (New LID Project PM9841)
- Construct LID practices at the Idlywood Towers Condominiums located at 2311/2300 Pimmit Drive. Bioretention areas could be installed in the medians of the parking lots. Tree box filters could replace the storm drain inlets in the parking lots. Bioretention areas could also be added in the landscaped areas near the buildings and yard inlets. (New LID Projects PM9850 and PM9852)

- Construct LID practices at the Tysons Glen multi-family residential development, located at 2250 Mohegan Drive. Bioretention areas could be constructed in the landscaped areas around the buildings and around yard inlets. Some of the storm drain inlets in the parking lot could also be replaced with tree box filters. (New LID Project PM9857)
- Install LID practices at the Tysons Renaissance high rise commercial property located at 2230 George C Marshall Drive. Storm drain inlets in the parking lots can be replaced with tree box filters. Also, landscaped areas around the building can be turned into rain gardens. (New LID Project PM9859)
- Construct LID practices at the commercial property located at 7990 Science Application Court. This location has a large amount of impervious surface in the parking lot. Adding bioretention in the landscaped areas near the buildings and in the medians of the parking lots will help to reduce runoff. The storm drain inlets could be replaced with tree box filters in the parking lots. (New LID Project PM9862)
- Construct LID practices at the Church of Jesus Christ of Latter-day Saints located at 2034 Great Falls Street. Bioretention could be installed in the parking lot medians and around the building to help detain water and remove pollutants. The storm drain inlets in the parking lot could also be replaced with tree box filters. (New LID Project PM9873)
- Construct LID practices at Chesterbrook Presbyterian Church located at 2036 Westmoreland Street. The church is located adjacent to Burke's Spring Branch and implementing LID methods will help improve water quality before the runoff enters the stream. Bioretention could be added to one of the grassed medians in the parking lot and also adjacent to the west edge of the parking lot to reduce runoff and pollutants. (New LID Project PM9874)

Middle Pimmit Run

- Construct LID practices at Saint John’s Catholic Church and School located at 6422 Linway Terrace. A tree box filter could replace the grate inlet that is located to the left of the Vianney House, a church building. The channel located along Linway Terrace at the front of the property could be converted into a bioswale. Bioretention areas could be installed near the buildings and in the landscape medians in the parking lot. Porous pavement could be installed in the outlying parking spaces in the northeast parking lot. (New LID Project PM9813)
- Construct LID practices at the McLean Chain Bridge Shopping Center at 1445 Chain Bridge Road, Langley Shopping Center at 1362 Chain Bridge Road, and Chain Bridge Corner at 6825 Redmond Drive. LID options may include installing tree box filters in the parking areas and constructing bioretention areas in the landscape medians in the parking areas. (New LID Project PM9818)
- Construct LID practices at McLean Baptist Church at 1367 Chain Bridge Road and at Redeemer Lutheran Church at 1545 Chain Bridge Road. McLean Baptist Church has landscaped areas around the building and parking lot that can be converted into bioretention areas. Redeemer Lutheran Church has a large landscaped area in front of the church which can be converted to a bioretention area to help reduce runoff. Bioretention areas could also be added in the landscaped areas around the church. (New LID Project PM9877)
- Construct LID practices at St. Dunstan Episcopal Church at 1830 Kirby Road and the Chesterbrook Swimming Club at 1812 Kirby Road. Adding bioretention in the landscaped

areas near the buildings and in the medians of the parking lots will help to reduce runoff. The storm drain inlets at the swim club could be replaced with tree box filters in the parking lot. (New LID Project PM9880)

Little Pimmit Run

- Construct LID practices at the Chesterbrook Methodist Church located at 6224 Old Dominion Drive. A bioswale should be installed east of the church along the side of the property in order to help redirect runoff and reduce peak flows. In the open field on the east side of the property, a bioretention basin could be constructed to help reduce runoff. (New LID Project PM9804)
- Construct LID practices at Vinson Hall, a retirement community, located at 1739 Kirby Road. Vinson Hall has large amounts of green space around the buildings and in the front yard along Kirby Road. Bioswales or bioretention areas could be installed adjacent to the parking lots or the building. This project should be completed in conjunction with the BMP Retrofit project PM9106. (New LID Project PM9805)
- Construct LID practices at the Chesterbrook Shopping Center located at 6224 Old Dominion Drive. LID options could include replacing the drop inlets in the parking lot with tree box filters and constructing bioretention areas in the parking lot medians and landscape areas. (New LID Project PM9825)

The pollutant removal benefit for the New BMP and LID projects that will be implemented first is shown in Table 8.8. The projects that will be implemented later in the watershed plan did not have drainage areas or benefits calculated for them and have an N/A in these columns. These parameters will be computed prior to the implementation of the projects.

Table 8.8 Benefits of New BMPs and LID Projects

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
PM9120	PM-SA-002	1633 Davidson Road	3.1	2.9
PM9144	PM-UN-003	1840 Olney Road	2.8	1.4
PM9155	PM-PM-016	7731 Leesburg Pike	13.7	12.7
PM9804	PM-LP-002	6224 Old Dominion Drive	N/A	N/A
PM9805	PM-LP-002	1739 Kirby Road	4.4	4.3
PM9807	PM-LP-003	1753 Kirby Road	N/A	N/A
PM9810	PM-PM-006, PM-UN-001	1301 Potomac School Road	N/A	N/A
PM9813	PM-BH-001	6422 Linway Terrace	N/A	N/A
PM9818	PM-SA-001	1445 Chain Bridge Road, 1362 Chain Bridge Road, and 6825 Redmond Drive	N/A	N/A
PM9821	PM-SA-002, PM-PM-011	1633 Davidson Road	8.2	8.0
PM9822	PM-SA-002	1659 Chain Bridge Road	12.9	2.7
PM9823	PM-SA-002	6630 Brawner Street	2.5	2.5
PM9824	PM-PM-011	1717 Melbourne Road	4.1	4.0
PM9825	PM-LP-002	6224 Old Dominion Drive	3.6	3.5
PM9826	PM-PM-012	2020 Kirby Road	N/A	N/A
PM9829	PM-UN-002, PM-BK-001	2000 Westmoreland Street	7.2	6.7

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
PM9830	PM-UN-002	2100 Westmoreland Street	3.0	2.6
PM9831	PM-UN-002, PM-BK-002	6616 Haycock Road	3.0	2.9
PM9839	PM-BK-002	7011 Falls Reach Drive	2.0	2.0
PM9841	PM-BR-002	7048 Haycock Road	8.6	8.4
PM9843	PM-BR-002	7124 Leesburg Pike	12.0	10.6
PM9850	PM-PM-016	2311 Pimmit Drive	6.9	5.8
PM9852	PM-PM-016	2300 Pimmit Drive	5.1	4.5
PM9856	PM-PM-016, PM-PM-017	7731 Leesburg Pike	16.5	16.2
PM9857	PM-PM-016	2250 Mohegan Drive	7.2	6.7
PM9859	PM-PM-017	2230 George C Marshall Drive	6.2	6.1
PM9862	PM-PM-017	7990 Science Application Court	6.8	6.7
PM9867	PM-PM-015	7230 Idylwood Road	3.0	2.8
PM9871	PM-BR-002	2328 North Oak Street	2.3	2.3
PM9872	PM-BH-001	6246 Linway Terrace	12.2	2.6
PM9873	PM-PM-012	2034 Great Falls Street	3.5	3.4
PM9874	PM-BK-003	2036 Westmoreland Street	1.3	1.1
PM9877	PM-SA-001 PM-SA-002	1367 & 1545 Chain Bridge Road	6.7	4.2
PM9880	PM-BH-001	1812 & 1830 Kirby Road	N/A	N/A

Action A1.3: Construct LID practices in neighborhoods in the public rights-of-way and encourage LID practices on private property.

The neighborhoods selected for neighborhood stormwater improvements do not have existing stormwater management controls and the runoff from these neighborhoods contributes to downstream erosion problems. Targeting these neighborhoods for LID methods will help to mitigate the effects of the impervious surfaces and to improve the effectiveness of stream restoration projects downstream. The neighborhood stormwater improvement areas are described below and are shown on Maps 8.7, 8.8 and 8.9.

Upper Pimmit Run

- Construct LID practices in the Nantucket and Westmoreland Heights neighborhoods. These neighborhoods are located adjacent to an unnamed tributary to Upper Pimmit Run and the runoff releases directly into the stream. Currently this neighborhood has concrete sidewalks, curb and gutter, storm drain inlets and many cul-de-sacs. Bioretention areas could be created in the cul-de-sacs to capture the runoff from the street and the surrounding houses. The storm drain inlets could be replaced with tree box filters. Infiltration trenches could be installed between the sidewalk and the curb. Also, there is a minor flooding problem near Relda Court that may be caused by leaking storm drain pipes that should be investigated as part of this project. (Neighborhood Stormwater Improvement Area PM9827)
- Construct LID practices in the Pimmit Hills and Olney Park neighborhoods. These neighborhoods are located adjacent to the main stem of Upper Pimmit Run and currently have no water quality controls. There are concrete sidewalks, curb and gutter, and storm drain inlets. The storm drain pipes have been cleaned recently, but the curb, gutter, and

sidewalk may need to be replaced in some areas in the future. The area between the sidewalk and the curb could be made into an infiltration strip. On the side of the street that does not have a sidewalk, a small bioretention or infiltration area could be constructed. The storm drain inlets could be replaced with tree box filters. Flooding has been occurring on Griffith Road and the surrounding area due to excessive flows. This problem should be addressed as part of this project. (Neighborhood Stormwater Improvement Area PM9845)

- Construct LID practices in the South Ridge and Devon Park neighborhoods. These neighborhoods have concrete sidewalks, curb and gutter, and storm drain inlets. Small bioretention areas could be constructed around storm drain inlets located in low areas behind the houses. Bioretention areas could be constructed in the cul-de-sacs and infiltration areas could be constructed between the sidewalk and the curb. Tree box filters could replace existing curb drop inlets. (Neighborhood Stormwater Improvement Area PM9819)

Middle Pimmit Run

- Construct LID practices in the El Nido, Chesterbrook Garden, and Grass Ridge neighborhoods. Currently the neighborhoods have concrete sidewalks, curb and gutter, and storm drain inlets. Bioretention areas could be constructed in the cul-de-sacs and infiltration areas could be constructed between the sidewalk and the curb. Tree box filters could replace the existing curb drop inlets. Ditches could be replaced with bioswales. The sidewalk may also be replaced with porous pavement to help reduce runoff to the stream. (Neighborhood Stormwater Improvement Area PM9814)

Little Pimmit Run

- Conduct a storm drain study in the Chesterbrook Woods, Chesterbrook Mews and Chain Bridge Heights Neighborhoods. Flooding in these neighborhoods may be a result of inadequate capacity in the storm drain system. A study should be conducted to mitigate the flooding as well as to evaluate installation of LID measures that will reduce the peak flows. The Chesterbrook Woods Neighborhood has grassed ditches in front yards with a minimal number of storm inlets. Bioswales could be constructed in the grassed ditches and bioretention areas could be created in the cul-de-sacs to capture the runoff. The Chesterbrook Mews and Chain Bridge Heights Neighborhoods have storm drain inlets and some sidewalks. The sidewalks could be replaced with porous pavement and infiltration trenches could be installed between the sidewalk and curb. Also, the storm drain inlets could be replaced with tree box filters in all neighborhoods. (Neighborhood Stormwater Improvement Area PM9889)
- Conduct a storm drain study to evaluate the storm drain system and construct recommended drainage system improvements for the Franklin Park and Chesterbrook neighborhoods. There is no piped storm drain system in either neighborhood so the roadside ditches convey all runoff during storms and the ditches should be maintained in order to prevent erosion and flooding of homes and property. (Neighborhood Stormwater Improvement Area PM9978)

The pollutant removal benefit for the neighborhood stormwater improvement areas that will be implemented first is shown in Table 8.9. The projects that will be implemented later in the watershed plan did not have drainage areas or benefits calculated for them and have an N/A in these columns. These parameters will be computed prior to the implementation of the projects.

Table 8.9 Benefits of Neighborhood Stormwater Improvement Areas

Project Number	Subbasin ID	Location	Proposed Drainage Area (acres)	Total Phosphorus Removal (lbs/yr)
PM9814	PM-PM-010, PM-PM-009, PM-PM-011, PM-BH-001	El Nido, Chesterbrook Garden, and Grass Ridge neighborhoods	15.8	14.7
PM9819	PM-SA-001, PM-SA-002, PM-PM-010, PM-PM-011	South Ridge and Devon Park neighborhoods	7.7	7.2
PM9827	PM-BK-001, PM-BK-002	Nantucket and Westmoreland Heights neighborhoods	N/A	N/A
PM9845	PM-PM-014, PM-PM-015, PM-UN-003, PM-UN-004	Pimmit Hills and Olney Park neighborhoods	13.8	12.8
PM9889	PM-LP-001, PM-LP-002, PM-PM-002, PM-PM-003, PM-ST-001, PM-ST-002	Chesterbrook Woods, Chesterbrook Mews, Chain Bridge Heights neighborhoods	N/A	N/A
PM9978	PM-LP-003, PM-LP-004, PM-LP-005	Franklin Park and Chesterbrook neighborhoods	N/A	N/A

Action A1.4: Reconnect the floodplains to stream channels to provide floodwater storage and treatment.

Reconnecting the stream channels to the floodplains involves removing any existing concrete channel or regrading the stream banks to allow stream flows to spread through the natural floodplain area. The floodplain reconnection projects will be performed in conjunction with stream restoration projects.

Upper Pimmit Run

- Reconnect the existing channel of Pimmit Run with the floodplain located in the Pimmit Run Stream Valley Park near 1912 Great Falls Street. The floodplain area is located east of the Dulles Toll Road at the confluence of Pimmit Run and Bridge Branch and is owned by the county. This project will help to prevent the frequent flooding at a property located on Great Falls Street. (Floodplain Restoration PM9346)
- Reconnect the existing channel of Pimmit Run with the floodplain at two locations within the Upper Pimmit Run subwatershed. The locations include the southern bank of Pimmit Run near Lemon Road Elementary School (7230 Idylwood Road) and the southern bank of Pimmit Run in the Pimmit Run Stream valley Park from 1946 Friendship Place to 1901 Miracle Lane. This section of the channel is lined with concrete, which will need to be removed in order to allow stream flows to reach the floodplain. The two floodplain areas are located on county-owned land. (Floodplain Restoration PM9347)

Middle Pimmit Run

- Reconnect the existing channel of Pimmit Run with the floodplain located just upstream of Old Dominion Drive. The floodplain area is located on the northwestern bank between Byrns Place and Hawthorne Street. (Floodplain Restoration PM9382)

Action A1.5: Remove detrimental channel obstructions.

Channel obstructions that block stream flow, like the ones listed below, should be removed. Dumpsites should also be cleaned up on a regular basis, if needed. Dumpsites and obstructions in the watershed will vary over time. It may be necessary to clean up future dumpsites and/or obstructions that are not listed below or shown on any of the watershed maps. Some of the obstructions and dumpsites shown on Maps 8.4 through 8.6 have been cleaned up since the SPA was conducted, so projects were not needed at those locations.

Upper Pimmit Run

- Remove obstructions from three locations along Upper Pimmit Run and its tributaries. The first obstruction is located along Bridge Branch near 2129 McKay Street and contains natural debris. The second location is along Darrell Branch behind 6458 Overbrook Drive. The third obstruction is a multiple tree logjam just downstream of Taylor Road along Upper Pimmit Run. (Dumpsite/Obstruction Removal PM9902)
- Remove the dumpsite located along Middle Pimmit Run in the Pimmit Run Stream Valley Park east of the Dulles Toll Road and west of Great Falls Street. This dumpsite contains extensive tree limb and yard debris. Whenever a major windstorm comes through the McLean area, the landscape companies dump considerable amounts debris at this location. In order to permanently fix the dumping problem, the missing section of the metal guard rail should be replaced and a "No Dumping" sign should be installed. (Dumpsite/Obstruction Removal PM9937)

Middle Pimmit Run

- Remove obstructions from eight locations along Middle Pimmit Run and its tributaries. The first location is behind 6622 Chesterfield Avenue where the existing channel capacity has been greatly reduced by sediment and rock. The second location is near Dominion Woods about a 1/4-mile upstream from Old Dominion Drive and contains debris and large trees that have washed downstream during large storms. The third location is the frequent log jams behind 1434 Brookhaven Drive mentioned in Problem Area PM33. The other locations mostly contain tree debris and are located behind 1404 Langley Drive, 6304 Hardy Drive, 1452 Waggaman Circle, 1331 Merchant Lane, 1334 Potomac School Road and 1324 Potomac School Road. (Dumpsite/Obstruction Removal PM9902)

- Remove obstructions from two locations along Bryan Branch at 1601 East Avenue and 1611 East Avenue. There is a large amount of woody debris buildup and large tree obstructions in both locations. (Dumpsite/Obstruction Removal PM9902)

Lower Pimmit Run

- Remove an obstruction about 600 feet downstream of 1428 Woodacre Drive along Lower Pimmit Run. (Dumpsite/Obstruction Removal PM9902)

Little Pimmit Run

- Remove an obstruction from Little Pimmit Run within the Pimmit Run Stream Valley Park. The obstruction is downstream of Chesterbrook Road and contains a newly formed logjam. (Dumpsite/Obstruction Removal PM9902)

Action A1.6: Stabilize eroding streambanks using bioengineering methods.

The projects identified for this action are also addressed by Action B5.1 and are described under that action.

Objective A2: Reduce stormwater flooding and the potential damage from stormwater flooding.

Action A2.1: Improve existing stormwater infrastructure to prevent flooding of roadways and property.

Improve the existing stormwater infrastructure at the following locations:

Upper Pimmit Run

- Connect the outfall and curb inlet located at 7415 Magarity Road. House flooding is occurring in this vicinity because these two structures are not connected. (Infrastructure Improvement PM9494)

- Regrade the ditch downstream of the dry detention basin at Temple Rodef Shalom at 2100 Westmoreland Street as well as the ditch to the west of the detention basin. These ditches should be replaced with infiltration trenches or bioswales to decrease the velocity of the flows and therefore reduce the peak flows. These improvements will help reduce flooding of the homes along Kirby Court, immediately downstream of the temple. The infiltration trenches or bioswales will also help to improve water quality. This project should be performed in conjunction with the BMP retrofit and LID projects at this location. (Infrastructure Improvement PM9464)

Middle Pimmit Run

- Improve the capacity of the storm drain system at Tennyson Drive, which floods often. The street may also need to be raised depending on the severity of the flooding. (Infrastructure improvement PM9417)
- Investigate the probable cause of house flooding occurring along Hunting Avenue and perform improvements to mitigate flooding in the eastern portion of the Hunting Ridge neighborhood. Flooding could be caused by runoff from the Dulles Toll Road or an undersized open channel flowing near these houses. (Infrastructure Improvement PM9465)

- Construct a channel for runoff to be conveyed from the end of Brookhaven Drive to Pimmit Run. Yard flooding is occurring because the water flows to the end of Brookhaven Drive and does not have a defined channel to the stream. (Infrastructure Improvement PM9468)
- Improve the capacity of the storm drain system near 1553 Forest Villa Lane. House flooding is occurring because the storm drain pipes carrying an unnamed tributary to Pimmit Run are undersized. This project will also include the replacement of a culvert at Bryan Branch from the county's master drainage project PM431. (Infrastructure Improvement PM9469)

Little Pimmit Run

- Improve the capacity of the storm drain system near Corland Court. House flooding is occurring because the storm pipes are undersized causing water to flow from the inlets during large rainfall events. (Infrastructure Improvement PM9492)

Action A2.2: Improve the existing stormwater infrastructure to prevent negative impacts to the stream.

Middle Pimmit Run

- Repair the ditch at 6622 Chesterfield Avenue. The ditch is significantly degraded and the channel capacity has been greatly reduced by accumulated sediment and debris. The channel is causing hazardous flooding of the surrounding homes. The ditch should be evaluated for modification and repair to prevent flooding of the surrounding homes. (Infrastructure Improvement PM9451)
- Repair and/or replace the concrete channel parallel to Dillon Avenue. The channel should be repaired to avoid further erosion of the bank as well as to prevent flooding of the homes in this area. It may be possible to modify the concrete channel with shallow weirs to slow the velocity of the water to help prevent downstream erosion and facilitate the construction of the proposed downstream stream restoration project. (Infrastructure Improvement PM9466)
- Repair the concrete channel at 1631 Wrightson Drive. The concrete is deteriorating causing erosion around the channel banks. (Infrastructure Improvement PM9490)

Little Pimmit Run

- Repair or replace up to 500 feet of concrete channel adjacent to 1821 Briar Ridge Court. The channel has been undermined in several locations and the concrete is in poor condition. The channel carries a large volume of water and should be repaired to maintain the flow capacity and avoid flooding of homes in this area. (Infrastructure Improvement PM9491)

Action A2.3: Protect structures located in the 100-year flood limit from flooding.

Table 8.10 lists the number of properties in the watershed that are located in the 100-year flood plain or are recommended for flood protection. Five of these locations are from the county's list of master drainage plan projects. (Flood Protection Project PM9663)

Table 8.10 Recommended Flood Protection Locations

Street	# Properties
Brookhaven Drive	2
Chesterbrook Road	2
Chesterbrook Vale Court	1
Chesterfield Avenue	1
Chesterfield Place	1
Cola Drive	1
Divine Street	1
Fairlawn Drive	2
Franklin Park Road	1
Hardy Drive	1
Hillside Drive	1
Idylbrook Court	3
Ivy Hill Drive	2
Kinyon Place	1
Kirby Road	3
Kirkley Avenue	4
Leonard Road	2
Linway Terrace	1
Old Dominion Drive	1
Park Road	1
Pimmit Court	6
Pimmit Drive	23
Ranleigh Road	1
Somerville Drive	2
Tucker Avenue	3
Westmoreland Street	1
Woodland Terrace	1

Objective A3: Reduce pollutants in stormwater runoff to protect human health.

Action A3.1: Identify the sources of fecal coliform bacteria in the watersheds and seek to reduce controllable sources.
Collaborate with DEQ and DCR to perform a study to identify the sources of fecal coliform bacteria in the Pimmit Run Watershed using E. coli as the indicator bacteria for and prepare an action plan that describes how the controllable sources, especially human sources, will be reduced. (Fecal Coliform Source Study PM9796)

Pimmit Run has been identified by the Virginia Department of Environmental Quality as an impaired stream due to high levels of bacteria. The proposed study will allow the evaluation and identification of the sources of fecal coliform bacteria in the watershed. The ultimate goal of the study action plan would be to remove Pimmit Run from Virginia's list of impaired waters.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B1: Reduce pollutants in stormwater runoff to protect fish and other aquatic life.

Action B1.1: Retrofit existing stormwater management facilities and BMPs.
The projects identified for this action are also addressed by Action A1.1 and are described in that section.

Action B1.2: Construct new BMPs including LID methods.
The projects identified for this action also addressed by Action A1.2 and are described under that action.

Objective B2: Increase the use of LID for all development projects to reduce runoff and improve water quality.

This objective will be achieved through policy and land use recommendations which are located in Chapter 9 under Objective B2.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control and to provide habitat for animals.

Action B3.1: Restore vegetated buffers along streams especially at public sites such as schools, park, and municipal facilities.
Restore vegetated buffers along streams especially at public sites such as schools, parks, and municipal facilities. The SPA found that the condition of existing riparian buffers is poor for 29 percent of the stream bank length assessed in the watershed. The deficient buffer locations described below were found during the 2002 SPA or were identified as potential locations for buffer restoration projects during the watershed planning process. These reach lengths will be further evaluated to determine what portions require restoration work. The locations are shown on Maps 8.7, 8.8, and 8.9. Steps to protect existing vegetated buffers are included in Public Education Project PM9984 described later in this chapter.

Upper Pimmit Run

- Evaluate the buffer vegetation adjacent to Pimmit Run and its tributaries in three locations in the Upper Pimmit Run Watershed and determine the locations where restoration work is necessary. The locations include 1,100 feet in Pimmit View Park, 1,400 feet near Olney Road, and 500 feet near Idylwood Road (Buffer Restoration PM9328).
- Evaluate the buffer vegetation adjacent to Pimmit Run and its tributaries in two locations to determine where buffer restoration is required. The locations to be evaluated are 1,100 feet near Rupert Street and 2,600 feet near Hutchinson Street. The location near Rupert Street contains two towers of the high tension utility line that sit directly in the middle of Pimmit Run upstream of the Little League Fields and have caused major destruction to the riparian buffer. Any buffer restoration done in this area should be coordinated with the power company to ensure that the new buffer vegetation will be properly maintained. (Buffer Restoration PM9317)

Middle Pimmit Run

- Evaluate the buffer vegetation adjacent to Salona Branch and unnamed tributaries to Pimmit Run at five different locations in the Middle Pimmit Run Watershed to determine where buffer restoration work is necessary. The locations include 1,900 feet near Langley Place, 1,800 feet near Ballantrae Lane, 1,000 feet of Salona Branch near Darnall Drive, and 900 feet near Wrightson Drive. (Buffer Restoration PM9311)

- Evaluate the buffer vegetation adjacent to Pimmit Run at four locations to determine where buffer restoration work is necessary. The locations are 500 feet near Hardy Drive, two segments in Pimmit Bend Park for a total of 2,400 feet, and 400 feet near Longfellow Court. This project will also include stabilization of a special tree near Madison Court, as described in Problem Area PM53. (Buffer Restoration PM9315)
- Evaluate the buffer vegetation adjacent to 1,400 feet of an unnamed tributary to Pimmit Run near Ranleigh Road to determine where buffer restoration work is necessary. (Buffer Restoration PM9311)

Lower Pimmit Run

- Evaluate the buffer vegetation along 1,200 feet of Stromans Branch and along 1,100 feet of Lower Pimmit Run, both near Rosamora Court, to determine if buffer restoration work is necessary. (Buffer Restoration PM9379)

Little Pimmit Run

- Evaluate the buffer vegetation adjacent to 5,000 linear feet of Little Pimmit Run and its tributaries. The locations are the downstream end of Little Pimmit Run, Little Pimmit Run near Solitaire Lane, and an unnamed tributary to Little Pimmit Run near Rhode Island Avenue (Buffer Restoration PM9301)

Action B3.2: Provide landowner education about the importance of stream buffers and how to manage and protect them (through coordination, brochures, and workshops).
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.3: Increase enforcement of stream buffer violations.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.4: Remove invasive species from stream buffer areas and replant with native plants.
This is a county-wide action and details of this action are presented in Chapter 3.

Action B3.5: Protect stream buffer areas from development.
There are no land conservation projects in this watershed.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Action B4.1: Conduct a detailed inventory of existing wetlands in order to identify areas for protection or restoration.
A wetlands functions and values survey should be performed. This wetlands survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and watershed stakeholders make decisions regarding priority wetland conservation and preservation areas. (Wetland Assessment Project PM9988)

Objective B5: Restore natural stream channels, banks and bed to provide improved habitat.

Action B5.1: Utilize bioengineering to restore and stabilize stream banks, restore natural geometries and remove concrete from stream banks and beds.

Utilize bioengineering to restore and stabilize stream banks, restore natural stream geometries, and remove concrete from stream banks and beds. Pimmit Run is actively widening along the majority of its length and the stream protection strategy composite site condition rating was "very poor." Restoring the stream and its tributaries will improve the condition of the aquatic habitat and should be carefully coordinated with the previously described objectives of reducing the quantity and improving the quality of runoff in order to prevent further erosion and channel widening. The locations of proposed stream restoration activities are described below and shown on Maps 8.7, 8.8, and 8.9. It should be noted that the stream reaches identified in the following project descriptions and on the maps designate lengths that will be further evaluated. Restoration work will be done in required areas, not necessarily along the continuous lengths designated.

Upper Pimmit Run

- Evaluate approximately 7,800 feet of Pimmit Run from Leesburg Pike to Great Falls Street for locations where stream restoration is necessary. Proposed activities will include removal of the concrete channel and restoration of the stream to resemble an identified reference reach stream in the same watershed. The new channel will be similar in dimension, pattern and profile to the reference stream. Additional proposed activities include riparian vegetation planting, and selective placement of in-stream structures. The stream restoration in this area should be coordinated with the power company to ensure that the new buffer vegetation will be properly maintained. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9232)
- Evaluate approximately 2,800 feet of an unnamed tributary to Pimmit Run flowing parallel to Cherri Drive for locations where stream restoration is needed. Ninety percent of this stream has been previously disturbed and is imbedded with sand. Proposed activities will include riparian vegetation planting, channel reconfiguration, and selective placement of in-stream structures. Only natural materials will be used in the construction of all in-stream structures. This project will also include checking the culvert capacity at Dexter Drive. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9232)
- Evaluate approximately 1,100 feet of Bridge Branch, a tributary to Pimmit Run, west of the Dulles Toll Road for stream restoration locations. Approximately 40 percent of the channel has been altered and the banks are 50 to 70 percent eroded. Proposed activities will include riparian vegetation planting, placement of selective natural in-stream habitat structures and trash and debris removal. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9232)
- Evaluate approximately 800 feet of an unnamed tributary to Pimmit Run that runs through Olney Park near the Dulles Toll Road for stream restoration locations. Proposed activities will include riparian vegetation planting, channel reconfiguration, and selective placement of in-stream structures. (Stream Restoration PM9232)
- Evaluate approximately 1,900 feet of Pimmit Run from Great Falls Street to Rupert Street to determine locations where stream restoration is needed. This portion of Pimmit Run is in a transitional phase of stream bank evolution from a stable stream to a widening/stabilizing stream. This type of channel incision is an indication of a change in stream slope. Proposed activities include channel reconfiguration, riparian vegetation planting and installation of in-stream habitat improvement structures. Stream restoration

in this area should be coordinated with the power company to ensure that the new buffer vegetation will be properly maintained. (Stream Restoration PM9235)

- Evaluate a 2,600 foot length of the Burke's Spring Branch that flows through Haycock Longfellow Park and Kirby Park for locations for stream restoration. Proposed activities will include removal of riprap along the stream banks, reconfiguring the stream banks, connecting the stream with its floodplain and/or installing soft structure stream bank measures such as live fascines, vegetated geogrids, and brush mattresses. (Stream Restoration PM9235)
- Evaluate approximately 4,300 feet of Darrell Branch in two different stretches, both south of Kirby Road, for locations where stream restoration is necessary. Proposed activities will include channel reconfiguration, riparian vegetation planting, and some bioengineering of the stream banks. (Stream Restoration PM9235)

Middle Pimmit Run

- Evaluate approximately 2,500 feet of Pimmit Run near Claiborne Drive and restore as necessary. The stream is widening and approximately 50 to 60 percent of the stream bank is eroded. Proposed activities will include channel reconfiguration, riparian vegetation planting, placement of in-stream habitat structures, and bioengineering of the stream banks. The stream bank located at 1362 Kirby Road is severely eroded and may need short-term mitigation measures to prevent structural damage to the house located at this property. The bridge located at Kirby Road has experienced flooding in the past and replacement of the bridge should be evaluated as part of this stream restoration project. (Stream Restoration PM9209)
- Evaluate approximately 1,800 feet of Pimmit Run that flows through Kent Gardens Park, as well as 600 feet of an unnamed tributary to Pimmit Run near Dempsey Street for stream restoration locations. The stream banks are widening in order to accommodate the increased flows and a new floodplain is being created within the old channel. The banks are 30 to 50 percent eroded. Proposed activities will include adding in-stream structures, riparian vegetation planting, channel bed and bank reconfiguration, and removing any obstructions present. The stream has been previously altered and further investigation will have to be conducted to determine what proposed activities will be needed. Stream restoration in this area should be coordinated with the power company to ensure that the new buffer vegetation will be properly maintained. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9209)
- Evaluate approximately 600 feet of Saucy Branch located in Bryn Mawr Park for stream restoration locations. The stream is eroded and has been modified extensively. The upstream portion has been piped and channelized. Proposed activities would include the establishment of the bed and banks with riparian vegetation and the reconfiguration of the bank slopes. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9209)
- Evaluate two additional stream segments along Saucy Branch to determine if stream restoration is necessary. The locations to be evaluated are 1,000 feet near Byrnes Place and 2,700 feet near Westbury Road. Proposed activities to stabilize the stream will include placement of in-stream habitat structures, channel reconfiguration, and riparian vegetation planting. This project will also include replacement of the culvert at Davidson Road. (Stream Restoration PM9209)
- Evaluate approximately 1,200 feet of Pimmit Run as it flows through a portion of Pimmit Bend Park for stream restoration locations. The stream is widening with the stream banks

eroding and sloughing into the stream. Proposed activities to stabilize the stream will include placement of in-stream habitat structures, channel reconfiguration, and riparian vegetation planting. Floodplain restoration will also be a part of this project; the existing channel of Pimmit Run is disconnected from the floodplain throughout this reach in Pimmit Bend Park as noted in Problem Area PM33. This project is in the county's list of master plan drainage projects. (Stream Restoration PM9209)

- Evaluate approximately 2,600 feet of Pimmit Run and its tributaries in four locations near the Potomac School for locations where stream restoration is necessary. The stream banks are widening to accommodate the increased flows and a new floodplain is being created within the old channel. Proposed activities to stabilize the stream will include placement of in-stream habitat structures, channel reconfiguration, and riparian vegetation planting. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9209)
- Evaluate approximately 3,400 feet of Bryan Branch and 1,300 feet of an unnamed tributary to Bryan Branch near Forest Villa Lane, for stream restoration locations. Proposed activities to stabilize the stream include placement of in-stream habitat structures, channel reconfiguration, and riparian vegetation planting. This project should also repair the erosion caused along Bryan Branch from an outfall from the Highland Swim and Tennis Club located near the confluence of Bryan Branch with Pimmit Run. (Stream Restoration PM9209)

Lower Pimmit Run

- Evaluate approximately 2,300 feet of Stromans Branch, and 1,000 feet of Pimmit Run near the confluence of Little Pimmit Run to determine locations where stream restoration is necessary. Proposed activities include channel reconfiguration, selective placement of in-stream habitat structures and riparian vegetation planting. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9208)

Little Pimmit Run

- Evaluate approximately 4,000 feet of Little Pimmit Run that runs through Pimmit Run Valley Run Park and 500 feet at the downstream end of Little Pimmit Run to determine locations where stream restoration is necessary. The stream has 50 percent eroded banks and is in the early stages of stream incision. Proposed activities include riparian vegetation planting, removal of invasive species, selected placement of in-stream habitat structures, and trash/debris removal. On the upstream end of Maddux Lane, several homeowners are cooperating with the Northern Virginia Soil and Water Conservation District in the design phase of a project to address the erosion problem just downstream of the trail entrance off of Maddux Lane. Also along Maddux Lane, nine lots in the Sycamore Falls subdivision have very steep slopes. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9203)
- Evaluate approximately 2,600 feet on an unnamed tributary to Little Pimmit Run near Valley Wood Road and Massachusetts Avenue for stream restoration locations. Approximately 50 percent of the stream has been altered and is eroding, causing the stream bed to widen. Proposed activities include channel reconfiguration, selective placement of in-stream habitat structures and riparian vegetation planting. A short 100-foot section of the unnamed tributary to Little Pimmit Run will be realigned with Little Pimmit Run to help eliminate erosion at the stream confluence. A portion of this project is in the county's list of master plan drainage projects. (Stream Restoration PM9203)
- An assessment and evaluation of headwater streams will be performed. Headwater streams with less than 50 acres of drainage area that were not included in the SPA will

be evaluated in this project. (Stream Assessment Project PM9997)

Goal C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the importance of watershed protection and providing opportunities for enjoyment of streams.

Watershed stewardship actions will build awareness of the importance of watershed protection and may also provide citizens with an opportunity to improve their watershed. Several watershed-wide projects will help with this goal. The projects under the following objectives will be developed and overseen by county staff, but will depend on the participation of citizens to be successful.

Objective C1: Improve education and outreach.
Public Education Project PM9984 will include the following actions:

- Provide materials to homeowners with septic tank systems to educate them about the proper operation and maintenance of their system.
- Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers.
- Write and distribute a watershed planning fact sheet and lesson plan for teachers that incorporate Standard of Learning 6.7, which deals with watershed protection. Provide specific information about the *Middle Potomac Watersheds Management Plan*.
- Consolidate existing educational materials that describe the value of the watersheds and make them accessible through one county contact.
- Create a watershed planning slide show with watershed basics that can be shown to civic groups, watershed associations, businesses, realtors and other interested groups.
- Provide homeowner brochures about proper yard compost practices and damage done to streams by improper disposal of yard wastes.
- If a stormwater utility is established and it entails billings to individual properties, include educational messages about reducing stormwater runoff (and incentives for doing so) in any mailings.
- Integrate the watershed management plan with existing state and local government planning efforts such as Capital Improvement Project planning, the County Comprehensive Plan, Area Plans, the Virginia Department of Transportation (VDOT) Six Year Plans, road standards and mitigation projects.

Objective C2: Improve watershed access and stewardship.
Community Outreach Project PM9985 will include the following actions:

- Establish an on-going relationship with civics and science teachers at middle schools and high schools who need to provide their students with opportunities for service credits or hands-on projects.
- Encourage voluntary donation of trail and conservation easements.
- Promote annual or semiannual cleanup projects for streams.
- Form or designate a volunteer community organization to aid in the stewardship of the Middle Potomac Watersheds and to coordinate watershed plan implementation activities with county staff.
- Post signage at stream crossings and watershed divides identifying the waterway to increase public awareness of watershed boundaries.

- Encourage private BMP owners to post signage at their facilities with contact information for reporting problems at the facility.

Enforcement Enhancement Project PM9987 will include the following actions:

- Evaluate the current enforcement of the Chesapeake Bay Preservation Ordinance to determine the best way to prevent the destruction of buffer vegetation.
- Improve enforcement of anti-dumping regulations.

Objective C3: Promote the implementation and maintenance of Low Impact Development (LID) practices.

LID Promotion Project PM9986 will include the following actions:

- Inspire landowners to use LID measures by demonstrating LID benefits via recognition programs for businesses and neighborhoods that implement LID measures voluntarily.
- Demonstrate that LID measures can increase property values.
- Provide marketing ideas to showcase properties using extensive LID methods and publicize environmental and social benefits.
- Provide a training and certification program for landscaping companies to learn LID installation and maintenance methods.
- Contact supply companies that could carry LID materials (such as biofilter soils and plants or pervious pavers) and encourage them to stock those items so that construction companies, landscaping companies and homeowners will have easy access to them.
- Stock educational brochures about LID practices for homeowners at hardware stores, home improvement stores, and nurseries.

8.3 Benefits of Plan Actions

Nineteen BMP retrofit projects, thirty-one LID projects, five Neighborhood Stormwater Improvement Areas, and three new BMP projects have been proposed for the Pimmit Run Watershed to help improve the quality of the stream. Fifteen of the 19 BMP retrofit projects had benefits calculated. The channel erosion control volume to be provided by these projects will be 76 percent of the required channel erosion control volume. These projects control approximately 146 acres of land. The channel erosion control volume to be provided by the new BMP projects will serve 70 percent of the required channel erosion control volume for the seven acres of drainage area. For the forty-six BMP retrofit projects, LID projects, Neighborhood Stormwater Improvement Areas, and new BMP projects that had benefit calculations performed, the total additional phosphorus removal for the proposed projects is estimated to be 230 lbs/year upon successful implementation of these projects.

Approximately 23,200 linear feet of stream buffers will be assessed to determine buffer restoration locations. The buffer restoration performed will increase the amount of habitat, reduce erosion and provide nutrient reduction for Pimmit Run. Approximately 46,000 linear feet of Pimmit Run will be assessed for stream restoration locations. The stream restoration performed will help minimize the erosion of the stream, provide nutrient reduction, and increase the amount of habitat. The floodplain reconnection projects will help to decrease the velocity of flow in the streams, which will facilitate the stream restoration projects. The infrastructure improvement projects and storm drain study projects will evaluate the storm drain system deficiencies and construct recommended drainage system improvements within the watershed.

8.4 Implementation of Plan Actions

The recommended plan actions described in this chapter will be implemented over the 25-year life of the watershed plan. The initial implementation schedule was developed using prioritization criteria provided by the county which were used to calculate a numerical score. The prioritization scores are on a scale of 0 to 5 with the highest scores having the highest priority in each watershed. Projects which received higher scores were generally located in the subbasins with the poorest existing conditions, in the headwaters of the watershed, on public land, or would provide the greatest benefits.

Once the prioritization score was calculated, other factors were considered when assigning the implementation timeframes. These factors included promoting projects that have high visibility and low costs but that may not have received a high priority score such as buffer restoration projects and obstruction removal projects. Sequencing and geographic location were also considered so that the Group A or B projects, when successfully implemented, will help to minimize the effects of stormwater in a specific subbasin which will make it possible to implement other projects in later timeframes.

The implementation periods have been divided into five-year timeframes with the following designations:

Group A	0 to 5 years
Group B	5 to 10 years
Group C	10 to 15 years
Group D	15 to 20 years
Group E	20 to 25 years

The public education, community outreach, LID promotion, and the enforcement enhancement capital projects were not ranked because they are to be implemented for the length of the 25-year plan period. Hence, these projects are designated under Group A*.

Priority projects will be implemented within the first fifteen years of the plan in each watershed. Detailed costs and benefits were computed for these projects. The priority projects each have a Fact Sheet, presented in Appendix A, which summarizes key information about the projects. This is only preliminary information and is expected to change as projects enter the design phase of implementation. The priority project total cost for Pimmit Run is $16,940,000. The priority projects are summarized in Table 8.11 below along with the land owners, prioritization scores and implementation groups for the projects.

Coordination with the land owners will be essential to the successful implementation of the plan actions. Cost-sharing opportunities may be explored for projects where both the land owner and the county will benefit. Projects identified on VDOT property will be coordinated directly with VDOT to determine final schedule and cost sharing.

Table 8.11 Summary of Pimmit Run Priority Projects

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
PM9155	New BMP Project	Fairfax County Public Schools (FCPS)	$70,000	4.25	A
PM9154	BMP Retrofit Project	Marshall Heights HOA[1]	$40,000	4.10	A
PM9161	BMP Retrofit Project	Courthouse Station HOA[1]	$70,000	4.00	A
PM9856	New LID Project	FCPS	$830,000	4.00	A
PM9148	BMP Retrofit Project	Churchill Square HOA[1]	$50,000	3.90	A
PM9160	BMP Retrofit Project	Commercial Development[1]	$110,000	3.90	A
PM9829	New LID Project	FCPS	$350,000	3.90	A
PM9830	New LID Project	Private Organization[1]	$140,000	3.90	A
PM9831	New LID Project	FCPS	$160,000	3.90	A
PM9843	New LID Project	Falls Church School Board	$540,000	3.90	A
PM9859	New LID Project	Residential Development[1]	$310,000	3.85	A
PM9328	Buffer Restoration	VDOT, Fairfax County Park Authority (FCPA), Fairfax County Water Authority, Private Residential and Commonwealth of VA[1]	$150,000	3.80	A
PM9852	New LID Project	Residential Development[1]	$230,000	3.80	A
PM9874	New LID Project	Private Organization[1]	$60,000	3.75	A
PM9144	New BMP Project	FCPA	$70,000	3.70	A
PM9824	New LID Project	FCPS	$240,000	3.70	A
PM9149	BMP Retrofit Project	Residential Development[1]	$50,000	3.65	A
PM9850	New LID Project	Residential Development[1]	$300,000	3.65	A
PM9136	BMP Retrofit Project	Brooks Square HOA[1]	$30,000	3.60	A
PM9822	New LID Project	FCPA	$120,000	3.30	A
PM9819	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$350,000	2.80	**
PM9301	Buffer Restoration	VDOT, FCPS, FCPA, and Private Residential[1]	$240,000	2.45	A
PM9379	Buffer Restoration	National Park Service and Chain Bridge Forest HOA[1]	$110,000	2.00	A
PM9311	Buffer Restoration	VDOT, FCPS, FCPA, Private Residential and Private Organization[1]	$340,000	1.25	A
PM9120	New BMP Project	FCPS and McLean Park Manor HOA[1]	$90,000	4.10	B
PM9823	New LID Project	FCPS	$140,000	4.10	B
PM9814	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$710,000	4.00	**
PM9821	New LID Project	FCPS	$400,000	4.00	B
PM9845	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$620,000	4.00	**
PM9116	BMP Retrofit Project	Hamptons of McLean HOA and McLean Mews HOA[1]	$30,000	3.90	B
PM9872	New LID Project	FCPA	$140,000	3.85	B

Project Number	Type	Land Owner	Estimated Cost	Score	Year Group
PM9877	New LID Project	Private Organizations[1]	$230,000	3.85	B
PM9841	New LID Project	Washington Metropolitan Area Transit Authority (WMATA) [1]	$450,000	3.75	B
PM9232	Stream Restoration	VDOT, FCPA and Private Residential[1]	$6,140,000	3.70	B
PM9153	BMP Retrofit Project	FCPA, Fairfax County Board of Supervisors and Private Development[1]	$190,000	3.60	B
PM9158	BMP Retrofit Project	Residential Development[1]	$100,000	3.60	B
PM9857	New LID Project	Residential Development[1]	$360,000	3.60	B
PM9867	New LID Project	FCPS	$160,000	3.60	B
PM9134	BMP Retrofit Project	Private Organization[1]	$60,000	3.45	B
PM9464	Infrastructure Improvement	Private Organization[1]	$160,000	2.65	B
PM9140	BMP Retrofit Project	WMATA[1]	$130,000	3.85	C
PM9142	BMP Retrofit Project	City of Falls Church[1]	$60,000	3.85	C
PM9873	New LID Project	Private Organization[1]	$190,000	3.85	C
PM9175	BMP Retrofit Project	Linway Park of McLean HOA[1]	$30,000	3.35	C
PM9106	BMP Retrofit Project	Residential Development[1]	$160,000	3.30	C
PM9133	BMP Retrofit Project	McLean Province HOA[1]	$70,000	3.30	C
PM9805	New LID Project	Residential Development[1]	$240,000	3.15	C
PM9862	New LID Project	Commercial Development[1]	$370,000	3.15	C
PM9988	Wetland Assessment Project	Watershed-wide Project	$100,000	2.95	C
PM9978	Neighborhood Stormwater Improvement Area	VDOT and Private Residential[1]	$450,000	2.90	**
PM9825	New LID Project	Commercial Development[1]	$180,000	2.80	C
PM9839	New LID Project	Residential Development[1]	$120,000	2.80	C
PM9871	New LID Project	Falls Church School Board[1]	$130,000	2.75	C

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

**These projects will be coordinated directly with VDOT.

The non-priority projects, including the watershed stewardship actions in Year Group A*, are shown in Table 8.12 below along with the land owners, prioritization scores, and implementation groups for the projects. While the projects in Groups A and A* will be implemented right away, the remainder of the projects in the table should be thought of as future opportunities. Conditions in the Middle Potomac Watersheds may be very different in fifteen years time, so the projects in Groups C, D, and E will be re-evaluated at that time.

Table 8.12 Summary of Pimmit Run Non-Priority Projects

Project Number	Type	Land Owner	Score	Year Group
PM9984	Public Education Project	Watershed-wide Project	N/A	A*
PM9985	Community Outreach Project	Watershed-wide Project	N/A	A*
PM9986	LID Promotion Project	Watershed-wide Project	N/A	A*
PM9987	Enforcement Enhancement Project	Watershed-wide Project	N/A	A*
PM9997	Stream Assessment Project	Watershed-wide Project	N/A	A*
PM9902	Dumpsite/Obstruction Removal	Private Organization, FCPA, Private Residential, VDOT, and WMATA[1]	1.95	A
PM9937	Dumpsite/Obstruction Removal	FCPA	1.95	A
PM9889	Neighborhood Stormwater Improvement Area	Private Residential, VDOT, and FCPA[1]	2.85	**
PM9317	Buffer Restoration	VDOT, Private Residential, Private Organization, Brooks Square HOA, McLean Province HOA, Montivideo Square HOA, and Residential Developer[1]	2.75	C
PM9491	Infrastructure Improvement	Private Residential[1]	2.70	C
PM9465	Infrastructure Improvement	VDOT and Private Residential[1]	2.35	**
PM9466	Infrastructure Improvement	Private Residential[1]	2.35	C
PM9468	Infrastructure Improvement	Private Residential, VDOT, and Private Organization[1]	2.35	**
PM9827	Neighborhood Stormwater Improvement Area	Private Residential and VDOT[1]	3.85	**
PM9170	BMP Retrofit Project	Highlands of McLean HOA[1]	3.65	D
PM9804	New LID Project	Private Organization[1]	3.65	D
PM9807	New LID Project	FCPS	3.30	D
PM9813	New LID Project	Private Organization[1]	3.15	D
PM9112	BMP Retrofit Project	Lynwood HOA[1]	3.10	D
PM9826	New LID Project	Private Organization[1]	3.05	D
PM9235	Stream Restoration	Private Residential, VDOT, FCPA, Private Organizations, Brooks Square HOA, Westmoreland Square HOA, and Residential Developer[1]	3.00	D
PM9810	New LID Project	Private Organization[1]	3.00	D
PM9818	New LID Project	Commercial Development[1]	2.80	D
PM9346	Floodplain Restoration	FCPA, VDOT, and Private Residential[1]	2.65	D
PM9347	Floodplain Restoration	FCPA, FCPS, and Private Residential[1]	2.65	D

Project Number	Type	Land Owner	Score	Year Group
PM9494	Infrastructure Improvement	Private Residential and VDOT[1]	2.60	D
PM9469	Infrastructure Improvement	Private Residential, FCPA, VDOT, and Private Organization[1]	2.35	**
PM9492	Infrastructure Improvement	Private Residential and VDOT[1]	2.15	**
PM9490	Infrastructure Improvement	Private Residential and FCPS[1]	2.05	D
PM9417	Infrastructure Improvement	VDOT, FCPA, and Private Residential[1]	1.90	**
PM9203	Stream Restoration	Private Residential, VDOT, FCPA, and Residential Developer[1]	1.60	D
PM9451	Infrastructure Improvement	Private Residential[1]	1.60	D
PM9880	New LID Project	Private Organization[1]	3.60	E
PM9176	BMP Retrofit Project	Private Residential and Private Organization[1]	3.20	E
PM9209	Stream Restoration	Private Residential, Private Organization, FCPA, and McLean Park Manor HOA[1]	2.20	E
PM9315	Buffer Restoration	FCPA, Private Organization, Private Developer, Old Dominion Square HOA, and Private Residential[1]	2.00	E
PM9208	Stream Restoration	VDOT and Private Residential[1]	1.95	E
PM9382	Floodplain Restoration	Private Residential[1]	1.80	E
PM9663	Flood Protection Project	Private Residential[1]	1.80	E
PM9796	Fecal Coliform Source Study	Watershed-wide Project	1.65	E

[1]These projects will require coordination with land owners prior to implementation to determine cost sharing and project schedule.

*All public education and outreach projects will be implemented for the entire 25-year period.
**These projects will be coordinated directly with VDOT.

Chapter 9

Policy and Land Use Recommendations

9.1 Watershed Strategy

The strategy for achieving the vision of minimizing runoff, reducing pollution, and restoring the quality of Middle Potomac Watersheds includes a wide range of recommendations. Not only are the capital improvement program projects described in chapters four through eight needed to meet the goals of the watershed management plan, but policy and land use changes are also vital in mitigating the effects of existing development in the watershed. This chapter describes the policy and land use recommendations proposed by the Middle Potomac Steering Committee. The policy recommendations include proposals that would typically involve amendments to the county code and other supporting documents such as the Public Facilities Manual. These recommendations will need to be further evaluated by the county in light of their countywide implications. The recommendations will be compiled by the county from all the adopted watershed management plans and a group will be convened to take the recommendations to the next step. This process will happen in conjunction with the planning process, which will continue with the second round of watershed management plans.

The current planned approach for processing the policy recommendations from the Middle Potomac Watersheds Management Plan is to integrate these recommendations with similar recommendations in the other county watershed management plans that were recently completed. Specific ordinance amendments would then be drafted in light of other county initiatives and address the common ground that can be established between the various policy recommendations.

9.2 Goals, Objectives, and Actions

The goals put forward in Chapter 3 are restated in this chapter to demonstrate the interaction of these recommendations with the structural and non-structural projects. The policy actions recommended in this chapter apply to all five Middle Potomac Watersheds.

GOAL A: Reduce stormwater impacts to protect human health, safety and property.

Objective A1: Reduce stormwater volumes and velocities to minimize stream bank erosion.

Policy Action A1.7: Encourage Fairfax County Department of Transportation (FCDOT) and the Virginia Department of Transportation (VDOT) road widening projects to control runoff from both newly paved areas and existing pavement which may not have any existing stormwater management controls or have poorly functioning controls in place.

Strategy to Achieve Action: The Virginia Stormwater Management Program Permit Regulations (4VAC50-60-110.F) state that if a locality has adopted more stringent requirements or implemented a regional (watershed-wide) stormwater management plan, it may request, in writing, that the Department of Conservation and Recreation consider these requirements in its review of state projects (including VDOT projects) within that locality. For example, the county's revised adequate outfall provisions and the minimum ten percent nutrient reduction for redevelopment could be applied to road projects also.

One possible approach to implement this action would be to size the stormwater management facility based on a desired reduction in flow rate. This approach could include existing and proposed pavement and be targeted on a subwatershed basis instead of by individual outfalls. This would provide a greater capture of runoff water and mitigate runoff from both old and new road surfaces. Another possible approach would be to reduce imperviousness along the project corridor by providing more efficient access to entrances, removing old pavement instead of abandoning it, and reducing overall pavement footprints.

Minor roadway improvement projects, such as the addition of turn lanes, should be excluded from this proposed requirement. This is because they typically have small cumulative impacts, often less than 0.10 acres of new imperviousness for each project. Also, the addition of stormwater management controls for minor urban improvement projects would be cost prohibitive and their installation would be extremely difficult, if not impossible, without major improvements to downstream stormwater conveyances.

It should be noted that it has become increasingly difficult to provide stormwater detention for the additional pavement associated with road widening projects, much less for the existing pavement. There are limited opportunities for stormwater management for many roadway and walkway projects, particularly widening roadways adjacent to existing developments. Coordination with FCDOT and VDOT is essential in the implementation of this objective.

Watershed Benefit: For new road widening projects the goal is to reduce the two-year peak flow by five percent for the existing roadway surfaces that currently do not have stormwater controls. Reducing the peak flow will benefit the watershed by reducing the velocity and quantity of runoff, and therefore allow for downstream restoration.

Policy Action A1.8: Strategy to reduce cumulative impacts of infill development.

Strategy to Achieve Action: Fairfax County has begun to investigate methods of reducing the negative impacts due to infill development, or mansionization, in the county. The county's new adequate outfall policy, effective December 5, 2005, was an initial step, but more action is needed. For instance, strategies can be developed which allow infill, but limit the amount of impervious cover added to a site.

Watershed Benefit: Reducing the impact of infill development will protect streams from increased runoff and decreased water quality.

GOAL B: Protect and improve habitat and water quality to sustain native animals and plants.

Objective B2: Increase the use of Low Impact Development (LID) for all new and existing development to reduce runoff and improve water quality.

Policy Action B2.1: Provide incentives for individual residential or commercial landowners and leading edge developers to encourage the use and adoption of LID on existing developed land. Incentives for LID are necessary to encourage the immediate and short term voluntary adoption of LID, while the longer term process for formally understanding and implementing LID becomes standard practice in the county.

Strategy to Achieve Action: Provide incentives for developers and land owners of already developed properties to implement LID measures on their properties even if they already meet minimum pollutant removal and peak flow requirements. The implications of the incentives will need to be considered in coordination with county land use, transportation, and revitalization goals. If implemented, the incentives would require extensive coordination with the appropriate county agencies. Some of the incentives may also require changes to the county code.

Examples of incentives might include the following:

- Design assistance and outreach programs for individual landowners to install LID on their property. Examples of this are providing for a pro bono LID consultation, soil analysis, site suitability review, 'LID-for-Homeowners' training workshops, etc.
- For properties that are already developed, provide financial assistance programs, such as low interest loans, grants, materials subsidies, and/or tax breaks for those who want to pursue and implement LID strategies on their existing property.
- Create a county grant, subsidy or tax abatement program for existing land owners who repave existing pavement (e.g. driveways) with porous pavers.
- Create a county grant or subsidy program to provide joint education and training for technical review staff, design professionals, and developers about the design, installation and maintenance of LID practices.
- Remove disincentives to use LID by arranging for a technical, pre-review process to ensure that proposed plans are workable and potentially acceptable to the county. A pre-review meeting or process involving technical review staff and developers can help to expedite the permitting and approval process and remove the uncertainty associated with proposing and implementing LID.
- Develop an incentive which will allow LID methods to offset a portion of the interior parking lot landscaping requirements for exceeding the county's minimum stormwater management requirements. These methods could include pervious paving, underground storage BMPs, infiltration trenches, or bioretention areas. The benefits of the interior parking lot landscaping will need to be compared to the benefits of the proposed LID methods during evaluation of this incentive.
- Provide flexibility to county staff to administratively approve deviations of the minimum yard requirements in exchange for the use of contiguous areas needed for LID in locations that do not displace natural areas within the Resource Protection Area, floodplains, or stream channels.

Watershed Benefit: A quantitative evaluation of these incentives was not made since it is difficult to accurately estimate developer participation should they be implemented. However, the benefit of LID can be quantified for individual sites and exceeding the minimum stormwater management requirements will help to offset the increased runoff and pollutants from existing developed sites that were constructed before stormwater controls were required. Reducing stormwater runoff will reduce stream erosion, and reducing pollutants in the stormwater will improve in-stream water quality.

Policy Action B2.2: Provide a list of desirable LID projects so that developers considering the use of proffers can easily find where projects are needed.

Strategy to Achieve Action: The county could provide a list of LID projects from Actions A1.2 and A1.3 to developers who are looking for proffer opportunities. This would make it easier for developers to select projects that are needed in the watershed.

Watershed Benefit: The LID projects in this watershed management plan may get constructed sooner if developers are encouraged to use them as proffers. LID projects will help to reduce the amount of pollutants in the runoff from areas that don't have existing stormwater controls.

Policy Action B2.3: Continue to evaluate LID practices for application to private sector development projects to the maximum extent practicable.

Strategy to Achieve Action: Fairfax County views LID as one of many tools in the stormwater management toolbox. The County recently adopted the LID amendments to the PFM which list acceptable stormwater management practices for development and provides design criteria for each. There were six LID practices included in the amendments: pervious pavement, bioretention filters and basins, vegetated swales, tree box filters, vegetated roofs and reforestation. This will facilitate greater usage of LID by developers.

The development of design and construction standards for additional LID practices and an overall design procedure for demonstrating that LID designs will meet county and state requirements for water quality control, stormwater detention, and adequate outfall will be necessary to implement comprehensive LID based designs on a broader scale. The county has partnered with other local jurisdictions, the Northern Virginia Regional Commission (NVRC), and the Engineers and Surveyors Institute (ESI) to develop a supplement to the Northern Virginia BMP Handbook (NVRC & ESI 1992) that will incorporate LID design and address some of these needs. As additional experience and understanding of these practices is obtained, staff will review the issues surrounding the location and maintenance of stormwater management facilities and will bring recommendations to the Board for amendments to the current policies.

Watershed Benefit: LID uses small scale stormwater management controls that are intended to mimic predevelopment site conditions by treating and controlling stormwater at its source instead of downstream at one large BMP. For existing development, LID measures are easier to fit onto a small site than larger facilities. Using LID will help control the small, frequent storm events which will help reduce stream erosion.

Policy Action B2.4: Require all public facilities to use LID to the 'maximum extent practicable'.

Strategy to Achieve Action: Fairfax County should install LID methods at all public facilities in order to lead by example. Developers would be less likely to resist using LID if the county had successfully employed it at their facilities. Local contractors would gain experience in the proper construction of LID. Educational signs at public facilities would help teach the public about stormwater issues and promote the use of LID in private development.

Watershed Benefit: Requiring all public facilities to use LID to the 'maximum extent practicable' would set a good example for homeowners, developers, and business owners to implement LID methods on their properties and in new development. Adding LID to public facilities that do not have stormwater controls will help to reduce the amount of runoff and improve water quality throughout the watershed.

Policy Action B2.5: Implement the Tysons Corner stormwater management strategy in light of the potential for significant redevelopment in this area. (Tysons Corner Stormwater Strategy Project SC9845)

Tysons Corner sits at the headwaters of several watersheds including Difficult Run, Pimmit Run and Scotts Run as shown in Figure 9.1. Watershed plans are currently being developed by the Department of Public Works and Environmental Services under two planning efforts: Difficult Run watershed plan and Middle Potomac watershed plan. The Middle Potomac Watersheds include Scotts Run and Pimmit Run as well as the adjacent watersheds Bull Neck Run, Dead Run and Turkey Run.

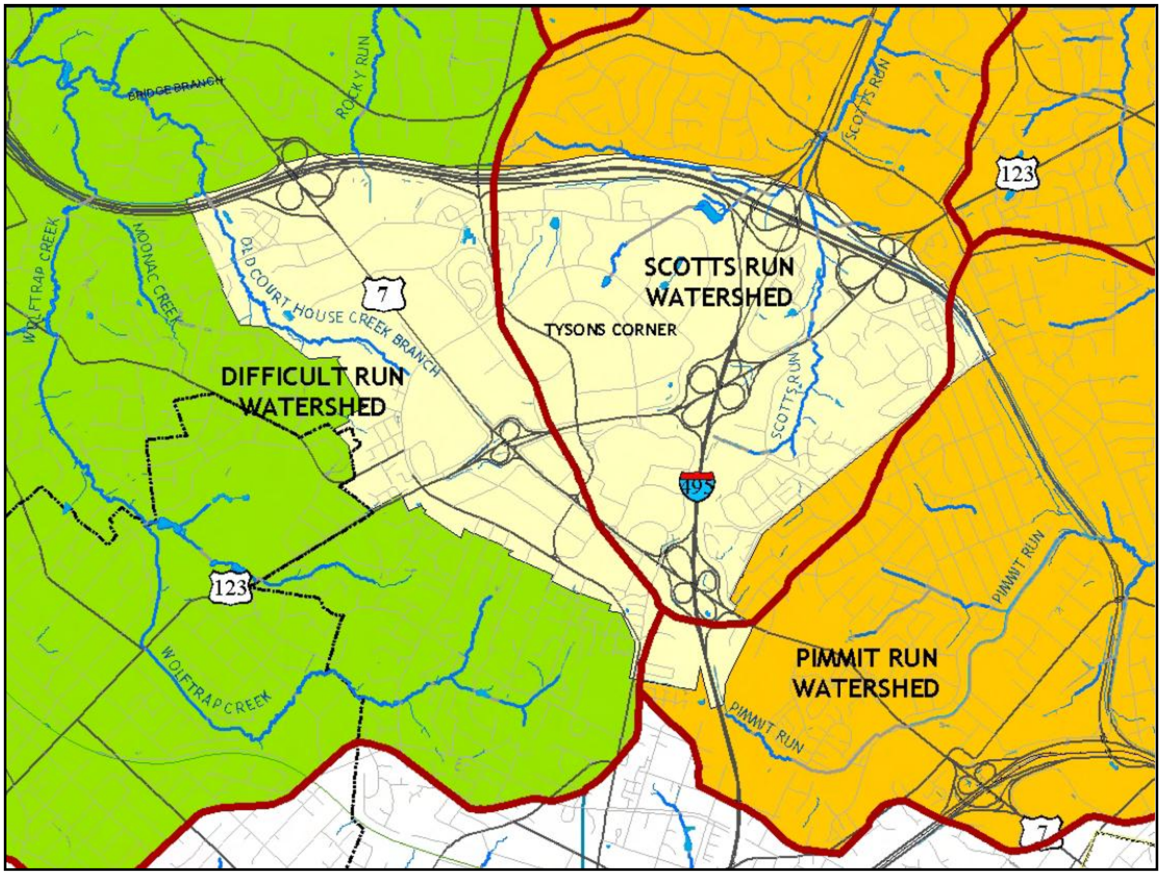


Figure 9.1 Difficult Run Watershed, Scotts Run Watershed, and Pimmit Run Watershed boundaries at Tysons Corner.

Many of the headwater streams in this area were buried and piped when the area began to develop in the 1960s and 1970s. This early development occurred prior to federal, state or local regulations to protect these headwater streams. In addition, these earlier developments were also built prior to stormwater management regulations to control runoff and water quality prior to being discharged to the receiving streams. The existing condition of Scotts Run and Pimmit Run within and downstream of Tysons Corner includes degraded stream habitat, inadequate buffers, actively widening streams, and minor to moderate erosion.

The Tysons Corner area will experience redevelopment as the Washington Metropolitan Area Transit Authority expands their rail lines and adds four rail stations to the area in the future. This redevelopment will further negatively impact Scotts Run unless a stormwater management strategy is implemented. LID measures, new Best Management Practices (BMPs), BMP retrofits, and additional stormwater management requirements for developed properties without existing BMPs should be implemented to mitigate the effects of existing and future impervious areas. Figure 9.2 shows the development potential for parcels in Tysons Corner from the current *Fairfax County Comprehensive Plan*. It is possible that substantially more redevelopment will be considered for this area. Fairfax County has initiated a Tysons Corner Transportation/Urban Design Study and appointed a Tysons Land Use Task Force to coordinate community participation and recommend changes to the 1994 Tysons Corner Comprehensive Plan. Additional information on the Tysons Corner Study is available at www.fairfaxcounty.gov/dpz/tysonscorner/.

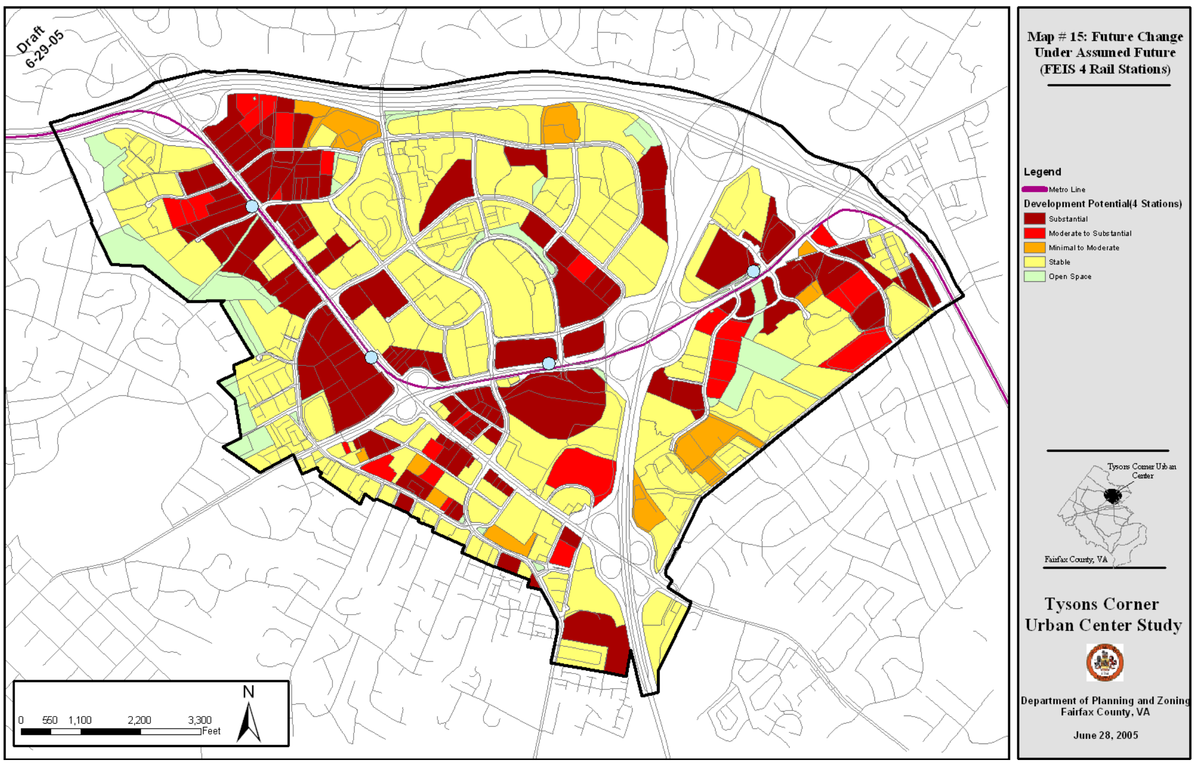


Figure 9.2 Fairfax County draft development potential for Tysons Corner.

Existing Conditions and Stormwater Management within Tysons Corner

As summarized in Table 9.1, Tysons Corner occupies approximately 1,412 acres or 37 percent of the 3,860 acre Scotts Run Watershed and 115 acres or one percent of the 8,083 acre Pimmit Run Watershed. The current impervious area for the entire Scotts Run Watershed is 30 percent while the portion of the watershed within Tysons Corner is 49 percent. The current impervious area for the entire Pimmit Run Watershed is 27 percent while the portion of the watershed within Tysons Corner is 50 percent.

Table 9.1 Watershed Information for Tysons Corner

Watershed	Drainage Area within Tysons (acres)	Existing Percent Imperviousness within Tysons Corner	Number of Stormwater Management Facilities	Parcel Area with Stormwater Controls(1) (acres)	Uncontrolled Parcel and ROW Area (acres)	Future Development Potential (2) (acres)
Scotts Run	1,412	48.6%	49	402	1,010	336
Pimmit Run	115	50.4%	10	56	59	28

[1]Based on parcel area not including roads.
[2]Based on site development potential shown on Figure 9.2.

Approximately 59 existing BMPs and stormwater management facilities are located in Tysons Corner. Figure 9.3 shows the parcels currently served by stormwater management facilities that control quantity only or both water quality and quantity. The total parcel area served by stormwater management facilities or BMPs is 458 acres and the total parcel area not controlled by stormwater management facilities or BMPs is 525 acres. The parcel area does not include the roadways which comprise approximately 35 percent of the total land area. There are currently two stormwater management facilities located in the northeast and northwest corners of the cloverleaf intersection of Chain Bridge Road and the Dulles Access Toll Road. For the 364 acres of parcels with future development potential, approximately 70 percent of the parcel area is not controlled by any existing stormwater management facilities.

Table 9.2 shows the total parcel area controlled by stormwater management facilities which only provide stormwater quantity control and the total parcel area controlled by BMPs which provide both stormwater quality treatment and quantity control. The developed parcel area without existing stormwater controls is approximately 57 percent of the total developed parcel area and only ten percent of the total developed parcel area is controlled by BMPs which provide both quality and quantity treatment.

Table 9.2 Parcel Area with Quantity and Quality Controls

	Scotts Run		Pimmit Run	
Parcel Area in Tysons Corner	Total Parcel Area	Total Developed Parcel Area	Total Parcel Area	Total Developed Parcel Area
Total Quantity Controlled	33%	36%	84%	85%
Total Quality Controlled	10%	11%	0%	0%
Total Uncontrolled	57%	53%	16%	15%

As part of the watershed planning process, the watersheds were further divided into smaller subbasins or drainage areas to evaluate existing and future conditions. Land use, stormwater management controls and receiving stream conditions were inventoried and assessed for each subbasin. The Scotts Run and Pimmit Run subbasins located in the Tysons Corner area include SC-UN-003, SC-UN-004, SC-UN-005, SC-UN-006, SC-UN-007, SC-SC-007, SC-SC-008, SC-SC-009, SC-SC-010, PM-SA-002, PM-UN-003, PM-PM-013, and PM-PM-017 as shown in Figure 9.3. The subbasin parcel area currently controlled by either stormwater management facilities or BMPs in Tysons Corner is described in Table 9.3.

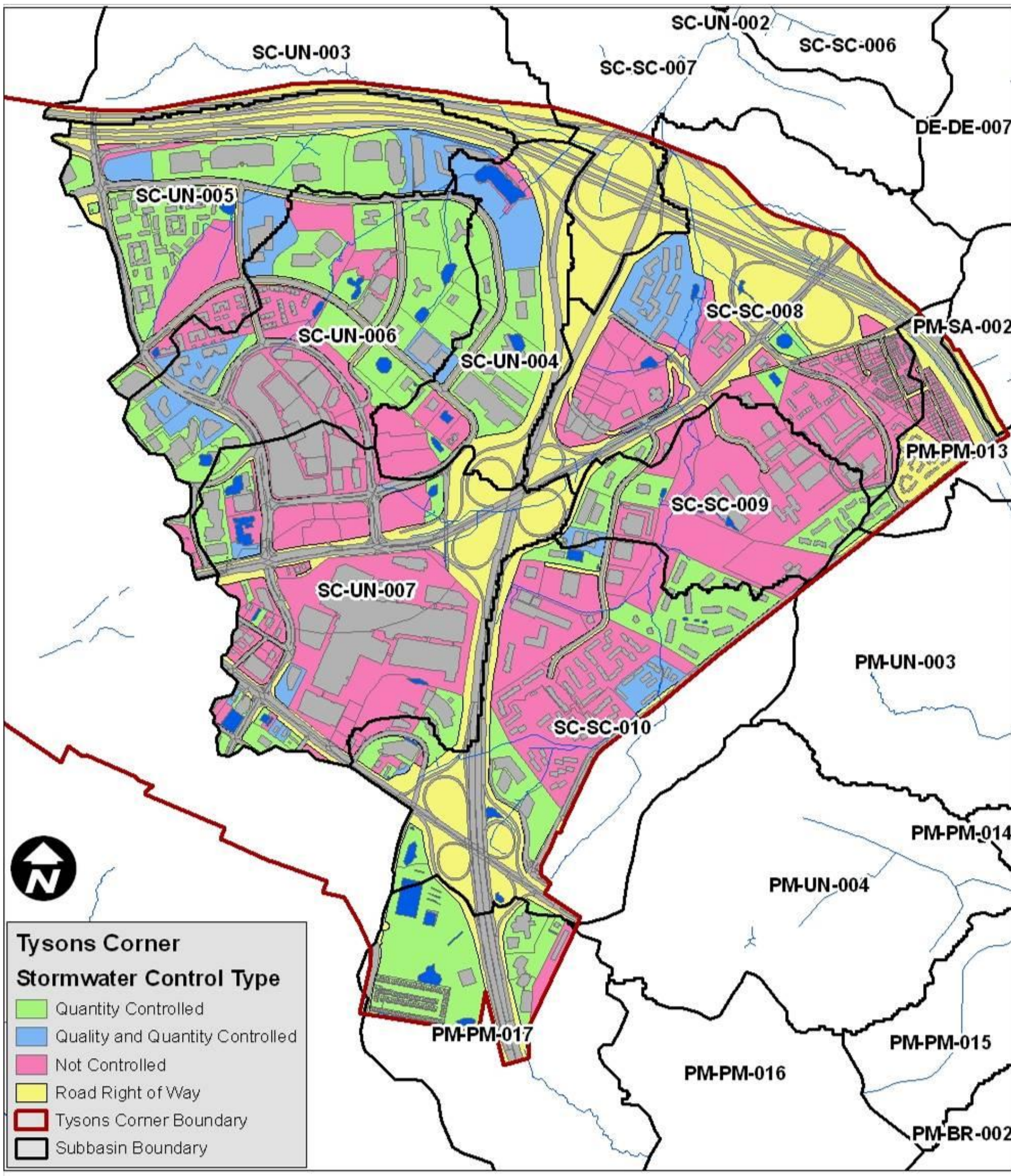


Figure 9.3 Tysons Corner Watershed Scotts Run Watershed and Pimmit Run Watershed Subbasins and Land Use Control Type

Table 9.3 Subbasin Parcel Area with Stormwater Controls

Subbasin	Subbasin Parcel Area (acres)	Percent Water Quantity Controlled Parcel Area	Percent Water Quality Controlled Parcel Area	Percent Uncontrolled Parcel Area
SC-UN-003	1	0%	0%	100%
SC-UN-004	75	52%	20%	28%
SC-UN-005	119	61%	18%	21%
SC-UN-006	165	50%	14%	36%
SC-UN-007	177	15%	3%	82%
SC-SC-007	0	0%	0%	0%
SC-SC-008	114	6%	18%	76%
SC-SC-009	112	23%	2%	75%
SC-SC-010	153	35%	5%	60%
PM-SA-002	0	0%	0%	0%
PM-UN-003	1	100%	0%	0%
PM-PM-013	9	22%	0%	78%
PM-PM-017	57	93%	0%	7%

Due to development of vacant parcels and redevelopment of underutilized parcels, the future peak flows will increase for almost all of the subbasins in Tysons Corner. The percent increase in peak flows for the existing and future conditions of the Tysons Corner area are shown in Table 9.4 for the subbasins with the majority of their area located in Tysons Corner. The peak flows for the future conditions are estimated for complete buildout over the next 25 years and take into account the BMPs that will be required to meet stormwater runoff quantity and quality regulations.

Table 9.4 Tysons Corner Existing and Future Peak Flows

Subbasin	Two-Year Rainfall Event			Ten-Year Rainfall Event		
	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase
SC-UN-004	654	690	6%	1,180	1,230	4%
SC-UN-005	375	393	5%	642	674	5%
SC-UN-006	195	195	0%	326	326	0%
SC-UN-007	448	452	1%	826	832	1%
SC-SC-008	1,640	1,690	3%	3,020	3,110	3%
SC-SC-009	950	962	1%	1,780	1,790	1%
SC-SC-010	386	389	1%	725	732	1%

Strategy to Achieve Action: The major stormwater management issue for the Tysons Corner area is the amount of existing developed area without stormwater management controls. Additional stormwater management controls, including LID measure, are needed in order to reduce peak flows and to support stream restoration efforts. Currently new development and redevelopment are required to implement stormwater management controls as described in the *Fairfax County Public Facilities Manual* (PFM).

1) Redevelopment projects must reduce phosphorus from subject properties by ten percent from existing conditions. New development projects must reduce phosphorous runoff by 40 percent from predicted postdevelopment conditions.

2) Development projects must have no increase in peak flow for the two-year and ten-year storm events. However, if a site is developed from a parking lot to a building, there is little or no runoff difference between predevelopment and post-development conditions, and there is therefore no net reduction in peak flows

3) Adequate outfall requirements also apply to all development and require an assessment of downstream conditions. However, in some cases the assessment area may end in a pipe if the existing storm drainage system is long enough. If the assessment area ends in a pipe that can accommodate the additional storm drainage, the outfall is considered adequate and no additional controls are needed.

If all area with development potential is required to implement stormwater management controls, the amount of total parcel area in Tysons Corner with stormwater controls will increase from 30 percent to 47 percent. Since not all of the Tysons Corner parcels will be developed or redeveloped in the next 25 years, the recommended Tysons Corner stormwater management strategy requires additional measures for stormwater controls. These additional measures include the following:

- For redevelopment sites that will be subject to the zoning process, a minimum of 30 percent phosphorous removal compared to existing conditions is suggested. The 30 percent phosphorous removal was calculated by taking the estimated future imperviousness of 54 percent and subtracting the Fairfax County average land cover condition of 18 percent imperviousness and using the resulting 36 percent imperviousness to calculate the target pollutant removal rate of 30 percent. Where there are opportunities to incorporate BMPs that will result in phosphorous removal rates above 30 percent, implementation of such BMPs should be encouraged. Consideration should be given to evaluating redevelopment sites on a case-by-case basis to determine the potential for additional water quality control opportunities. New development sites would continue to be subject to the phosphorous removal requirement as noted above, whether or not any zoning action will be required for the development.

- For development sites that will be subject to the zoning process, the adequate outfall requirements establish that there is a need to review the downstream drainage system to one of the following points:

    - A point at which the total drainage area is at least 100 times greater than the contributing drainage area of the site.

    - A point that is at least 150 feet downstream of a point where the drainage area is 360 acres or greater.

- A point that is at least 150 feet downstream of a point where the receiving pipe or channel is joined by another that has a drainage area that is at least 90 percent of the size of the first drainage area at the point of confluence.

It is suggested that the review of the downstream drainage system for development sites that will be subject to the zoning process not be limited to the third bullet point above because this will not allow review of the potential adverse impacts to the receiving stream channel. This adequate outfall review recommendation is more stringent than what is required in the Public Facilities Manual.

- For redevelopment sites that may not have a future increase in the amount of impervious area and that do not have existing stormwater quantity controls, there is an opportunity to provide peak flow and runoff volume reduction to help mitigate the effects of existing impervious area on stormwater runoff. Consideration should be given to evaluating redevelopment sites on a case-by-case basis to determine the potential for providing stormwater quantity controls. In the future, a stream restoration studies will determine the goals for stream restoration of Difficult, Pimmit and Scotts Run so that the amount of peak flow from that portion of Tysons Corner in each watershed that can be accommodated by the restoration effort can be quantified and a flow reduction target percentage can be recommended for individual redevelopment sites.

- New BMPs and BMP retrofit projects are also recommended for specific sites in Tysons Corner in order to provide greater water quality and quantity reduction benefits.

Both new development and redevelopment will also need to comply with Fairfax County stormwater regulations that address drainage diversions and floodplains.

In order to meet the stormwater runoff quantity and quality requirements, new BMPs may include wet ponds or dry ponds constructed on vacant or underutilized parcels. LID measures may include constructing bioretention areas in the parking lot medians and in landscaped areas. Underground manufactured BMPs could be placed in parking lots and manufactured BMP water quality inlets could replace existing curb drop inlets. Porous pavement could be used in overflow parking areas and green roofs could be installed on mixed use buildings as an amenity for the residential units.

Watershed Benefit: Stormwater management facilities and LID measures on redevelopment sites will help to mitigate the effects of existing impervious areas that do not have stormwater controls and will provide a reduction in stormwater peak flows and pollutant discharge. The reduction in peak flows and the amount of pollutants will benefit the downstream conditions of Scotts Run and allow successful implementation of stream restoration methods. The estimated cost of the Tysons Corner Stormwater Strategy Project proposed in this policy action is $200,000 and does not include the cost of implementing the recommended projects from the study.

Objective B3: Restore and protect vegetated stream buffers to filter pollutants from runoff, to provide erosion control, and to provide habitat for animals.

Policy Action B3.6: Utilize environmentally-sensitive trail design to reduce stormwater impacts where possible.

Strategy to Achieve Action: Environmentally-sensitive trail design focuses on trails in environmentally sensitive areas in order to avoid or limit the impacts of trail use and maintenance on stream channel geomorphology and function, wildlife, water quality, and water quantity. If the county builds trails adjacent to streams, they should be environmentally friendly and use porous paving instead of concrete or asphalt. Trails that are located adjacent to streams and are contributing to bank instability and erosion may need to be relocated. In addition, the county's Pubic Facilities Manual should be changed to allow for alternate but friendlier trail and bridge designs that still meet ADA requirements where possible.

Watershed Benefit: Reducing the amount of impervious trail surface along streams will reduce the amount of runoff which will help to reduce the amount of erosion in streams. Relocating trails that contribute to streambank erosion will help improve stream water quality and habitat. The benefit of this action was not quantified, however when implemented, this action will help maintain the appearance of a natural stream buffer area and will reduce the amount of stormwater runoff and pollutants delivered to the stream.

Policy Action B3.7: Establish wildlife or environmental quality corridors where possible.

Strategy to Achieve Action: Fairfax County should encourage property owners adjacent to streams to donate their land for the development of wildlife or environmental quality corridors. This could be done through conservation easements or through outright donation. The Virginia Department of Conservation and Recreation's Office of Land Conservation could assist in setting up this program.

Watershed Benefit: Protecting land from future development through this program will prevent increases in runoff amounts, protect water quality, and preserve habitat for wildlife.

Objective B4: Protect and restore wetlands to provide habitat and improve water quality.

Policy Action B4.2: The county should work with the appropriate permitting agencies to encourage mitigation for wetland losses resulting from development to be mitigated within the same hydrologic area (same local watershed).

Strategy to Achieve Action: The county should work with appropriate federal and state regulatory officials to encourage mitigation for wetland impacts within the same watershed area. The County should also map existing wetlands and identify potential restoration opportunities to use for mitigation.

Watershed Benefit: This action will help to keep the wetland function and benefit within the same watershed so that there is no net loss of wetlands within a watershed.

GOAL C: Provide for long term stewardship of the Middle Potomac Watersheds by building awareness of the

importance of watershed protection and providing opportunities for enjoyment of streams.

Objective C3: Promote the implementation and maintenance of LID practices.

Policy Action C3.7: Create a program to certify citizens to inspect rain gardens and other LID measures. Ensure that maintenance agreements are recorded on HOA deeds and that the maintenance responsibility transfers with property title changes.

Strategy to Achieve Action: An agreement between the county and HOAs should be established requiring new HOAs to maintain rain gardens and other LID measures in their neighborhood. The maintenance agreement will ensure that the sites continue to function properly and are kept in good condition. Educational materials should be provided by the county to residential property owners and a certified training program should be implemented for citizens to inspect the LID measures. The educational and training materials should include checklists and schedules for maintenance actions for different types of LID methods.

Watershed Benefit: Requiring the HOAs to inspect and maintain the LID sites will help to keep them functioning properly. Properly functioning LID sites will maximize water quality treatment and therefore improve stream quality.

Policy Action: C3.8: HOAs should post signs identifying locations of LID measures in order to prevent inadvertent damage. A universal common symbol (e.g. a bucket with plants coming out of it) should be developed and posted near LID measures.

Strategy to Achieve Action: The county should develop a common symbol to post on LID signage and include it in the Public Facilities Manual with county-approved LID methods. The proposed maintenance agreements between the county and HOAs should require that HOAs post the LID signs near LID sites in order to promote awareness and prevent damage.

Watershed Benefit: LID signs will increase public awareness of LID measures and should help to prevent inadvertent damage to LID sites.

Policy Action C3.9: If a stormwater utility is established, provide opportunities for landowners to lower their utility fees by installing LID measures on their properties. If such an arrangement is reached, ensure that the LID is noted on the deed and transfers with the property to prevent loss of the LID measure under new ownership.

Strategy to Achieve Action: Landowners who voluntarily install and maintain LID methods on their property should receive a discount on their utility fees. The reduction of the utility fee could be measured by the percentage of runoff reduced by the LID method or by the reduction of impervious surfaces on the property. The county can provide workshops for landowners to learn about the concept, building procedures, and maintenance schedules for LID methods.

Watershed Benefit: In the event that a stormwater utility is established, this action would help to increase the installation of LID methods by individual property owners, which will benefit the watershed by reducing the amount of runoff and of its associated pollutants.

Glossary

A

Acre: A measure of land equating to 43,560 square feet.

Average Land Cover Conditions: The average percent of impervious area within the county, as set forth in the Fairfax County Public Facilities Manual.

B

Benthic Macroinvertebrate: An aquatic animal lacking a backbone and generally visible to the unaided eye.

Best Management Practice (BMP): A structural or nonstructural practice that is designed to minimize the impacts of changes in land use on surface and groundwater systems. Structural best management practices refer to basins or facilities engineered for the purpose of reducing the pollutant load in stormwater runoff, such as bioretention, constructed stormwater wetlands, etc. Nonstructural best management practices refer to land use or development practices that are determined to be effective in minimizing the impact on receiving stream systems such as the preservation of open space and stream buffers, disconnection of impervious surfaces, etc.

Bioretention Basin: A water quality best management practice engineered to filter the water quality volume through an engineered planting bed, consisting of a vegetated surface layer (vegetation, mulch, ground cover), planting soil, and sand bed (optional), and into the in-situ material. Also called rain gardens.

Bioengineering: Combines biological (live plants) and engineering (structural) methods to provide a stream bank stabilization method that performs natural stream functions without habitat destruction.

Bioretention Filter: A bioretention basin with the addition of a sand layer and collector pipe system beneath the planting bed.

Brush Mattress: A thick layer of live branch cuttings held together with stakes constructed on steep stream banks. The plants sprout and develop a root network in the stream bank which provides stability and prevents erosion.

Buffer: An area of natural or established vegetation managed to protect other components of a resource protection area and state waters from significant degradation due to land disturbances. See also resource protection area and riparian buffer.

C

Capacity: The amount of water that a channel can accommodate up to its bank full condition, which is dependent on its slope, roughness characteristics, and geometric shape.

Channel Evolution Model (CEM): The geomorphologic assessment of the incised stream channels developed by Schumm et. al.

Channel: A natural or manmade waterway.

Chesapeake Bay Preservation Areas: Any land designated by the county pursuant to Part III of the Chesapeake Bay Preservation Area Designation and Management Regulations and Code of Virginia, Section 10.1-2107. A Chesapeake Bay Preservation Area shall consist of a resource protection area and a resource management area.

Confluence: The joining point where two or more streams create a combined, larger stream.

Constructed Stormwater Wetlands: Areas intentionally designed and created to emulate the water quality improvement function of wetlands for the primary purpose of removing pollutants from stormwater.

Cross Vein: An upstream-directed, gently sloping rock structure constructed perpendicular to flow and forming a "V" when looking in the downstream direction. The structure is designed to direct flow from the banks toward the center of the channel in order to help with grade control and channel modifications.

D

Density: The number of dwelling units per acre.

Design Storm: A selected rainfall hyetograph of specified amount, intensity, duration, and frequency that is used as a basis for design.

Detention: The temporary impoundment or holding of stormwater runoff.

Detention Basin: A stormwater management facility that temporarily impounds runoff and discharges it though a hydraulic outlet structure to a downstream conveyance system. While a certain amount of overflow may also occur via infiltration through the surrounding soil, such amounts are negligible when compared to the outlet structure discharge rates, and therefore, are not considered in the facility's design. Since a detention basin impounds runoff only temporarily, it is normally dry during periods of no rainfall.

Detention Basin, Extended: A stormwater management facility that impounds runoff for a longer period of time than a regular detention basin, which provides greater pollutant removal. Extended detention basins may utilize multiple basins in the facility to achieve this result.

Developer: The legal or beneficial owner or owners of all the land proposed to be included in a given development or the authorized agent thereof. In addition, the holder of an option or contract to purchase, a lessee having a remaining term of not less than 30 years, or other persons having an enforceable proprietary interest in such land shall be deemed to be a developer.

Development: The construction, rehabilitation, rebuilding or substantial alteration of residential, commercial, industrial, institutional, recreational, transportation, or utility uses, facilities, or structures.

Dwelling Unit: One or more rooms in a residential building or residential portion of a building that are arranged, designed, used, or intended for use as a complete, independent living facility which includes permanent provisions for living, sleeping, eating, cooking, and sanitation.

E

Ecosystem: All of the component organisms of a biological community and their environment that together form an interacting system.

Effective Imperviousness: The fraction of total impervious area with a direct hydraulic connection to the downstream drainage, such as through the storm drainage system. Effective imperviousness area is also known as directly connected area.

Estate Residential: Comprehensive plan land use characterized as single-family detached residences with 0.1 to 0.5 dwelling units per acre.

Eutrophication: The process of over-enrichment of water bodies by nutrients often typified by the presence of algal blooms.

F

Fecal Coliform Bacteria: A group of organisms common to the intestinal tracts of humans and animals. The presence of fecal coliform bacteria in water is an indicator of pollution and of potentially dangerous bacterial contamination.

First Flush: The first portion of runoff resulting from a rainfall event, usually defined as a depth in inches, considered to contain the highest pollutant concentration.

Floodplain: Those land areas in and adjacent to streams and watercourses subject to continuous or periodic inundation from flood events with a one percent chance of occurrence in any given year (i.e., the 100-year flood frequency event) and having a drainage area greater than 70 acres. Minor floodplains shall be those floodplains that have a drainage area greater than 70 acres but less than 360 acres. Floodplains shall include all areas of the county which are designated as a floodplain by the Federal Insurance Administration, the United States Geological Survey, or Fairfax County.

Floor Area Ratio: Determined by dividing the gross floor area of all buildings on a lot by the area of that lot.

Frequency (design storm frequency): The recurrence interval of storm events having the same duration and volume. The frequency of a specified design storm can be expressed either in terms of exceedence probability or return period.

Exceedence Probability: The probability that a storm event having a specified volume and duration will be exceeded in one time period, usually assumed to be one year. If a storm has a one percent chance of occurring in any given year, then it has an exceedence probability of 0.01.

G

Gabion: A wire basket or cage that is filled with gravel and generally used to stabilize stream banks and improve degraded aquatic habitat.

Geographic Information System (GIS): A method of overlaying spatial land and land use data of different kinds. The data are referenced to a set of geographical coordinates and encoded in a computer software system. GIS is used by many localities to map utilities and sewer lines and to delineate zoning areas.

Geomorphology: A science that deals with the land and submarine relief features of the earth's surface.

Glide: Section of a stream with a relatively high velocity and with little or no turbulence on the surface of the water.

Grassed Swale: An earthen conveyance system that is broad and shallow, has check dams, and is vegetated with erosion-resistant and flood-tolerant grasses. It is engineered to remove pollutants from stormwater runoff by filtration through vegetation and infiltration into the soil.

H

Head Cut: The geomorphologic incision of the stream due to the hydraulic effects of a channel from head forces. One example is the accelerated cutting of a stream due a manmade or natural constriction where water velocities are increased substantially. Another example is the outlet of a dam, where extreme velocities can occur due to the high static head forces created by the build-up of water from the dam structure.

Headwater: The source of a stream or watershed.

High-Density Residential: Comprehensive plan land use characterized as greater than eight dwelling units per acre.

Highly Erodible Soils: Soils (excluding vegetation) with an erodibility index (EI) from sheet and rill erosion equal to or greater than eight. The erodibility index for any soil is defined as the product of the formula RKLS/T, as defined by the Food Security Act (F.S.A.) Manual of August, 1988, in the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service, where K is the soil susceptibility to water erosion in the surface layer; R is the rainfall and runoff; LS is the combined effects of slope length and steepness; and T is the soil loss tolerance.

High-Intensity Commercial: Comprehensive plan land use characterized as Retail.

Highly Permeable Soils: Soils with a given potential to transmit water through the soil profile. Highly permeable soils are identified as any soil having a permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches (permeability groups "rapid" and "very rapid") as found in the National Soils Handbook of July 1983, in the Field Office Technical Guide of the U.S. Department of Agriculture Soil Conservation Service.

Hydraulics: The physical science and technology of the static and dynamic behavior of fluids.

Hydrograph: A plot showing the rate of discharge, depth, or velocity of flow versus time for a given point on a stream or drainage system.

Hydrology: The science dealing with the distribution and movement of water.

Hyetograph: A graphic representation of the amount of precipitation that falls over time for the localities represented.

I

Imperviousness or Impervious Cover: A surface composed of any material that significantly impedes or prevents natural infiltration of water into soil. Impervious surfaces include, but are not limited to, roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface. Impervious areas or impervious surfaces do not include the water surface area of a swimming pool.

Industrial: Comprehensive plan land use characterized as Industrial facilities.

Infill: A residential development that has occurred proximate to, or within, an already established neighborhood.

Infiltration Facility: A stormwater management facility that temporarily impounds runoff and discharges it though the surrounding soil. While an infiltration facility may also be equipped with an outlet structure to discharge impounded runoff, such discharge is normally reserved for overflow and other emergency conditions. Since an infiltration facility impounds runoff only temporarily, it is normally dry during periods of no rainfall. Infiltration basins, infiltration trenches, infiltration dry wells, and porous pavement are considered infiltration facilities.

Intensely Developed Area: An area of existing development and infill sites where development is concentrated and little of the natural environment remains as of the date of adoption of the county's Chesapeake Bay Preservation ordinance and which is so designated on the county's map of Chesapeake Bay Preservation Areas.

Invert: The lowest flow line elevation in any component of a conveyance system, including storm sewer, channels, weirs, etc.

J

J-hooks: An upstream directed, gently sloping structure composed of boulders or logs constructed on the outside of stream bends and forming a "J" when looking downstream. The structure is designed to direct flow from the banks toward the center of the channel in order to reduce downcutting and bank erosion, dissipate energy, and create habitat for fish and other aquatic organisms.

L

Land Development: A manmade change to, or construction on, the land surface that changes its runoff characteristics. Certain types of land development are exempted from stormwater management requirements as provided in the Stormwater Management Act, 10.1-603.8 B of the Code of Virginia.

Land Disturbing Activity: Any land change which may result in soil erosion from water or wind and the movement of sediments into state waters or onto lands in the Commonwealth, including but not limited to, clearing, grading, excavating, permanent flooding associated with the impoundment of water, and filling of land.

Landscaping: The improvement of a lot with grass, shrubs, trees, other vegetation and/or ornamental objects. Landscaping may include pedestrian walks, flowerbeds, ornamental objects such as fountains, statues, and other similar natural and artificial objects designed and arranged to produce an aesthetically pleasing effect.

Live fascines: long tightly bound bundles of live woody vegetation, such as Willow, Alder, or Dogwood, buried in a stream bank in shallow trenches placed parallel to the flow of the stream. The plant bundles sprout and develop a root network in the stream bank which provides stability and prevents erosion.

Low-Density Residential: Comprehensive plan land use characterized as single-family detached residence with 0.5 to 1 dwelling units per acre.

Low Impact Development (LID): Integrated hydrologically functional site design with pollution prevention measures to compensate for land development impacts on hydrology and water quality. The primary goal of Low Impact Development methods is to mimic the predevelopment site hydrology.**Low-Intensity Commercial:** Comprehensive plan land use characterized as Office or Public Facilities.

M

Major Floodplain: Those land areas in and adjacent to streams and watercourses subject to continuous or periodic inundation from flood events with a one percent chance of occurrence in any given year (i.e., the 100-year flood frequency event) and having a drainage area equal to or greater than 360 acres.

Mansionization: the trend of tearing down smaller houses and replacing them with much larger houses, or adding large additions to existing houses that are out of character with the surrounding homes.

Medium-Density Residential: Comprehensive plan land use characterized as five to eight dwelling units per acre.

Mitigation: To change a situation to make it less harmful to people and property, such as as flood protection projects which will lessen the extent of flood damages to houses during a flood. Also, to provide a habitat in another more conducive, larger, or better-suited area, typically in a different location from the original. Mitigation may result due to constructability, cost, or other site restriction issues.

N

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, monitoring, and enforcing permits under Sections 307, 402, 318 and 405 of the Clean Water Act. The NPDES permit is for discharges to the waters of the United States and is administered in Virginia under the Virginia Pollutant Discharge Elimination System.

Nonpoint Source Pollution: Contaminants such as sediment, nitrogen, phosphorous, hydrocarbons, heavy metals, and toxics whose sources cannot be pinpointed but rather are washed from the land surface in a diffused manner by stormwater runoff.

O

Off-Site: Any area outside the boundary of a lot.

Open Space: That area within the boundaries of a lot that is intended to provide light and air, and is designed for either scenic or recreational purposes. Open space shall, in general, be available for entry and use by the residents or occupants of the development, but may include a limited proportion of space so located and treated as to enhance the amenity of the development by providing landscaping features, screening for the benefit of the occupants or those in neighboring areas, or a general appearance of openness. Open space may include, but need not be limited to lawns, decorative planting, walkways, active and passive recreation areas, children's playgrounds, fountains, swimming pools, undisturbed natural areas, agriculture, wooded areas, water bodies, and those areas with landscaping. Open space shall not include driveways, parking lots, or other vehicular surfaces, any area occupied by a building, nor areas so located or so small as to have no substantial value for the purposes stated in this definition. Within a residential subdivision, open space shall be composed of only those areas not contained in individually owned lots.

P

Passive Recreation: Recreational activities that are commonly unorganized and noncompetitive, including, but not limited to, picnicking, bird watching, kite flying, bicycling, and walking. Site amenities for such activities include, but are not limited to, picnic tables, photo stands, open play areas where substantial clearing is not required, rest rooms, tot lots, boardwalks, paved paths, pathways, benches, and pedestrian bridges and appurtenant structures.

PCBs: PCBs are a class of chemicals known as polychlorinated biphenyls. They are entirely man-made and do not occur naturally. They were first manufactured commercially in 1929 by Monsanto, their sole U.S. manufacturer. They were used in many different types of products including hydraulic fluid, casting wax, pigments, carbonless copy paper, plasticizer, vacuum pumps, compressors, heat transfer systems, and others. Their primary use, however, was as a dielectric fluid in electrical equipment. Because of their stability and resistance to thermal breakdown as well as their insulating properties, they were the fluid of choice for transformers and capacitors. Because of their fire resistance, they were required by some fire codes.

Peak Discharge: The maximum rate of flow at an associated point within a given rainfall event or channel condition.

Perennial Stream: A body of water that normally flows year-round in a defined channel or bed and is capable, in the absence of pollution or other manmade stream disturbances, of supporting bottom-dwelling aquatic animals.

Phosphorus: An element found in fertilizers and sediment runoff that can contribute to the eutrophication of water bodies. It is the keystone pollutant in determining pollutant removal efficiencies for various best management practices as defined by the Virginia Stormwater

Management Regulations.

Point Source: The discernible, confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, container, concentrated animal feeding operation, landfill leachate collection system from which pollutants may be discharged. This term does not include return flows from irrigated agricultural stormwater runoff.

Post-Development: Refers to conditions that reasonably may be expected or anticipated to exist after completion of the land development activity on a specific site or tract of land.

Pre-Development: Refers to the conditions that exist at the time that plans for the land development of a tract of land are approved by the plan approval authority. Where phased development or plan approval occurs (preliminary grading, road, and utilities, etc.), the existing conditions at the time prior to the first item being approved or permitted establishes the pre-development conditions.

Proffers: Voluntary projects or conditions undertaken by a developer to mitigate the effects of increased development as a result of the rezoning process.

Pro Rata Share (PRS)**: The payment by a subdivider or developer of land for his share of the cost of providing reasonable and necessary drainage facilities located outside the property limits of the land owned or controlled by the subdivider or developer of land and necessitated or required, at least in part, by the new construction or improvement of his subdivision or development.**

R

Redevelopment: The substantial alteration, rehabilitation, or rebuilding of a property for residential, commercial, industrial, or other purposes.

Resource Management Area (RMA): As established in accordance with Chapter 118 of the Code of County of Fairfax, Virginia, that component of the Chesapeake Bay Preservation Area comprised of lands that, if improperly used or developed, have a potential for causing significant water quality degradation or for diminishing the functional value of the resource protection area. A resource management area is a Chesapeake Bay Preservation Area, whose land features typically include floodplains, highly erodible soils, highly permeable soils, nontidal wetlands not in the resource protection area, and other land as designated by the locality. See also resource protection area.

Resource Protection Area (RPA): As established in accordance with Chapter 118 of the Code of County of Fairfax, Virginia, that component of the Chesapeake Bay Preservation Area comprised of lands at or near the shoreline or water's edge that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation of the quality of state waters. In their natural condition, these lands provide for the removal, reduction, or assimilation of sediments, nutrients, and potentially harmful or toxic substances from runoff entering the Bay and its tributaries, and minimize the adverse effects of human activities on state waters and aquatic resources. Resource protection areas filter pollutants out of stormwater runoff, reduce the volume of stormwater runoff, prevent erosion, and perform other important biological and ecological functions. A resource management area is a Chesapeake Bay Preservation Area, whose land features generally include tidal wetlands, nontidal wetlands contiguous to tidal wetlands, tidal shores, tributary streams, a buffer area (of not less than 100 feet), and other lands as designated by the locality.

Retention: The permanent storage of stormwater.

Retention Basin: A stormwater management facility that includes a permanent impoundment for the purpose of enhancing water quality and, therefore, is normally wet, even during periods without rainfall. Storm runoff inflows may be temporarily stored above this permanent impoundment for the purpose of reducing flooding or stream channel erosion.

Retrofit: The modification of stormwater management systems through the construction and/or enhancement of wet ponds, wetland plantings, or other best management practices designed to improve water quality.

Return Period: The average length of time between events having the same volume and duration. If a storm has a one percent chance of occurring in any given year, then it has a return period of 100 years.

Riffle: A reach of stream that is characterized by shallow, fast moving water broken by the presence of rocks and boulders.

Riparian Buffer: Strips of grass, shrubs, and trees along the banks of rivers and streams that filter polluted runoff and provide a transition zone between water and human land use. Buffers are also complex ecosystems that provide habitat and improve the stream communities they shelter.

Road Right of Way (ROW): The area over which a legal right of passage exists; land used for public purposes in association with the construction or provision of public facilities, transportation projects, or other infrastructure.

Runoff: The portion of precipitation, snow melt, or irrigation water that runs off the land into surface waters.

S

Sediment: Material, both mineral and organic, that is in suspension, is being transported, or has been moved from its original site of origin by water or wind. Sediment piles up in reservoirs, rivers and harbors, reducing channel depth, impeding navigability, destroying wildlife habitat and clouding water so that sunlight cannot reach aquatic plants.

Sedimentation (Settling): A pollutant removal method to treat stormwater runoff in which gravity is utilized to remove particulate pollutants. Pollutants are removed from the stormwater as sediment settles or falls out of the water column. An example of a best management practice utilizing sedimentation is an extended detention basin.

Site Plan: A required submission that contains detailed engineering drawings of the proposed uses and improvements required in the development of a given lot.

Soil Bioengineering: An integrated technology that uses sound engineering practices, in conjunction with integrated ecological principles, to assess, design, construct, and maintain living vegetative systems and to repair damage done by erosion and failures by the land to create a healthy and functioning riparian ecosystem.

Stakeholder: Stakeholders include a range of groups within the watershed (residents, industry, local government, agencies, community groups, etc.), as well as those whose livelihoods take them into the watershed.

Stormwater Management Facility: A device that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow.

Stream Rehabilitation: Stream rehabilitation is making the land useful again after a disturbance. It involves the recovery of ecosystem functions and processes in a degraded habitat (Dunster and Dunster 1996). Rehabilitation does not necessarily reestablish the predisturbance condition, but does involve establishing geologically and hydrologically stable landscapes that support the natural ecosystem.

Stream Restoration: Stream restoration is reestablishment of the structure and function of ecosystems (National Research Council, 1992). Ecological restoration is the process of returning an ecosystem as closely as possible to predisturbance conditions and functions. Implicit in this definition is that ecosystems are naturally dynamic. It is therefore not possible to recreate a system exactly. The restoration process reestablishes the general structure, function, and dynamic but self-sustaining behavior of the ecosystem.

Stream Valley: A stream and the land extending from either side of it to a line established by the high point of the concave/convex topography as delineated on a map adopted by the Fairfax County Board.

Substantial Alteration: Expansion or modification of a structure or development which would result in disturbance of any land within a resource protection area or land exceeding an area of 2,500 square feet within a resource management area.

Subwatershed: A smaller subsection of a larger watershed, which may have been delineated to describe a particular land use, function, or hydrologic condition.

T

Tidal Shores or Shore: The land contiguous to a tidal body of water between the mean low water level and the mean high water level.

Tree Cover: The area directly beneath the crown and within the dripline of a tree.

U

Underutilized: Underutilized parcels have a *Comprehensive Plan* density greater than the existing land use for the parcel. The majority of the underutilized parcels are currently estate residential and have a planned land use of low-density residential.

Urban Runoff**: Stormwater from city streets and adjacent domestic or commercial properties that carries nonpoint source pollutants of various kinds into the sewer systems and receiving waters.**

Use: Any purpose for which a structure or a tract of land may be designed, arranged, intended, maintained, or occupied; also, any activity, occupation, business or operation carried on, or intended to be carried on, in or on a structure or on a tract of land.

V

Vegetated Geogrid: A soil-wrapped structure in natural or synthetic geotextile material with live cuttings placed in between and secured by tucking the geotextile material into the slope. Vegetated geogrids work well for the repair of eroding banks where the currents are strong and are useful for very steep sites. They provide soil reinforcement, produce rapid growth, offer overhanging material for aquatic habitat, and become very natural in appearance and function.

W

W-Weir: An upstream directed, gently sloping structure which forms a "W" when looking in the downstream direction. The structure is designed to direct flow from the banks toward the center of the channel in order to reduce downcutting and bank erosion, dissipate energy, and create habitat for fish and other aquatic organisms.

Water Body with Perennial Flow: A body of water flowing in a natural or manmade channel year-round, except during periods of drought. The term "water body with perennial flow" includes perennial streams, estuaries, and tidal embayments. A perennial stream means any stream that is both perennial and so depicted on the map of Chesapeake Bay Preservation Areas adopted by the Board of Supervisors pursuant to Section 118-1-9(a). Streams identified as perennial on the adopted map are based on field studies conducted by the Department of Public Works and Environmental Services. Lakes and ponds that form the source of a perennial stream, or through which the perennial stream flows, are a part of the perennial stream. The width of a perennial stream may be measured from top-of-bank to top-of-bank or at the Ordinary High Water Mark (OHWM) as defined by 33 CFR Part 328.3(e). The aerial extent of a pond or lake is measured at the OHWM. Generally, the water table is located above the streambed for most of the year and groundwater is the primary source for stream flow. In the absence of pollution or other manmade disturbances, a perennial stream is capable of supporting aquatic life.

Watercourse: A stream with incised channel (bed and banks) over which waters are conveyed.

Water Quality Standards: State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Water Quality Volume: The volume equal to the first one-half inch of runoff multiplied by the impervious surface of the land development project as defined by the Virginia Stormwater Management Regulations. It should be noted that the runoff frequency spectrum for Washington D.C. and the surrounding Chesapeake Bay watershed is based on the fact that 90 percent of the annual runoff is generated by storms of one inch of rainfall or less. Therefore, some of the best management practices will require two times the water quality volume, or the first one inch of runoff, to be treated.

Watershed: A defined land area drained by a river, stream, or drainage way, or system of connecting rivers, streams, or drainage ways such that all surface water within the area flows through a single outlet.

Wetlands: A land area are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

List of Acronyms and Abbreviations

Ac	Acre
BOD	Biochemical Oxygen Demand
cfs	Cubic Feet per Second
CEM	Channel Evolution Model
CBPA	Chesapeake Bay Preservation Area
COD	Chemical Oxygen Demand
CMP	Corrugated Metal Pipe
CWA	Clean Water Act
DCR	Virginia Department of Conservation and Recreation
DEM	Digital Elevation Model
DEQ	Virginia Department of Environmental Quality
DO	Dissolved Oxygen
DPZ	Fairfax County Department of Planning and Zoning
E&S	Erosion and Sediment
FEMA	Federal Emergency Management Agency
fps	Feet per Second
FBP	Future Basin Plan
GIS	Geographic Information System
GP	General Permit
IAP	Immediate Action Plan
IDA	Intensely Developed Area
IMBI	Index of Macro-Benthic Integrity
IMP	Integrated Management Practices
JPA	Joint Permit Application
LF	Linear Foot
LID	Low-Impact Development
mg/l	Milligrams per Liter

NPDES	National Pollutant Discharge Elimination System
NRCS	U.S. Natural Resources Conservation Service
NWP	Nationwide Permit
OSDS	Fairfax County Office of Site Development Services
PCBs	Polychlorinated Biphenyls
PFM	Public Facilities Manual
ppb	Parts per Billion
PRS	Pro Rata Share
RBP	Rapid Bioassessment Protocol
RCP	Reinforced Concrete Pipe
RMA	Resource Management Area
RPA	Resource Protection Area
SCS	Soil Conservation Service
SOS	Save Our Streams
SPS	Stream Protection Strategy
STATSGO	National Resources Conservation Service State Soil Geographic Database
SWM	Stormwater Management
TMDL	Total Maximum Daily Load
TR-55	Technical Release 55
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VPDES	Virginia Pollutant Discharge Elimination System
VWPP	Virginia Water Protection Permit

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