Little Hunting Creek
Watershed Management Plan

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Final

Prepared for:

Fairfax County
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Department of Public Works and Environmental Services

Prepared by:

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Institute for Environmental Negotiation

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Executive Summary

The Little Hunting Creek Watershed Management Plan is a strategic plan developed with input from the community for achieving the following watershed vision:

> "The vision of the Little Hunting Creek Watershed Management Plan is to integrate environmental management, natural resource protection, and community goals to minimize runoff, reduce pollution, and restore the quality of Little Hunting Creek for the community's benefit."

The Little Hunting Creek Watershed Management Plan (the plan) provides an array of strategies for achieving the goals described in the vision. The plan was developed by the watershed stakeholders to help engage and educate all members of the Little Hunting Creek Watershed community. The plan is a guide to:

- Define the goals and objectives to support the plan vision
- Assess the existing condition of the watershed and future impacts due to changes in land use
- Identify key watershed issues and define goals and objectives for addressing these issues
- Provide action strategies that support the objectives and coordinate existing and proposed watershed activities
- Educate and engage the watershed stakeholders to improve the watershed condition

The Little Hunting Creek Watershed Management Plan provides a strategy for mitigating the impacts of development, such as increased runoff and poor water quality. This plan is the first one to be developed as part of a county initiative to create watershed management plans for all Fairfax County watersheds.

Background

The Little Hunting Creek Watershed is located in the Chesapeake Bay Watershed in the southeastern part of Fairfax County, Virginia, and is one of the most developed watersheds in the county as shown on Map E.1. It is bounded to the west by the Dogue Creek Watershed, to the south and east by the Potomac River, and to the north by the Belle Haven Watershed. The Little Hunting Creek Watershed encompasses 7,067 acres (11.04 square miles) and is located in the coastal plain physiographic province, a region characterized by sandy soil and low-gradient topography.

Much of the land that is located in the Little Hunting Creek Watershed was once owned by General George Washington. In fact, the original name for General Washington's Mount Vernon plantation was the Little Hunting Creek Plantation. Clearing and building on the land started before General George Washington was the principal landholder in the watershed.

The headwaters of Little Hunting Creek are found in Huntley Meadows Park, located at the northwest border of the watershed. The creek flows in a southeasterly direction to its confluence with the Potomac River east of the historic Mount Vernon Estates. The Little Hunting Creek Watershed experiences tidal effects two to three miles upstream of its confluence with the Potomac River.

Purpose

The primary reasons the Little Hunting Creek Watershed Management Plan was developed can be summarized as follows:

1. To restore and protect the county's streams, of which 70% 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 the Chesapeake Bay
4. To replace the currently outdated watershed management plan through the use of new technologies
5. To take a comprehensive approach in addressing multiple regulations, commitments, and community needs

With input from the Little Hunting Creek 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 watershed.

Watershed Condition

For the purposes of this watershed plan, the Little Hunting Creek Watershed was divided into five subwatersheds: North Little Hunting Creek, South Little Hunting Creek, Paul Spring Branch, North Branch, and the Potomac River. The residential, commercial, and industrial development in the Little Hunting Creek Watershed began in earnest in the late 1940s. Today, the watershed is 82% developed and includes some of the oldest developed areas in Fairfax County. The total impervious area in the watershed is approximately 1,762 acres (25% of the total area).

The predominant existing land use in the watershed is medium-density, single-family residential comprising 33% of the watershed area. The next major land use in the watershed is open space, parks, and recreational areas comprising 17% of the watershed area. For ultimate future build-out of the watershed, medium-density, single-family residential land use may increase to 55%, and the future watershed imperviousness may increase to 27%.

The county initiated a stream physical assessment for all of its watersheds in August 2002, and the Little Hunting Creek Watershed was assessed as one of the five watersheds with the poorest condition in the county. The stream physical assessment included a habitat assessment, infrastructure inventory, stream characterization, and stream geomorphologic assessment. The stream habitat quality was rated as very poor for 15% of the assessed stream length and poor for 58% of the assessed stream length.

The Fairfax County Health Department monitors stream water quality at two water quality sampling sites located in the watershed. The Fairfax County 2001 Stream Water Quality Report concluded that the overall water quality of Little Hunting Creek Watershed is considered poor for fecal coliform bacteria and good for the chemical and physical parameters of the streams except for the low dissolved oxygen level found in North Branch.

The Fairfax County Stream Protection Strategy (SPS) Baseline Study from January 2001 evaluated the quality of streams throughout the county. Little Hunting Creek and its tributaries, North Branch and Paul Spring Branch, 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.

Little Hunting Creek is included in a segment of the Potomac River listed as an impaired waterbody in the 2002 303(d) Priority List prepared by the Virginia Department of Environmental Quality (DEQ). The impairment classification is due to a health advisory issued by the Virginia Department of Health for fish consumption based on high levels of polychlorinated biphenyls (PCBs) found in fish tissue samples and high fecal coliform bacteria counts in the water samples. Sediment samples taken from the tidal portion of Little Hunting Creek in 2000 contained the chemical chlordane above the limit that can threaten aquatic life. The Virginia DEQ stated that aquatic life is threatened by the presence of excessive algae in the tidal waters of Little Hunting Creek and it has been designated by the Virginia DEQ as nutrient-enriched waters. In addition to the causes of waterbody impairment described above, the Virginia DEQ Draft 2004 305(b)/303(d) Water Quality Assessment Integrated Report stated that there were enough samples that exceeded the fecal coliform bacteria criterion to cause the creek to not support the state's recreational use goal.

Plan Goals, Objectives, and Actions

The goals of the Little Hunting Creek Watershed Management Plan were derived from the issues identified by the community and the county's consultants based on their analysis of the watershed condition.

Goal A: Reduce stormwater impacts on the Little Hunting Creek Watershed from impervious areas to help restore and protect the streams.

The increased volume of polluted stormwater runoff from impervious surfaces is the primary cause of most of the problems in the watershed. The watershed has 25% imperviousness with approximately 6,245 acres of developed land not controlled by any stormwater management facilities such as dry detention ponds.

Goal B: Preserve, maintain, and improve watershed habitats to support native flora and fauna.

The habitat quality is rated poor for the majority of the streams in the Little Hunting Creek watershed, with approximately 10 miles of degraded buffers and eroded stream banks. The creek and streams have manmade alterations such as paved and straightened channels and hardened shorelines that decrease the available habitat in the watershed. The increased quantity and poor quality of the stormwater runoff also impacts the habitat by eroding the stream bed and banks and polluting the water. The environment section of the county's Policy Plan states under Objective 2, "…Protect and restore the ecological integrity of streams in Fairfax County." The actions under this goal will strive to maintain the existing quality habitat areas in good condition and improve those habitat areas in poor condition.

Goal C: Preserve, maintain, and improve the water quality of the streams to benefit humans and aquatic life.

The existing water quality of the creek and streams is poor based on the information from the county's stream quality monitoring and Virginia DEQ's monitoring data regarding fecal coliform bacteria, nutrients such as nitrogen and phosphorous, chlordane, and PCBs. Sedimentation caused by stream bed and bank erosion and land disturbances in the watershed have caused silting of streams and the creek. There is a direct relationship between the upstream volume of runoff and velocities and the amount of sediment deposited downstream. To reduce the amount of degradation of the streams and sediments transported downstream, upstream runoff volumes and velocities must be reduced. This goal is consistent with the environment section of the county's Policy Plan as stated in Objective 2, "Prevent and reduce pollution of surface and groundwater resources."

Goal D: Provide a means for increasing community involvement for long-term watershed stewardship.

Education and involvement in watershed issues will help drive the actions for all of the goals of this plan. The community has been involved in the process to develop the Little Hunting Creek Watershed Management Plan, and continued involvement will help in improving the state of the watershed. The strategy to achieve this goal will include actions such as distributing educational materials to the public, providing technical assistance to the community, and assisting in conducting outreach to neighborhood groups and associations.

Objectives and actions were developed to help achieve the plan goals and include recommendations to change county policy and recommendations for structural and non-structural capital improvements. The 25-year funding requirements for all of the recommended actions is estimated at $30.4 million and the commitment needed from county staff for implementing the plan actions is estimated at 2.81 staff year equivalents. $26.6 million of this estimate is attributed to project implementation costs and $3.8 million is for policy-related recommendations.

Benefits of Plan Actions

Hydrologic, hydraulic, and water quality models were created for the Little Hunting Creek Watershed in order to quantify the benefit of the plan's proposed alternatives. As a separate indicator, the Army Corps of Engineers stream attributes rating method was also used to compare existing stream conditions with anticipated improvements to the watershed as a result of complete plan implementation. The models and stream rating system helped to identify the following benefits to the Little Hunting Creek Watershed with implementation of the proposed actions:

1) Reductions in peak stormwater discharges, resulting in:
   - Reductions in road, house, and yard flooding
   - Reductions in stream velocities and bank erosion
2) Reductions in pollutant loads, resulting in improved stream water quality
3) Improved stream habitat

Future ultimate development conditions without any proposed BMP alternatives (future), and future ultimate development conditions with the proposed BMP alternatives (future proposed), were modeled to evaluate the effect of the proposed alternatives in the watershed and to allow formalization of cause and effect relationships.

Reductions in stormwater peak discharges based on complete implementation of the plan are summarized in Table E.1.

Table E.1 Subwatershed Peak Flow Reduction Summary

Subwatershed	Two-year Reduction in Peak Flow (%)	10-year Reduction in Peak Flow (%)
North Little Hunting Creek	-18.0	-13.8
South Little Hunting Creek	-3.2	-2.3
Paul Spring	-23.1	-33.2
North Branch	-14.1	-15.6
Potomac River	N/A	N/A

Reductions in pollutant loads for total suspended solids (TSS), total phosphorous (TP), and total nitrogen (TN) based on complete implementation of the plan are summarized in Table E.2. The overall watershed benefit of the proposed projects in the plan, with respect to the Chesapeake Bay Preservation Ordinance, is a reduction in TP of 9%. This has nearly the same effect as treating the entire watershed as a "redevelopment project," which would generally require a reduction in TP of approximately 10%.

Table E.2 Pollutant Loading Rate Reduction Summary

Subwatershed	% Decrease TSS Loading Rate	% Decrease TP Loading Rate	Decrease T N Loading Rate %
North Little Hunting Creek	14	14	10
South Little Hunting Creek	1	1	1
Paul Spring	20	15	9
North Branch	14	11	7
Potomac River	0	0	0
Little Hunting Creek Total	11	9	6

The Army Corps of Engineers stream attributes rating method[1] was used to compare existing stream conditions with anticipated improvements to the watershed as a result of plan implementation. The following parameters are considered in this rating system:

1) Channel Incision: The degree to which the channel has downcut or is incised in its floodplain
2) Riparian Condition: Riparian corridor width
3) Bank Erosion: The amount of bank erosion
4) Channelization: Whether or not the stream has been channelized
5) In-stream Habitat: The amount and condition of instream habitat

The index values range from 1 (lowest score) to 5 (highest score). By applying the 2003 Stream Physical Assessment habitat-related data to this methodology, the overall existing stream condition index for Little Hunting Creek is 2.86. For comparison, the countywide reach-length weighted stream index is 3.49. Based on complete implementation of the stream and tree buffer restoration projects proposed in the watershed plan, the overall Little Hunting Creek stream index is projected to be 3.51. It is anticipated that the corresponding measurable improvement for Little Hunting Creek would be for the Stream Physical Assessment total habitat rating to shift from the "poor" category to the high range of the "fair" category. It must be emphasized that this rating system only applies to stream habitat conditions. Direct water quality and quantity improvements realized as a result of implementation of other watershed plan recommendations (i.e. excluding the stream and tree buffer restoration projects) are not reflected in this stream habitat rating.

Plan Implementation

The recommended plan actions will be implemented over the 25-year life of the Little Hunting Creek Watershed Management Plan. The implementation schedule was developed with input from the Little Hunting Creek Steering Committee using a prioritization of the actions to evaluate how well they met the plan goals. The prioritization criteria that were used included the peak flow reduction, habitat benefit, water quality improvement, promotion of watershed stewardship, and cost of the capital improvement program (CIP) actions. Some of the actions were scheduled by the Steering Committee in the implementation plan according to other important factors in addition to the prioritization rating.

The following tracks have been identified for the implementation of plan recommendations:

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

The capital improvement program projects implementation plan is provided in Table E.3 and the policy actions are summarized in Table E.4. Policy actions will need to be further evaluated in light of their countywide implications. The current planned approach for processing the policy recommendations from the plan is to integrate these recommendations with similar recommendations developed with the Popes Head Creek, Cameron Run, Cub Run, and Difficult Run Watershed Management Plans over the next few years. Land use recommendations are grouped with the policy actions and will be further evaluated as part of the county's comprehensive plan area plan review (APR) process. Land use recommendations that are adopted through the APR process would become part of the comprehensive plan. Map E.1 shows the proposed CIP projects that have specific locations. The projects and policy actions that are watershed wide are not shown on this map.

Table E.3 Capital Improvement Program Projects Implementation[2]

Plan Map No.	Project Description	Fiscal Year Start	Estimated Cost
NB11	New BMP at 7603 Elba Road	2005	$240,000
PSB25	New BMP at 3223 Groveton Street	2005	$240,000
PSB1	New Commercial LID at 6700 Richmond Highway	2005	$610,000
PSB8	Retrofit BMP at 1909 Windmill Lane	2005	$60,000
N/A	Community Watershed Support Services Project:	2005	$1,000,000
N/A	Dumpsite Removal Project: D1.1	2005	$200,000
N/A	North Little Hunting Creek Residential Rain Barrel and Rain Garden: A4.1	2005	$40,000
N/A	Paul Spring Branch Residential Rain Barrel and Rain Garden: A4.1	2005	$60,000
N/A	North Branch Rain Barrel and Rain Garden: A4.1	2005	$70,000
PSB32	New BMP at 6950 Richmond Highway	2006	$600,000
NLHC1	New BMP at 7201 Richmond Highway	2006	$430,000
NLHC20	New BMP at 2709 Popkins Lane	2006	$260,000
PSB24	New BMP at 6625 Lenclair Street	2006	$240,000
NLHC23	New BMP at Mount Vernon Square Townhomes	2006	$110,000
PSB31	New BMP at 2223 Beacon Hill Road	2006	$140,000
NLHC16	New BMP at 2313 Darius Lane	2006	$130,000
NLHC21	New School LID at the Hybla Valley Elementary School and the Bryant High School	2006	$250,000

Plan Map No.	Project Description	Fiscal Year Start	Estimated Cost
NLHC17	New BMP at 3431 Lockheed Boulevard	2006	$110,000
PSB2	New Comm./Instit. LID at Various Churches and the Bucknell Elementary School	2006	$520,000
N/A	Public Education Project: B3.5, C2.5, D1.2, D2.2 , D2.3	2006	$1,440,000
N/A	Wetlands Survey Project: B3.1	2007	$320,000
N/A	PCB Contamination Study Project: C3.1	2007	$30,000
NB1	New School LID at the Whitman Middle School, the Hollin Meadows Elementary, and the Stratford Landing Elementary School	2007	$580,000
NB14	New BMP at 8200 West Boulevard Drive, and 1138, 1200, 1204, and 1208 Cedar Dale Lane	2007	$160,000
NLHC9	New Commercial LID at Mount Vernon Plaza, Hybla Plaza, the Multiplex Cinema, and the Audubon Estates Valley Mobile Home Park	2007	$590,000
N/A	Fecal Coliform Source Study Project: C2.1	2007	$320,000
PSB29	New BMP at 1600 Paul Spring Road	2007	$260,000
N/A	Conservation Acquisition Project: B2.3, B3.3	2007	$200,000
N/A	Sediment Monitoring/Stream Physical Assessment/ Monitoring Project: B2.2, C2.3	2007	$200,000
N/A	Small Watershed Grant Program: D2.1	2007	$460,000
N/A	Buffer Monitoring Project: B1.3	2007	$345,000
N/A	Street Sweeping Program: C1.2	2007	$460,000
NB12	New BMP at 2500 Woodlawn Terrace	2008	$200,000
PSB26	New BMP at 2501 Beacon Hill Road	2008	$150,000
PSB4	Retrofit BMP at 7628 Essex Manor Place	2008	$110,000
PSB30	New BMP at 7509 Fort Hunt Road	2008	$210,000
NLHC24	New BMP at the Mount Vernon Square Apartments at 2722 Arlington Drive	2009	$170,000
PSB7	Retrofit BMP at 7116 Fort Hunt Road	2009	$110,000
PSB15	Stream Restoration at Paul Spring Branch	2010	$2,620,000
N/A	Dredging Feasibility Study Project: C1.1	2010	$510,000
NB13	New BMP at 2500 Parkers Lane	2010	$150,000
NB2	Retrofit BMP at 8033 Holland Road	2010	$250,000
NLHC11	Buffer Restoration at North Little Hunting Creek	2010	$400,000
NLHC14	Stream Restoration at North Little Hunting Creek	2010	$350,000
NLHC19	New BMP at the Grove at Huntley Meadows	2010	$210,000
NLHC4	Retrofit BMP at 3115 Sherwood Hall Lane	2010	$30,000
NLHC6	Retrofit BMP at 3742 Roxbury Lane	2010	$70,000
PR2	Wetland Restoration at Various Locations	2010	$200,000
PR3	New School LID at the Waynewood Elementary School	2015	$80,000
PSB14	Buffer Restoration at Paul Spring Branch	2015	$30,000

Plan Map No.	Project Description	Fiscal Year Start	Estimated Cost
PSB27	New BMP at 6925 University Drive	2015	$100,000
PSB28	New BMP at 2424 Ross Street	2015	$70,000
PSB9	New Wetland BMP at Paul Spring Branch	2015	$230,000
SLHC11	Wetland Restoration at Martin Luther King Jr.	2015	$390,000
SLHC17	Wetland Restoration at the Main Stem of Little Hunting Creek	2015	$230,000
SLHC3	New School LID at the Fort Hunt Elementary School	2015	$270,000
SLHC6	Buffer Restoration at South Little Hunting Creek	2015	$20,000
SLHC7	Buffer Restoration at South Little Hunting Creek	2015	$40,000
NB3	Retrofit BMP at 8306 Rampart Court	2015	$60,000
NB7	Stream Restoration at North Branch	2015	$390,000
NB9	Retrofit BMP at 8225 Stacey Road	2015	$90,000
NLHC12	Stream Restoration at North Little Hunting Creek	2015	$800,000
NLHC15	Stream/Buffer Restoration at North Little Hunting Creek	2020	$820,000
NLHC2	Retrofit BMP at 7770 Richmond Highway	2020	$90,000
NLHC5	Retrofit BMP at the Village at Gum Springs Townhomes	2020	$110,000
PSB10	New Wetland BMP Paul Spring Branch at Fort Hunt Road	2020	$200,000
PSB3	Retrofit BMP at 7008 Bryant Towne Court	2020	$50,000
PSB5	Retrofit BMP at 2923 Preston Avenue	2020	$60,000
PSB6	Retrofit BMP at 6733 Richmond Highway	2020	$70,000
SLHC5	Stream Restoration at South Little Hunting Creek	2020	$560,000
SLHC9	Stream Restoration at South Little Hunting Creek	2020	$230,000
NB10	Retrofit BMP at Noral Place	2020	$30,000
NB4	Retrofit BMP at 8306 Marble Dale Court	2020	$80,000
NB5	Retrofit BMP at 8313 Riverton Lane	2020	$90,000
B8	Stream Restoration at North Branch	2020	$110,000
NLHC13	Stream Restoration at North Little Hunting Creek	2025	$150,000
NLHC3	Retrofit BMP at 7836 Fordson Road	2025	$60,000
PSB12	Buffer Restoration at Paul Spring Branch	2025	$20,000
PSB13	Stream Restoration at Paul Spring Branch	2025	$1,370,000
PSB16	Stream Restoration at Paul Spring Branch	2025	$100,000
PSB17	Stream Restoration at Paul Spring Branch	2025	$40,000
PSB18	Stream Restoration at Paul Spring Branch	2025	$100,000
PSB19	Stream Restoration at Paul Spring Branch	2025	$100,000
PSB20	Stream Restoration at Paul Spring Branch	2025	$100,000
PSB23	Retrofit BMP at 2002 Windmill Lane	2025	$80,000
SLHC16	Retrofit BMP at Woodland Heights	2025	$60,000
SLHC4	Stream Restoration at South Little Hunting Creek	2025	$200,000
SLHC8	Buffer Restoration at South Little Hunting Creek	2025	$150,000
N/A	Inspection Enhancement Project: A3.1[3]	—	$200,000

Plan Map No.	Project Description	Fiscal Year Start	Estimated Cost
N/A	Enforcement Enhancement Project: C2.4, D1.3[4]	—	$1,920,000
N/A	Stormwater Infrastructure Condition Assessment A3.11[3]	—	$216,000

Table E.4 Policy Actions

Recommended Action	Action No.
Reduce existing peak runoff from redevelopment	A2.1
Countywide maintenance agreement authority	A3.2
Evaluate CBPA waivers	B1.4
Promote use of natural shorelines	B3.4
Adopt comprehensive LID calculation methodology	A3.4
Evaluate recommended BMP list	A3.3
No waivers for 18% imperviousness	A3.9
County facilities natural landscaping and green buildings	A3.10
Wetland mitigation for impacts	B3.6
Reduce existing peak runoff from roads	A5.1
Require buffer vegetation restoration for development	B1.5
Zoning incentives	A1.2
BMP siting on individual residential lots	A3.5
Expedited review process	A1.1
Strengthen pooper scooper ordinance	C2.6
Lawn management company requirement	C2.7

Monitoring Plan

In order for the Little Hunting Creek Watershed Management Plan to be implemented effectively, it will need to be updated and revised to address the dynamic nature of the watershed conditions and land use. The monitoring plan was developed to provide monitoring actions and targets to determine the effectiveness of the implemented plan actions. The information collected for the monitoring plan will help the county and stakeholders adjust the plan as necessary to ensure the plan goals and objectives for the Little Hunting Creek Watershed are achieved.

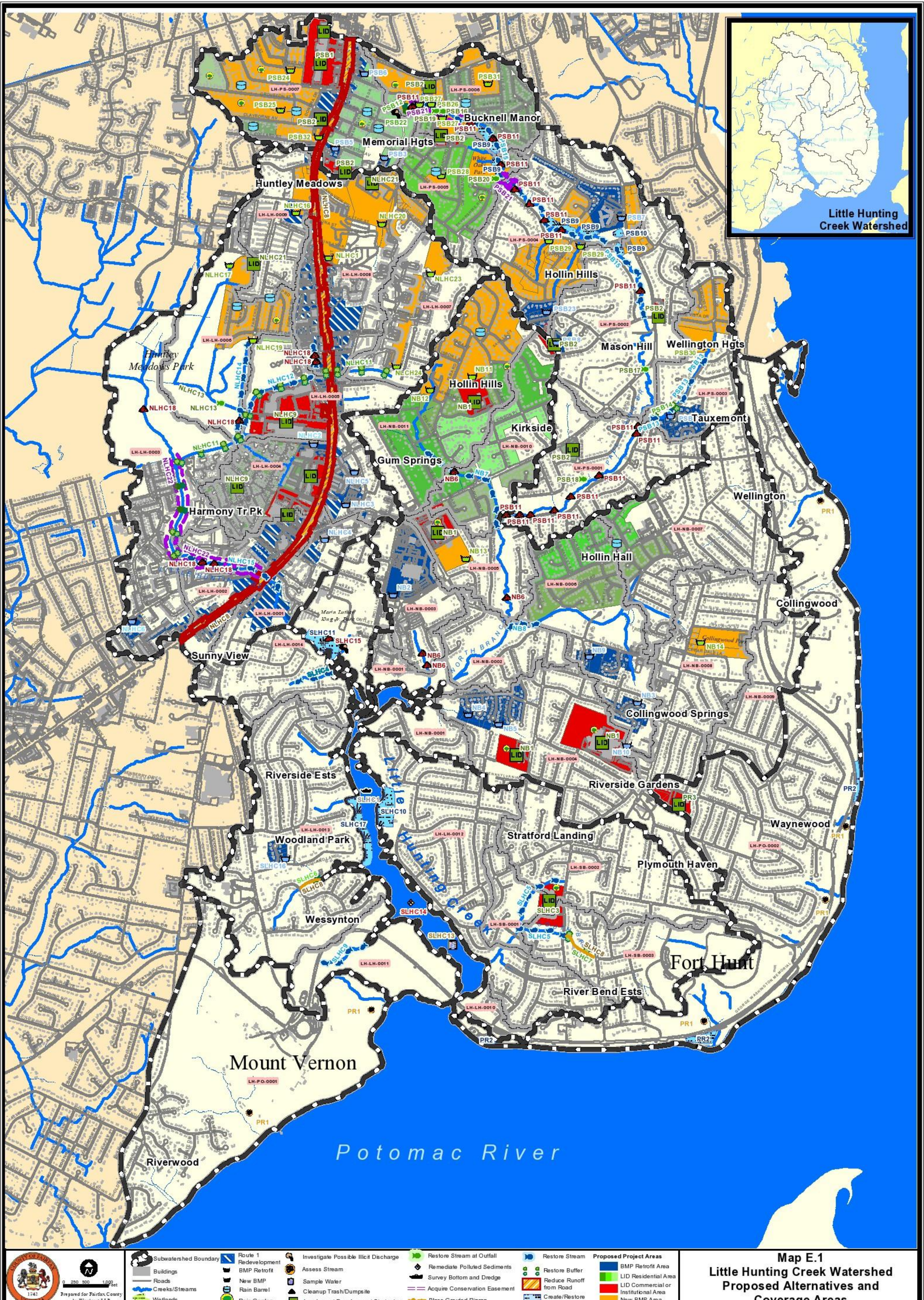
(Footnotes)

1 Stream Attributes Crediting Methodology: Impact and Compensation Reaches. Norfolk District Corps of Engineers Regulatory Branch.

2 The implementation dates are target time frames subject to county funding approval and updates to the watershed plan.

3 Actions A3.1 and A3.11, described in Chapter 5 as "policy" recommendations, would be implemented as capital projects. Since the projects are subject to the policy review process, no fixed start date can be proposed at this time.

4 Action D1.3, described in Chapter 5 as a "policy" recommendation, would be implemented as a capital project. Since the project is subject to the policy review process, no fixed start date can be proposed at this time.



Map E.1
Little Hunting Creek Watershed Proposed Alternatives and Coverage Areas

Chapter 1: **Introduction**

1.1 Background

The Little Hunting Creek Watershed is one of the most developed watersheds in Fairfax County. Clearing and building on the land started before General George Washington was the principal landholder in the watershed. The Little Hunting Creek Watershed Management Plan provides a strategy for mitigating the impacts of development, such as increased runoff and poor water quality. This plan is the first one to be developed as part of a county initiative to create watershed management plans for all Fairfax County watersheds.

The history of the county's watershed management began in the 1940s with the conversion of primarily agricultural land use to residential and commercial land uses. 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. 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 Little Hunting Creek Watershed. This plan identified projects to solve problems including flooding, erosion, sedimentation, and other environmental problems projected through the year 2000. Recently, the county started a stream restoration and protection study and completed the Fairfax County Stream Protection Strategy (www.fairfax.va.us/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.

Building on the recommendations from the Stream Protection Strategy, the county initiated a process to develop watershed management plans for all 30 watersheds in the county over a period of five to seven years. 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.

1.2 Purpose

The primary reasons the Little Hunting Creek Watershed Management Plan was developed can be summarized as follows:

1. To restore and protect the county's streams, of which 70% 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 the Chesapeake Bay
4. To replace the currently out-dated watershed management plan through the use of new technologies
5. To take a comprehensive approach in addressing multiple regulations, commitments and community needs

With input from the Little Hunting Creek 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 watershed.

1.3 Plan Organization

The Little Hunting Creek Watershed Management Plan integrates environmental management, natural resource protection, and community goals to improve the watershed. It provides a guide that:

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

The watershed plan chapters contain the following information:

Chapter 1 Background, purpose, and plan organization

Chapter 2 General watershed information, watershed history, land use and impervious cover, subwatershed and tributary information, and a summary of existing reports and data

Chapter 3 Subwatershed characteristics, description of the storm drain infrastructure, stream geomorphology, stream quality, problem areas, and modeling results

Chapter 4 Plan vision, goals, structural and non-structural objectives and actions, action benefits, implementation strategy, and monitoring plan

Chapter 5 Policy and land use objectives and actions, action benefits, implementation strat- egy, and monitoring plan

Supplemental appendices include a glossary, list of acronyms and abbreviations, references, stream restoration information, sources of native plant information, and project fact sheets with cost estimates.

Chapter 2:
Watershed Condition

2.1 General Watershed Information

The Little Hunting Creek Watershed is located in the Chesapeake Bay watershed in the southeastern part of Fairfax County, Virginia, as shown on Figure 2.1 and in greater detail on Map 2.1. It is bounded to the west by the Dogue Creek Watershed, to the south and east by the Potomac River, and to the north by the Belle Haven Watershed. The Little Hunting Creek Watershed encompasses 7,067 acres (11.042 square miles) and is located in the coastal plain physiographic province, a region characterized by sandy soil and low-gradient topography.

Figure 2.1 Location of the Little Hunting Creek Watershed

The headwaters of Little Hunting Creek are found in Huntley Meadows Park, located at the northwest border of the watershed. The creek flows in a southeasterly direction to its confluence with the Potomac River east of the historic Mount Vernon Estates. The Little Hunting Creek Watershed experiences tidal effects two to three miles upstream of its confluence with the Potomac River.

U.S. Route 1, also known as Richmond Highway, traverses the northwestern portion of the watershed and is the most heavily traveled roadway in the watershed. The George Washington Memorial Parkway is the second most heavily traveled roadway. It is located along the southeastern boundary of the watershed and runs parallel to the Potomac River. Mount Vernon Estates, the former home of General George Washington, is located at the southwestern tip of the watershed.

The Little Hunting Creek Watershed is part of the Chesapeake Bay Preservation Area (CBPA), and the entire main stream corridor of the Little Hunting Creek Watershed is 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 858 acres in the watershed. 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.

2.2 History of the Watershed

Much of the land that is located in the Little Hunting Creek Watershed was once owned by General George Washington, as shown on the map in Figure 2.2. In fact, the original name for General Washington's Mount Vernon plantation was the Little Hunting Creek Plantation. The Little Hunting Creek Plantation's name was changed to Mount Vernon in the 1750s by General Washington's half-brother, Lawrence. One of General Washington's maps of his estate showed severe siltation near the mouth of Little Hunting Creek.

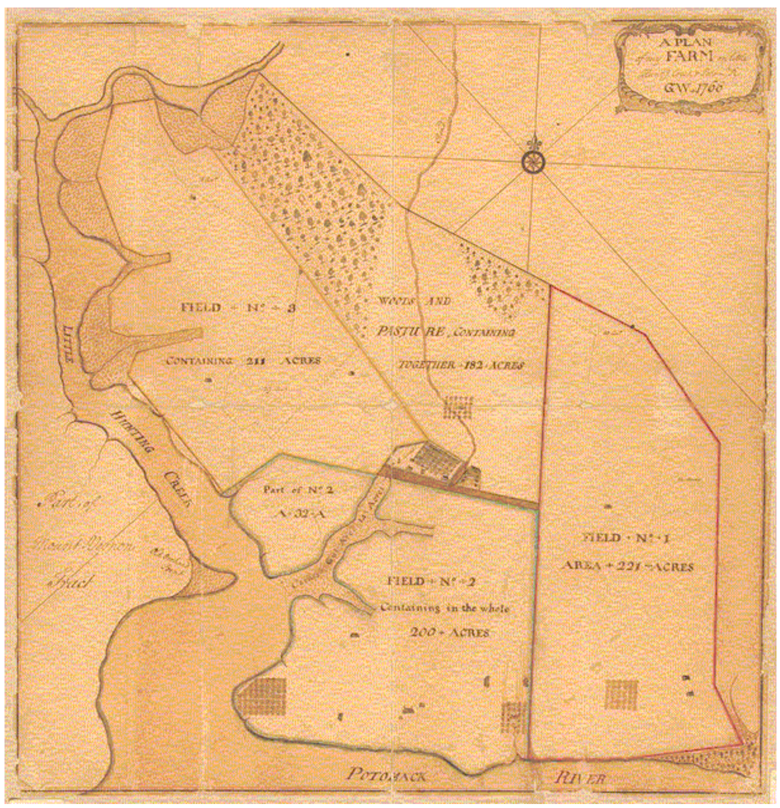


Figure 2.2 Map of Little Hunting Creek drawn by General George Washington

The original land grant from Lord Culpeper to George Washington's great-grandfather, John Washington, and Nicholas Spencer, was for 5,000 acres on or near Little Hunting Creek. That 5,000 acres was later evenly divided between the heirs of the two men in 1690, with the Little Hunting Creek property passing into the hands of George Washington's grandfather, Lawrence Washington. Through a series of deaths and remarriages, the land, by then known as Mount Vernon, became the property of George Washington, who spent a great deal of effort trying to acquire the lands that had been part of the original grant and reconstitute the original 5,000-acre parcel on Little Hunting Creek.

Fort Hunt Park is located along the Potomac River to the east of the mouth of Little Hunting Creek and is managed by the National Park Service. The land for Fort Hunt was purchased by the U.S. government in 1892 to establish a coastal defense fortification for the protection of the nation's capital. In 1930, the property was transferred from the War Department to the Office of Public Buildings and Public Parks of the National Capital for development as a recreational site along the newly established George Washington Memorial Parkway.

Huntley Meadows Park was once part of the plantation holdings of George Mason IV. It was acquired in the 1920s by Henry Woodhouse who planned to create the nation's greatest air center. The U.S. government purchased the land and used it as an asphalt road surface testing site in the 1940s. The Virginia National Guard provided anti-aircraft protection at this location for the capital in the 1950s. In addition, the Navy conducted highly classified radio communication research on the land before it was donated to Fairfax County in 1975 for use as a public park.

U.S. Route 1 passes through the Little Hunting Creek Watershed and was once known as Potomac Path. It is one of Fairfax County's oldest roads connecting the southeastern part of the county to Fredricksburg, Maryland. Potomac Path developed into an important colonial highway as a result of the 1662 Road Act of the Virginia Assembly.

2.3 Land Use and Impervious Cover

The residential, commercial, and industrial development in the Little Hunting Creek Watershed began in earnest in the late 1940s. Today, 82% of the developable land within the watershed has been developed, not including roadway right-of-way and wetlands. This watershed includes some of the oldest developed areas in Fairfax County. The total impervious area in the watershed is approximately 1,762 acres (25% of the total area). The percentage of each land use category that comprises the total impervious area is shown in Table 2.1. The impervious area was delineated by the county from the geographic information system (GIS) data showing the paved area and rooftops.

Table 2.1 Little Hunting Creek Watershed Imperviousness

Land Use	% of Total Impervious Area
Commercial/Industrial	18%
Residential	48%
Roads/Sidewalks	34%

The predominant existing land use in the watershed is medium-density, single-family residential, as shown in Table 2.2, with 33% of the watershed area consisting of a density of 0.5 to 1.0 acre per dwelling unit. The next major land use in the watershed is open space, parks, and recreational areas comprising 17% of the overall area. For ultimate future buildout of the watershed, medium-density, single-family residential land use may increase to 55% and the future watershed imperviousness may increase to 27%. The existing and future land use in the watershed is shown on Maps 2.2 and 2.3. The land use definitions are provided in Appendix A.

Table 2.2 - Existing and Future Land Use in the Little Hunting Creek Watershed

Land Use Description	Land Use			
	Existing Area (acres)	%	Future Area (acres)	%
Open space, parks, and recreational areas	1,200	17	1397	20
Estate residential	220	3	0	0
Low-density residential	851	12	0	0
Medium-density residential	2,316	33	3,860	55
High-density residential	580	8	391	5
Low-intensity commercial	335	5	289	4
High-intensity commercial	189	3	113	2
Industrial	36	1	4	0
Other	0	0	58	1
Unknown	14	0	15	0
Undeveloped	386	5	0	0
Road right-of-way (including shoulder areas)	855	12	855	12
Wetlands[1]	85	1	85	1
TOTAL	7,067	100	7,067	100

[1] This figure includes only delineated wetlands within the watershed and may not account for all existing wetlands.

The locations of vacant and underutilized parcels in the watershed are shown on Map 2.4. The vacant parcel data was obtained from the county's 2002 database and the underutilized parcel information was obtained from the county's 1999 database. Underutilized parcels with a comprehensive plan have a density greater than the existing land use on the parcel. Some of the vacant parcels are stream conservation areas located along the creek and creek tributaries. The majority of the planned land use for the underutilized parcels is medium-density residential. The Virginia Department of Transportation (VDOT) is currently performing a location study for Richmond Highway to determine the best design alternatives for widening and other future improvements.

2.4 Subwatersheds and Tributaries

For the purposes of this watershed plan, the Little Hunting Creek Watershed was divided into five subwatersheds, as shown on Map 2.1, to make it easier to evaluate the characteristics of the area draining to each of the major tributaries. The subwatersheds were delineated using the topographic data from the county's GIS and are described in Table 2.3.

Table 2.3 Subwatershed Area and Major Tributary Length

Subwatershed Name	Area (acres)	Tributary Name	Major Tributary Length (miles)
North Little Hunting Creek	1,384	Little Hunting Creek	2.23
South Little Hunting Creek (includes South Branch)	1,404	Little Hunting Creek South Branch	2.10 0.56
Paul Spring Branch	1,262	Paul Spring Branch	3.25
North Branch	1,760	North Branch	2.48
Potomac River (includes East and West Potomac)	1,257	N/A	N/A
TOTAL	**7,067**		

The tidally influenced Little Hunting Creek main stem is over 2.10 miles in length and lies mostly in the South Little Hunting Creek Subwatershed. For the purposes of this report, the northern portion of the Little Hunting Creek—from its headwaters to approximately 1,400 feet down-stream of Richmond Highway—is called North Little Hunting Creek. The major tributaries of Little Hunting Creek include North Branch, Paul Spring Branch (a major tributary of North Branch), and South Branch. Table 2.3 also shows the length of the major tributaries in the Little Hunting Creek Watershed.

2.5 Summary of Existing Reports and Data

2.5.1 Stream Water Quality Report

The Fairfax County Health Department monitors stream water quality at 84 sampling sites throughout the county. Two water quality sampling sites are located in the Little Hunting Creek Watershed and are shown on Map 2.2. Site 14-02 is located on Little Hunting Creek and site 14-03 is located on North Branch. In 2001, 19 water samples were collected from each of these sites and evaluated for fecal coliform, dissolved oxygen, nitrate nitrogen, pH, phospho-rous, temperature, and heavy metals. These parameters indicate the amount of pollution contributed from manmade sources and help to evaluate the quality of the aquatic environ-ment. Information regarding the parameters and data collected for the Fairfax County 2001 Stream Water Quality Report can be found at http://www.co.fairfax.va.us/service/hd/strannualrpt.htm.

Fifteen percent of samples collected from site 14-03 on North Branch 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 14-02 was 7.2 mg/l and for site 14-03 was 7.0 mg/l, which is above the minimum standard. Low stream flows due to low rainfall can affect the dissolved oxygen levels.

As shown on Figure 2.2 for site 14-02, 42% of the samples had fecal coliform counts greater than 1,000/100 ml and for site 14-03, 37% of the samples had fecal coliform counts greater than 1,000/100 ml. Countywide, 30% of the samples exceeded fecal coliform counts of 1,000/100 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. From 2000 to 2001, Little Hunting Creek showed a 3% drop in the number of fecal coliform sample

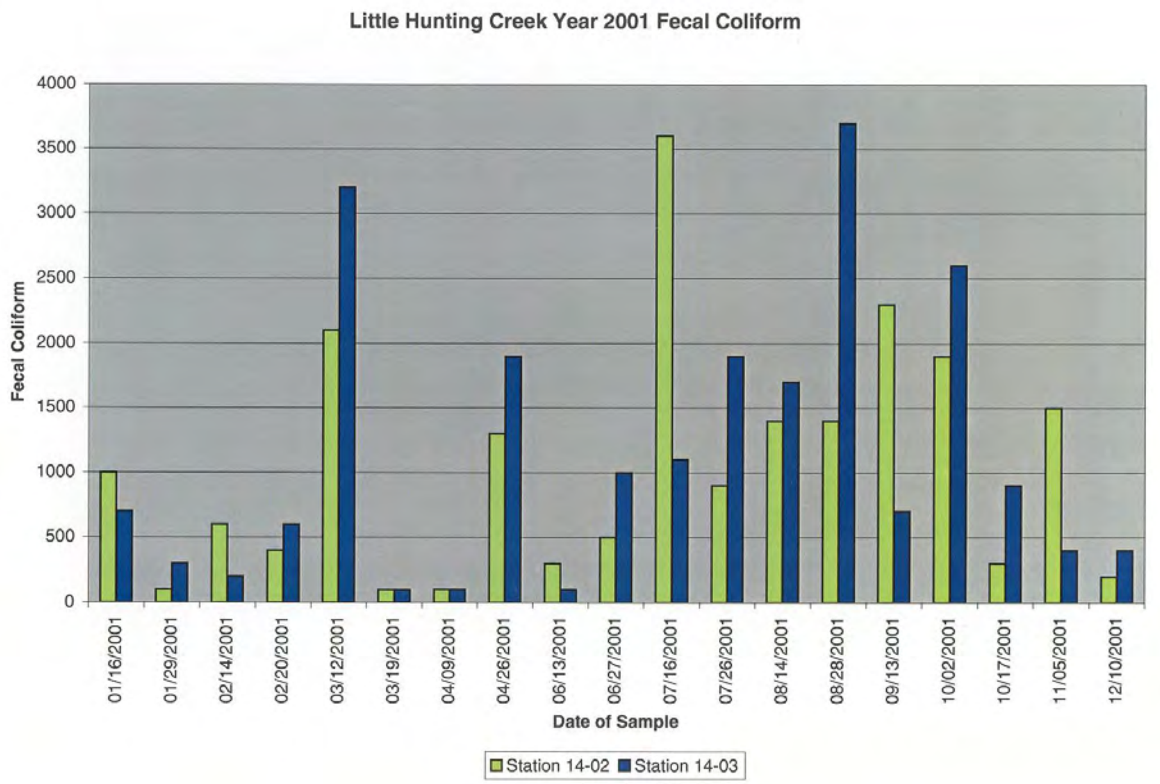


Figure 2.3 Year 2001 Fecal Coliform for Little Hunting Creek

results meeting the good water quality criteria. From 2000 to 2001, the geometric mean of fecal coliform rose from 426 to 625 for site 14-02 and from 574 to 672 for site 14-03. 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.

The Fairfax County 2001 Stream Water Quality Report concluded that the overall water quality of Little Hunting Creek watershed is considered poor for fecal coliform and good for the chemical and physical parameters of the streams (except for the low dissolved oxygen level found in North Branch).

2.5.2 Volunteer Water Quality Monitoring

As part of the Northern Virginia Soil and Water Conservation District water quality monitoring program, sampling has been performed quarterly by a citizen volunteer at Paul Spring Branch since January 2002. The results show that 95% to 99% of the organisms found in the stream samples are pollution-tolerant species and that Paul Spring Branch has an unacceptable ecological condition as measured by the Virginia Save Our Streams Multimetric Index. The Multimetric Index is used to measure several biological attributes of a stream to calculate a score indicating the overall ecological condition of the stream. Information regarding the Northern Virginia Soil and Water Conservation District volunteer stream monitoring can be found at www.fairfax.va.us/nvswcd/monitoring.htm.

2.5.3 Wetland Data

The amount of existing tidal wetlands in the subwatersheds as measured from the county's GIS data is shown in Table 2.4. Wetlands account for approximately 2% of the total area in the Little Hunting Creek Watershed.

Table 2.4 Subwatershed Wetland Area

Subwatershed	Wetland Area (acres)
North Little Hunting Creek	0
South Little Hunting Creek	44
Paul Spring Branch	0
North Branch	23
Potomac River	18
Total	**85**

Wetlands provide habitat for wildlife and fish and act as natural filters for pollutants in stormwater runoff. They also slow and store stormwater, thus reducing downstream flooding and erosion. Wetland loss greatly affects the lower reaches of Little Hunting Creek with loss of water quality and habitat. A wetlands function and values survey has not been performed for the Little Hunting Creek Watershed.

From 1780 to 1980, there was a 42% loss in wetlands in Virginia as reported by the U.S. Fish and Wildlife Service. There is no specific data for the historic wetland loss in the Little Hunting Creek Watershed. More information is needed on the amount of wetland impacts, wetland mitigation, and restoration that have been performed in the Little Hunting Creek Watershed.

2.5.4 Environmental Baseline Report

The Dogue-Little Hunting-Belle Haven Environmental Baseline Report was written by Parsons, Brinkerhoff, Quade and Douglas in October 1976. The report presented a comprehensive view of the environmental baseline conditions for the three watersheds. The stream water quality and the majority of the habitat in the Little Hunting Creek Watershed was assessed in poor to fair condition. In the 2002 stream physical assessment, the majority of the stream water quality and habitat condition was found to be in poor condition.

Severe erosion was noted in North Branch at two locations and in Paul Spring Branch at two locations in the Environmental Baseline Report. North Branch appears to have slightly less erosion today. The stream physical assessment performed in 2002 showed that North Branch has minor to moderate erosion at all crossings and pipe outfalls and active widening of the majority of the stream channel. Paul Spring Branch has more erosion today with severe to extreme erosion at three pipe and crossing locations and severe to extreme bank erosion at seven locations.

In the 1976 study, severe sedimentation was noted at five locations in North Branch. The 2002 stream physical assessment results showed that 50% to 80% of the stream bottom is affected by sedimentation. In the 1976 study, six locations in Paul Spring Branch had severe sedimentation, and today, 50% to 70% of the stream bottom is affected by sedimentation in the upstream reaches. Debris accumulation was noted in both the North Branch and Paul Spring Branch in the 1976 study; it was also noted in the 2002 stream physical assessment.

The main stem of Little Hunting Creek did not have erosion, sedimentation, or debris noted in the 1976 study. The 2002 assessment showed that North Little Hunting Creek is in worse condition today with very poor to poor habitat condition, moderate to severe erosion at three crossings, and active widening of the stream channel. Sedimentation affects 40% to 60% of the stream bottom and debris was noted in several locations in the North Little Hunting Creek in 2002.

2.5.5 Immediate Action Plan Report

The Immediate Action Plan (IAP) Report for the Dogue Creek, Little Hunting Creek, and Belle Haven Watersheds was written by Parsons Brinckerhoff, Quade and Douglas in December 1978. The report identified 18 projects for the Little Hunting Creek Watershed at an estimated cost of $2,119,000. The various projects included piping, 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 roadway flooding, and abating bank erosion. Eight of the projects have been constructed and one project is active with full funding. The remaining nine projects are inactive with no funding.

2.5.6 Future Basin Plan Report

The Future Basin Plan (FBP) Report for the Dogue Creek, Little Hunting Creek, and Belle Haven Watersheds was also written by Parsons, Brinckerhoff, Quade and Douglas in December 1978. This report, in conjunction with the IAP, specified the watershed's projected needs up to the year 2000. The report identified projects for constructing floodwalls at two locations in the watershed with an estimated cost of $83,000. These two projects are inactive with no funding.

2.5.7 Gum Springs Drainage Master Plan

The Gum Springs neighborhood is located east of Richmond Highway and includes the area surrounding Fordson Road, Sherwood Hall Lane, and Holland Road. The Gum Springs Drainage Master Plan Report was prepared in October 1981 to provide recommendations for drainage improvements to overcome flooding and ponding issues at low-lying areas in the neighborhood. The recommended Gum Springs drainage improvement projects have been completed in phases and the total estimated project costs were $1,707,000. The majority of the drainage improvement recommendations included constructing storm sewers to improve the efficiency of the storm drain system.

2.5.8 Fairfax County Master Plan Drainage Projects

Fairfax County has a list of 43 master plan drainage projects for the Little Hunting Creek Watershed dated February 2003. This list includes projects identified in the IAP, FBP, and Gum Springs Drainage Master Plan Reports. Twenty-three of the master plan drainage projects have been completed. The Little Hunting Creek Watershed study is one of the master plan drainage projects that is fully funded, active, and included in the pro rata share (PRS) program. Another active, fully funded project is a culvert replacement at Collingwood Road in the North Branch Subwatershed. Eighteen projects are inactive because of inadequate funds. The master plan drainage projects are described in more detail in the subwatershed descriptions provided in subsequent document sections.

2.5.9 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. Infill development is expected to occur more frequently in the future in the Little Hunting Creek Watershed because the majority of the watershed is already developed. 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 watershed plan actions.

2.5.10 Fairfax County Virginia Pollutant Discharge Elimination System Permit Data

As part of its Virginia Pollutant Discharge Elimination System (VPDES) permit for a municipal separate storm sewer system, Fairfax County has initiated a program to monitor its streams on a routine basis and perform monitoring for illicit discharges. There have been 39 VPDES illicit discharge screening sites in the Little Hunting Creek Watershed since August 2002. The flow in the drainage system during dry weather conditions is monitored for pH, chlorine, copper, phenol, and detergents to determine if there is an illicit discharge. Illicit discharges could include sanitary, car wash, or laundry wastewater; radiator flushing; or improper disposal of oil and toxic materials. The monitoring parameters help to determine the possible occurrence and type of illicit discharge to the storm drain system. Based on the available data, there have been minimal illicit discharges in the Little Hunting Creek Watershed.

2.5.11 Virginia Department of Environmental Quality Water Quality Data Little Hunting Creek is included in a segment of the Potomac River listed as an impaired waterbody in the 2002 303(D) Priority List prepared by the Virginia Department of Environ- mental Quality (DEQ). The impairment classification is due to a health advisory issued by the Virginia Department of Health for fish consumption based on high levels of polychlorinated biphenyls (PCBs) found in fish tissue samples. Fish tissue analysis has revealed exceedances of the human health-risk based screening value of 54 parts per billion (ppb) of PCBs. Five differ- ent types of fish taken from Little Hunting Creek in 2000 had PCB concentrations between the range of 81 ppb and 682 ppb.

Sediment samples taken in 2000 from the tidal portion of Little Hunting Creek contained 7.57 ppb of chlordane, which is above the 6 ppb concentration that can threaten aquatic life. The five fish taken from Little Hunting Creek in 2000 were analyzed for chlordane in their tissue and had results below the DEQ screening value of 300 ppb. The sources of chlordane and PCBs are listed as unknown. Documentation for this information can be found in the Virginia 305(b) Water quality Assessment Report at www.deq.state.va.us/wqa/305b.html.

Algae blooms can be evidence of too much nitrogen and phosphorous in the water. The Virginia DEQ stated that aquatic life is threatened by the presence of excessive algae in the tidal waters of Little Hunting Creek. Little Hunting Creek has been designated by the Virginia DEQ as nutrient-enriched waters.

In addition to the causes of waterbody impairment described above, the Virginia DEQ Draft 2004 305(b)/303(d) Water Quality Assessment Integrated Report stated that there were enough samples that exceeded the fecal coliform bacteria criterion to cause the creek to not support the state's recreational use goal.

2.5.12 Virginia Natural Heritage Resource

The Virginia Natural Heritage Resources Database describes the following status and rank of rare plant and animal species in the Little Hunting Creek and Dogue Creek Watersheds:

Table 2.5 Natural Heritage Resources in the Little Hunting Creek/Dogue Watersheds

Common Name	State Rank
Bird	
American Bittern	Extremely rare
Common Moorhen	Extremely rare
Bald Eagle	Very rare
Yellow-Crowned Night-Heron	Very rare
Pie-Billed Grebe	Very rare
King Rail	Very rare
Butterfly or Moth	
Hoary Elfin	Extremely rare
Dragonfly or Damselfly	
Midland Clubtail	Extremely rare
Reptile	
Wood Turtle	Very rare
Vascular Plant	
River Bulrush	Extremely rare
Carolina Fanwort	Extremely rare
Crested Sedge	Very rare
Epiphytic Sedge	Very rare
Lake-Bank Sedge	Extremely rare
Rough Avens	Very rare
Nuttal's Micranthemum	Historically known but not verified in 15 years
Hairy Beardtongue	Very rare
Heart-Leaved Plantain	Historically known but not verified in 15 years
Large-Leaf Pondweed	Extremely rare
Flatleaf Pondweed	Historically known but not verified in 15 years
Flatstem Pondweed	Extremely rare
Virginia Mallow	Extremely rare
Carolina Yellow-Eyed Grass	Extremely rare

2.5.13 Stream Protection Strategy

The Fairfax County Stream Protection Strategy (SPS) Baseline Study from January 2001 evaluated the quality of streams throughout the county. Little Hunting Creek and its tributaries, North Branch and Paul Spring Branch, 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. Table 2.6 provides information regarding the macroinvertebrate and fish species in three of the streams located in the watershed. Map 2.2 shows the location of the three stream protection strategy sampling sites.

Table 2.6 Macroinvertebrate Assessment and Fish Species

Stream Name	Macroinvertebrate Assessment	No. of Fish Species
Little Hunting Creek	Very poor	Moderate
North Branch	Poor	Very low
Paul Spring Branch	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 between excellent, good, fair, poor, and 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. For the number of unique fish species collected, the ratings were high, moderate, low, or very low. The amount of development in the watershed contributes to the poor water quality found in the waters of Little Hunting Creek.

In the SPS Baseline Study, the Little Hunting Creek Watershed was classified as a watershed restoration level II area with goals of maintaining areas to prevent further degradation and implementing measures to improve water quality and comply with Chesapeake Bay initiatives, total maximum daily load regulations, and other water quality initiatives and standards. The Little Hunting Creek Watershed Management Plan is a result of the county's stream protection strategy recommendations to help achieve the goal of preserving and restoring stream quality.

2.5.14 Stream Physical Assessment

The county initiated a stream physical assessment for all of its watersheds in August 2002. The stream physical assessment included a habitat assessment, infrastructure inventory, stream characterization, and stream geomorphologic assessment. The stream physical assessment data is described for each of the subwatersheds in the following sections.

As part of the stream physical assessment, the following items were identified and characterized:

- Deficient buffer vegetation
- Dumpsites
- Erosion locations
- Head cuts
- Obstructions
- Pipe and ditch outfalls
- Public utility lines
- Roads and other crossings

An impact score was assigned to those inventory items causing a negative impact to the stream. Based on the impact score, the degrees of impact were classified into three groups: minor to moderate, moderate to severe, and severe to extreme. Table 2.7 describes the impact ranges for each of the stream inventory items. Maps provided in the following subwatershed sections show the locations and severity of impact for the inventoried items.

Table 2.7 Description of Impacts

Deficient Buffer Vegetation (within 100 feet of stream bank)	
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	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	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	
Extreme	Impending threat to structures or infrastructure
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.
Impact	Description
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.
Minor	A minor area of erosion that is a low threat to property and causes no noticeable instream degradation.
Head Cuts	
Severe to Extreme	Greater than two-foot head cut height
Moderate	One- to two-foot head cut height
Minor	One-half- to less than one-foot head cut height
Obstructions	
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	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	Stormwater runoff from a ditch or pipe is causing a minor erosion problem and some discharge is occurring.
Public Utility Lines	
Extreme	A utility line is leaking.
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.
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).
Minor	A utility line is exposed but stabilized with concrete lining and stable anchoring into the bank.
Road and Other Crossings	
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.
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.
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.
Minor	The condition is noticeable but may not warrant repair.

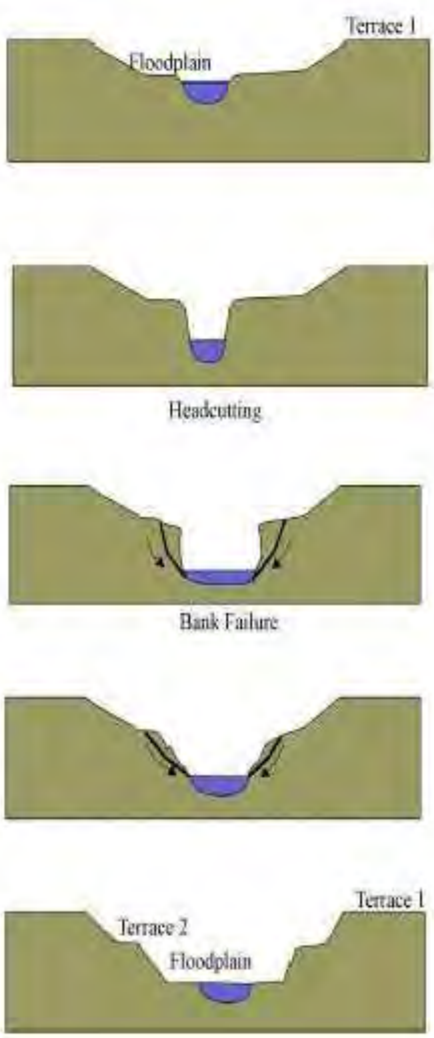
Source: Fairfax County Stream Physical Assessment Protocols, December 2002

The geomorphologic assessment of the stream channels in the Little Hunting Creek Watershed 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, the CEM type was assigned for the channel segment. The CEM types assigned to the Little Hunting Creek stream segments are summarized in Table 2.8. The five stages of the channel evolution process are shown in Figure 2.3. The CEM type for the stream segments is shown on the stream geomorphology maps provided for each of the subwatersheds.

Table 2.8 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

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 majority of the stream habitat assessed as poor. Table 2.9 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 subwatersheds.



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

Table 2.9 Summary of Stream Habitat Quality

Stream	Percent of Stream Length				
	Very Poor	Poor	Fair	Very Poor	Excellent
North Little Hunting Creek	33%	51%	16%	0%	0%
Paul Spring Branch	0%	47%	53%	0%	0%
North Branch	9%	82%	9%	0%	0%
Tributary to the Potomac River	0%	100%	0%	0%	0%
Total Watershed	**15%**	**58%**	**27%**	**0%**	**0%**

Riparian Buffer Loss

The majority of the nontidal streams in the watershed have an average buffer zone width of 25 to 50 feet. The total length of deficient buffer zone along the nontidal streams is 54,100 feet, 52% of the total assessed bank length. A deficient buffer does not have much vegetation such as trees, shrubs, or native ground cover in the 100-foot width adjacent to the stream. The vegetative cover in the deficient buffer areas typically consists of lawn. An average of 60% of the stream bank surface is covered by scattered shrubs, grasses, and thick non-woody vegetation with thin or bare spots or closely cropped vegetation. The average impact score for the deficient buffer areas is 4.5 out of a scale of 1 to 10 (10 is best). The buffer zone for the tidal portion of the creek and streams was not assessed. The riparian buffer assessment for the nontidal portions of the Little Hunting Creek watershed is summarized in Table 2.10.

Table 2.10 Riparian Buffer Assessment

Subwatershed	Description of Buffer Zone
North Little Hunting Creek	The majority of stream banks have thin vegetative cover—typically lawns with buffer widths of less than 25 feet. One stream tributary has 50 to 100-foot buffer widths.
South Little Hunting Creek (nontidal portion of South branch)	Some vegetation exists within the 25-foot buffer zone, but lawn typically makes up the rest of the 100-foot buffer zone.
Paul Spring Branch	The vegetation is primarily lawn, non-grass plants, and shrubs. The buffer width is between 25 and 50 feet.
North Branch	The buffer width is 25 to 50 feet with a majority of lawn, some shrubs, non-woody thick vegetation, grasses, and a few plant species. More than 25% the area beyond the buffer zone is impervious.
Potomac River (tributary located south of Eaglebrook Court)	The buffer zone width is 25 to 50 feet with a majority of lawn, isolated trees, and shrubs on the banks. More than 25% of the area beyond the buffer zone is impervious.

Deficient buffer zone width provides less filtering of pollutants in stormwater runoff. The stream banks are more likely to become unstable when they don't have any vegetation. Limited vegetation and non-native plant species do not offer sufficient habitat and food for birds and wildlife and may out-compete or replace native species. North Branch and Paul Spring Branch have conservation areas or parks adjacent to the stream. The county's comprehensive plan proposes placing park or conservation areas around most of the streams in the watershed.

Sedimentation

Streams, in their natural and stable condition, undergo 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 those typically seen at a stream's mouth, and erosion will occur where flow velocities are higher than the stream channel banks can withstand, typically at stream bends. Higher in-stream velocities and flows due to increased runoff result in larger amounts of sediment being transported with a greater weight and size. In-stream velocities and flows that are uncharacteristic and cannot be accommodated by a stream's natural geometry will result in a stream actively widening and transporting high amounts of sediment.

Approximately 50% to 60% of the bottom of nontidal streams in Little Hunting Creek is affected by sediment deposition, which contributes to a fair to poor habitat assessment throughout the watershed. Sediment deposition affecting less than 20% of the stream bottom is considered not to impact stream habitat.

The actively widening and unstable stream bed and banks found in Little Hunting Creek are the primary source of sediment in the watershed. Other sources may come from the stormwater runoff of unstabilized soil areas and from the sand placed on the roads for traction in 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 create an unstable environment for aquatic organisms, and pollutants that attach to sediments are harmful to aquatic organisms. Table 2.11 summarizes the sedimentation assessment from the stream physical assessment for the nontidal portions of Little Hunting Creek. None of the assessed stream tributaries were unaffected by sediment deposition.

Table 2.11 Sedimentation Assessment

Subwatershed	Description of Sedimentation
North Little Hunting Creek	40% to 60% of the stream bottom is affected by sediment deposition of sand and/or silt
South Little Hunting Creek	No data
Paul Spring Branch	40% to 70% of the stream bottom is affected by sediment deposition of gravel, sand, and/or silt
North Branch	Pools are almost absent due to sedimentation for 5,000 feet in the stream tributary. The rest of the stream bottom has 50% to 80% sediment deposition of sand and/or silt.
Potomac River (tributary located south of Eaglebrook Court)	70% to 80% of the stream bottom is affected by sediment deposition of sand and/or silt

From visual observations by residents, and assuming that the sediment observed in the nontidal portions of Little Hunting Creek is carried downstream, the tidal areas have experienced significant sediment deposition. In order to determine the amount of sedimentation in the tidal areas of Little Hunting Creek, a hydrographic survey will need to be performed and compared to historical records.

Trash and Dumpsites

The county's stream physical assessment identified seven dumpsites in the nontidal stream segments. 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 the floodplain. The volume of trash found in the stream was not measured.

2.5.15 Modeling Approach and Results

Hydrologic, hydraulic, and water quality models were created for the Little Hunting Creek Watershed to help identify flooding, channel erosion, and pollutant loads in the watershed. Current and anticipated ultimate development conditions (future) were modeled to evaluate the effects of development in the watershed and to allow formalization of cause and effect relationships. 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. The work to develop the models and analyze the results included the following steps:

- Selection of sub-basin scale and delineation of sub-basins
- Characterization of existing soils, land use, and impervious cover based on county GIS and other mapping sources
- Creation 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

The 37 sub-basins are the smallest watershed area units delineated in the hydrologic model with an average size of approximately 191 acres. All of the watershed area was 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 was unavailable for most of the watershed area.

The existing impervious cover for the model was developed from the county's GIS layers showing paved 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 existing residential land use conditions have an average of 19% imperviousness which is greater than the 18% imperviousness limit that requires implementation of water quality controls for development on non-bonded residential lots. No additional imperviousness was modeled for future residential development other than the predicted land use changes due to development of underutilized and vacant parcels.

The stream channel profiles and cross sections were developed from the county's topographical GIS data and stream culvert crossing data input from field survey data. The hydraulic model includes approximately eight miles of streams and 40 major road crossings over the various creeks and streams located within the Little Hunting Creek Watershed. The small streams, tributaries, and tidal portion of Little Hunting Creek 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 1994 and the peak flow and quality treatment for parcels developed after 1994.

The hydrologic and hydraulic models were calibrated to validate the model results. No historical stream gage data was available for the Little Hunting Creek Watershed, so the calibration was based on historical flooding information at the Paul Spring Branch where it crosses Paul Spring Road. The model parameters were adjusted during the calibration process to replicate the historical road flooding condition for known storm events. The model parameter calibrations for the Paul Spring Branch Subwatershed were then applied to the rest of the watershed model. The calibrated hydrologic and hydraulic models were run for three rainfall events corresponding to the two-year return period and the 10-year return period for both existing and future build-out conditions and the 100-year return period for future build-out conditions. Peak discharges for each sub-basin were compared to evaluate any change in stormwater runoff as a result of the change in future land use, and the results are shown on the Map 2.5. No additional stormwater management facilities were included in the future development condition model in order to evaluate the change in peak flows from existing to future development conditions. The hydraulic model results were reviewed with respect to existing and future flow velocities in the streams, and the velocities for the two-year rainfall event for the existing conditions are shown on the Map 2.6. The model results for the flooding limits for the two- and 10-year peak rainfall events were evaluated, and the results for the future development conditions are shown on the Map 2.7. The difference in the flooding limits for the existing and future conditions was very minor. The results from the model were evaluated against observed or documented erosion and flooding conditions within each subwatershed to help further validate the hydraulic model. The model results for the 100-year peak rainfall event were used to determine the number of dwellings located in the flooding limits. The addresses of these properties are provided in Chapter 4.

The water quality model was used to evaluate 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), and total nitrogen (TN) for the entire watershed. The parameters used for the water quality model were developed by the county. The hydrologic model was run for a continuous 10-year time period from 1992 to 2002 to calculate the average annual contribution for each pollutant in units of pounds per acre per year for both existing and future land use conditions and existing and future land use conditions with proposed alternatives.

Though eight water quality parameters were modeled, only three, TSS, TP, and TN were evaluated in detail for the effect of development and BMP controls on the water quality of the watershed. 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 is the fertilizer used for lawns; it 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 dies and decays, it takes 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 in the stream destroys aquatic habitat, and when suspended in the water, it blocks sunlight from reaching the aquatic plants located at the bottom.

In order to evaluate the effects of the modeled sediment, phosphorus, and nitrogen loading rates, target loading rates were developed from the Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Shenandoah and Potomac River Basins, Public Comment Draft, April 2004. The target rates for the watershed were developed from the target rates specific to the portion of Fairfax County located below the fall line, which includes the area of the Little Hunting Creek Watershed. The Tributary Strategy values are the target nutrient and sediment standards for the Potomac River that were established to meet the Chesapeake Bay Program cap or target loading values. The target loading values were established because of the Chesapeake 2000 Agreement, which calls for a reduction in nutrients and sediment to remove the Chesapeake Bay and its tributaries from the EPA's list of impaired waters by the year 2010.

The watershed sub-basin pollutant loading rates are categorized as good, fair, or poor. The good pollutant loading rates are equal to or less than the Tributary Strategy target rates. The fair pollutant loading rates are greater than the good rate but less than the poor rate. The poor pollutant loading rates are equal to or greater than nutrient and sediment pollutant loading rates predicted for the year 2010 if no BMPs were implemented. The numerical values used to evaluate the pollutant loading rates are provided in Table 2.12.

Table 2.12 Pollutant Loading Rates for Water Quality Evaluation

Pollutant	Loading Rate		
	Good	Fair	Poor
Sediment	≤ 78 lb/acre/yr	78 to 163 lb/acre/yr	≥ 78 lb/acre/yr
Total Phosphorous	≤ 0.67 lb/acre/yr	0.67 to 1.15 lb/acre/yr	≥ 1.15 lb/acre/yr
Total Nitrogen	≤ 6.5 lb/acre/yr	6.5 to 9.8 lb/acre/yr	≥ 9.8 lb/acre/yr

The model result summaries for each subwatershed are provided in Table 2.13 and described in the following sections. The evaluation of the pollutant loading rates for the future development conditions for each sub-basin is shown on Maps 2.8, 2.9, and 2.10. To help develop and evaluate the Little Hunting Creek Watershed Management Plan strategy, the hydrologic, hydraulic, and water quality models were used to determine the projected reduction in runoff and pollutants for the recommended actions.

Table 2.13 Water Quality Pollutant Loading Rates and Loads

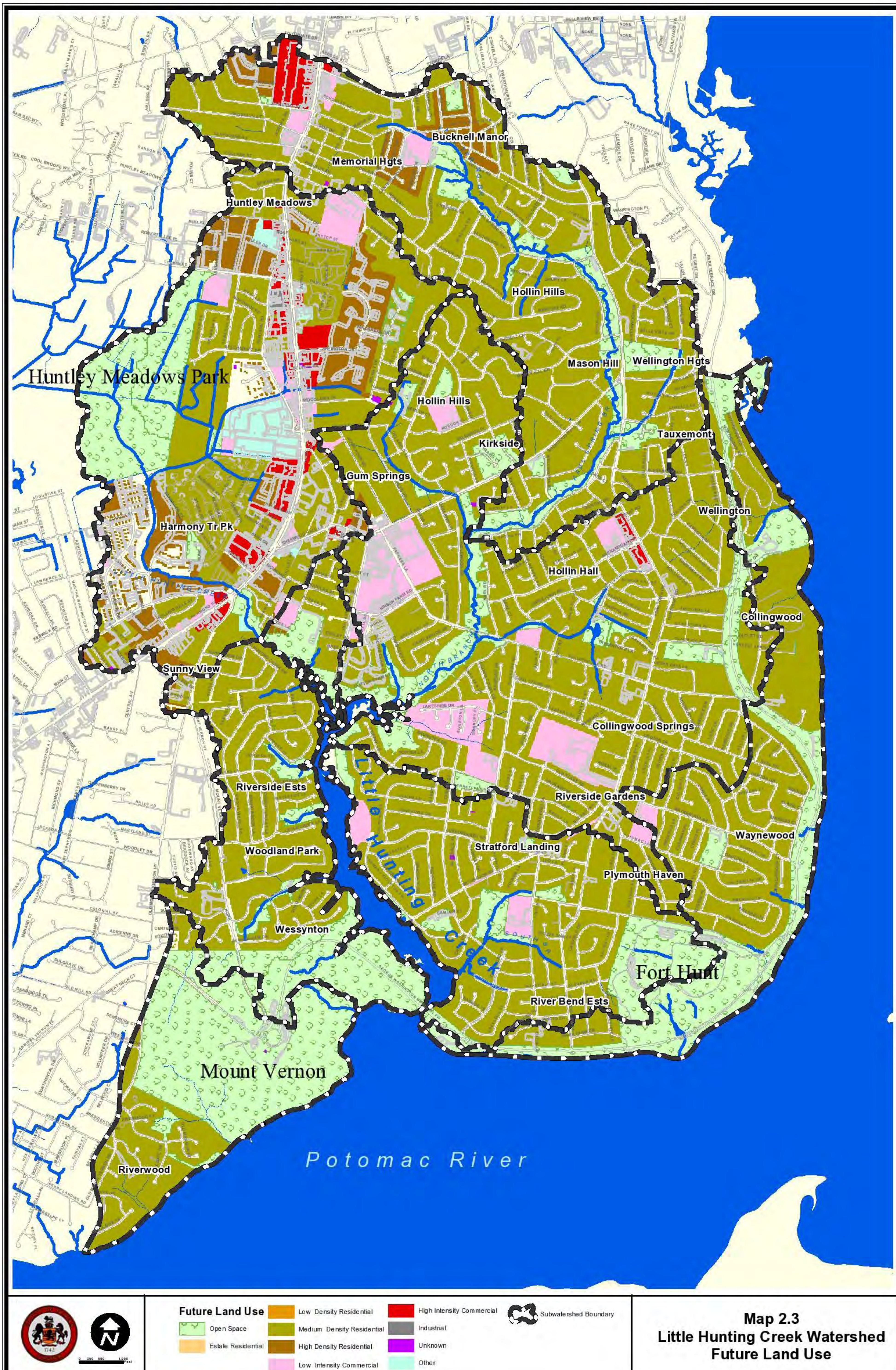
Subwater-shed	Existing TSS Loading Rate, lb/ac/yr	Existing TSS Load, tons/year	Future TSS Loading Rate, lb/ac/yr	Future TSS Load, tons/year	% Increase TSS Load	Existing TSS Loading Rate, lb/ac/yr Existing TP Existing TP Loading Rate, lb/ac/yr	Existing TP Load, tons/year	Future TP Loading Rate, lb/ac/yr	Future TP Load, tons/year	% Increase TP Load	Existing TN Loading Rate, lb/ac/yr	Existing TN Load, tons/year	Future TN Loading Rate, lb/ac/yr	Future TN Load, tons/year	% Increase TN Load
North Little Hunting Creek	136	94	152	105	12	0.94	1307	1.21	1675	28	6.27	8680	7.32	10132	17
South Little Hunting Creek	75	53	87	61	16	0.68	957	0.90	1262	32	3.47	4874	4.35	6114	25
Paul Spring Branch	116	66	122	71	5	0.90	1164	1.08	1404	20	5.28	6273	5.88	7080	11
North Branch	49	102	56	108	15	0.47	1590	0.59	1902	27	2.16	9286	2.65	10346	22
Potomac River	105	31	112	35	7	0.92	585	1.11	742	21	4.97	2721	5.61	3328	13

Prepared for Fairfax Co
by Woolpert LLP

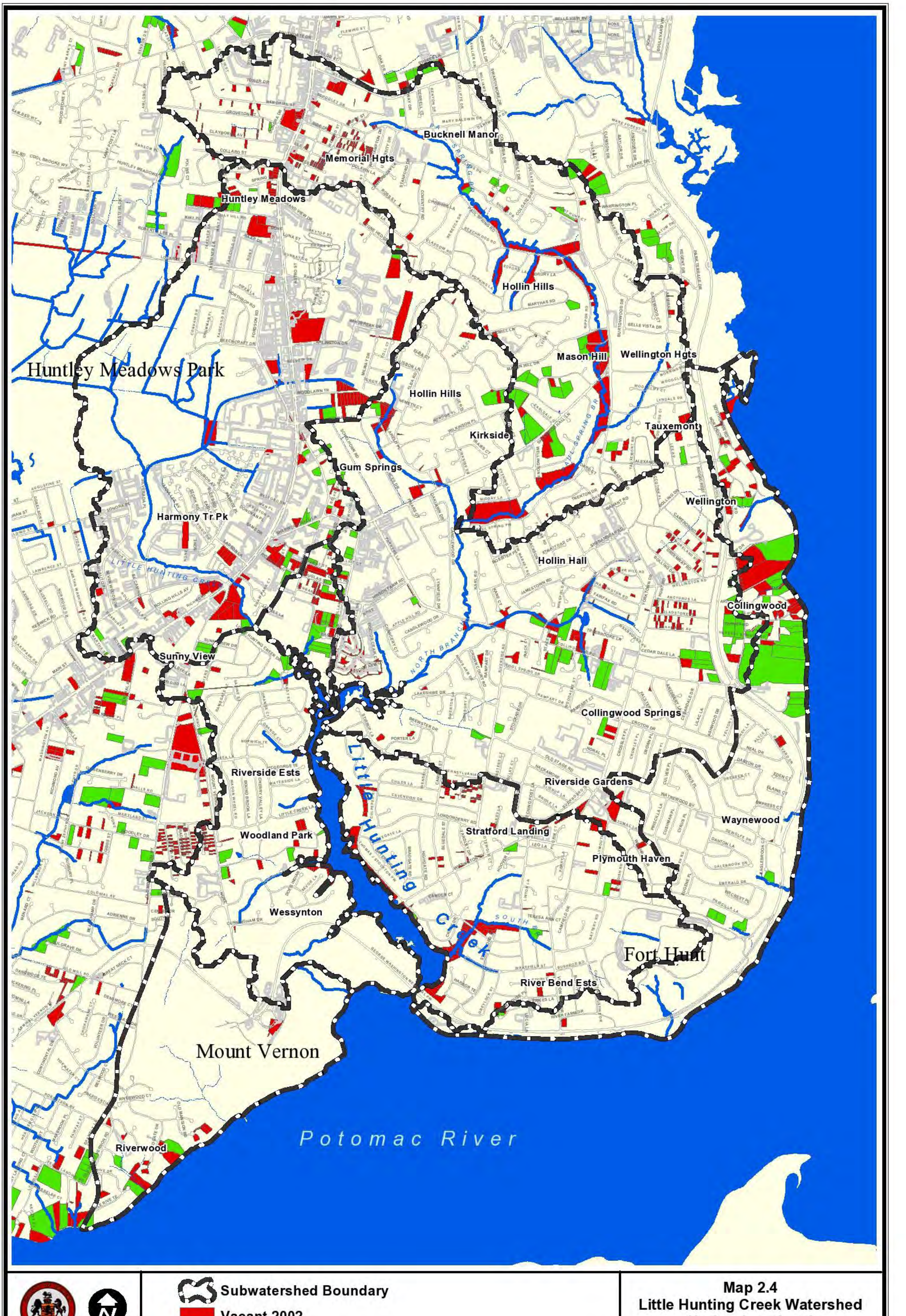
Subwatershed Boundary
Rivers/Creeks

Map 2.1
Little Hunting Creek Watershed

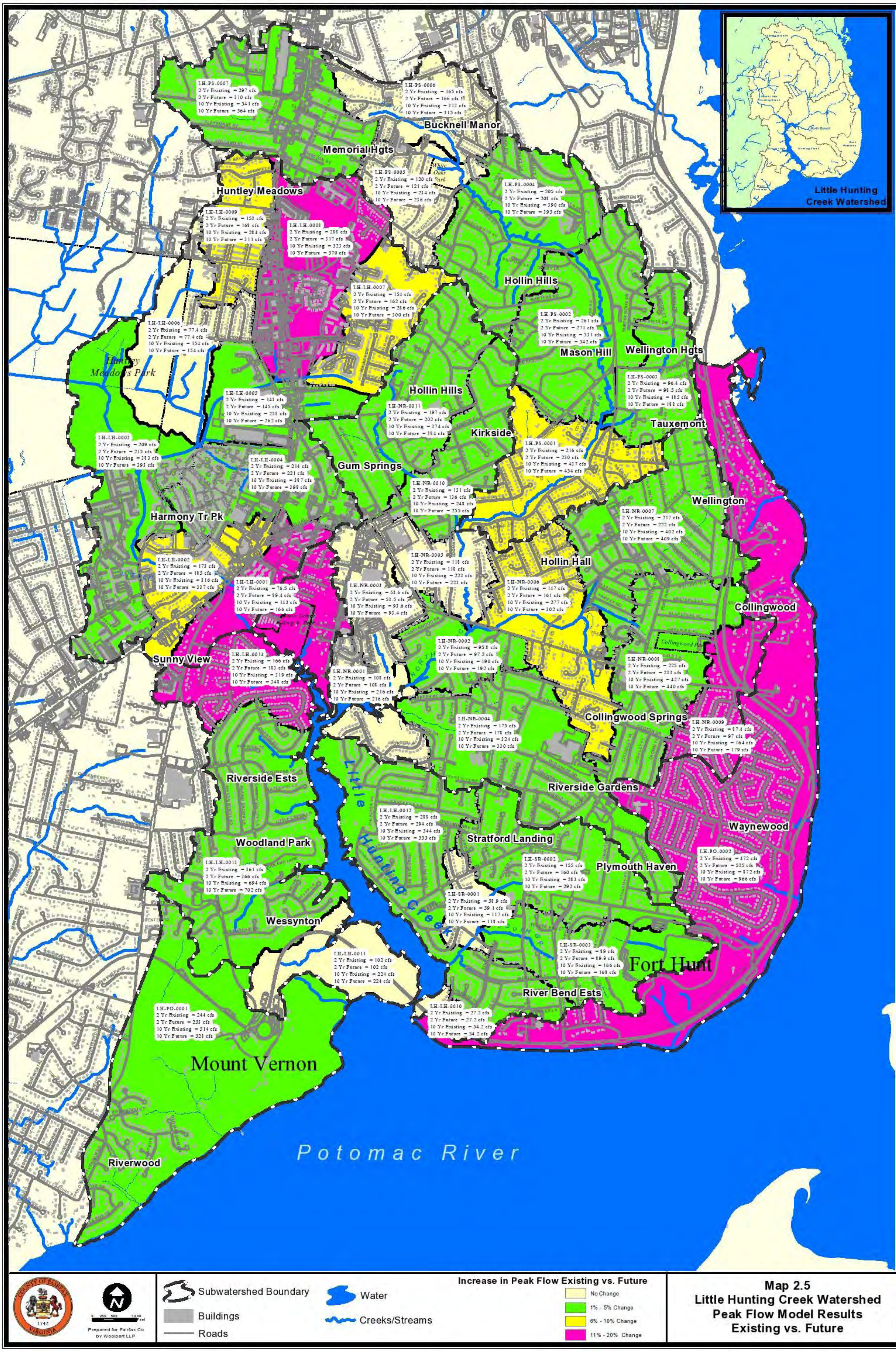
Map 2.2
Little Hunting Creek Watershed
Existing Land Use



Map 2.3
Little Hunting Creek Watershed
Future Land Use



Map 2.4
Little Hunting Creek Watershed
Undeveloped and
Underutilized Parcels



Map 2.5
Little Hunting Creek Watershed
Peak Flow Model Results
Existing vs. Future

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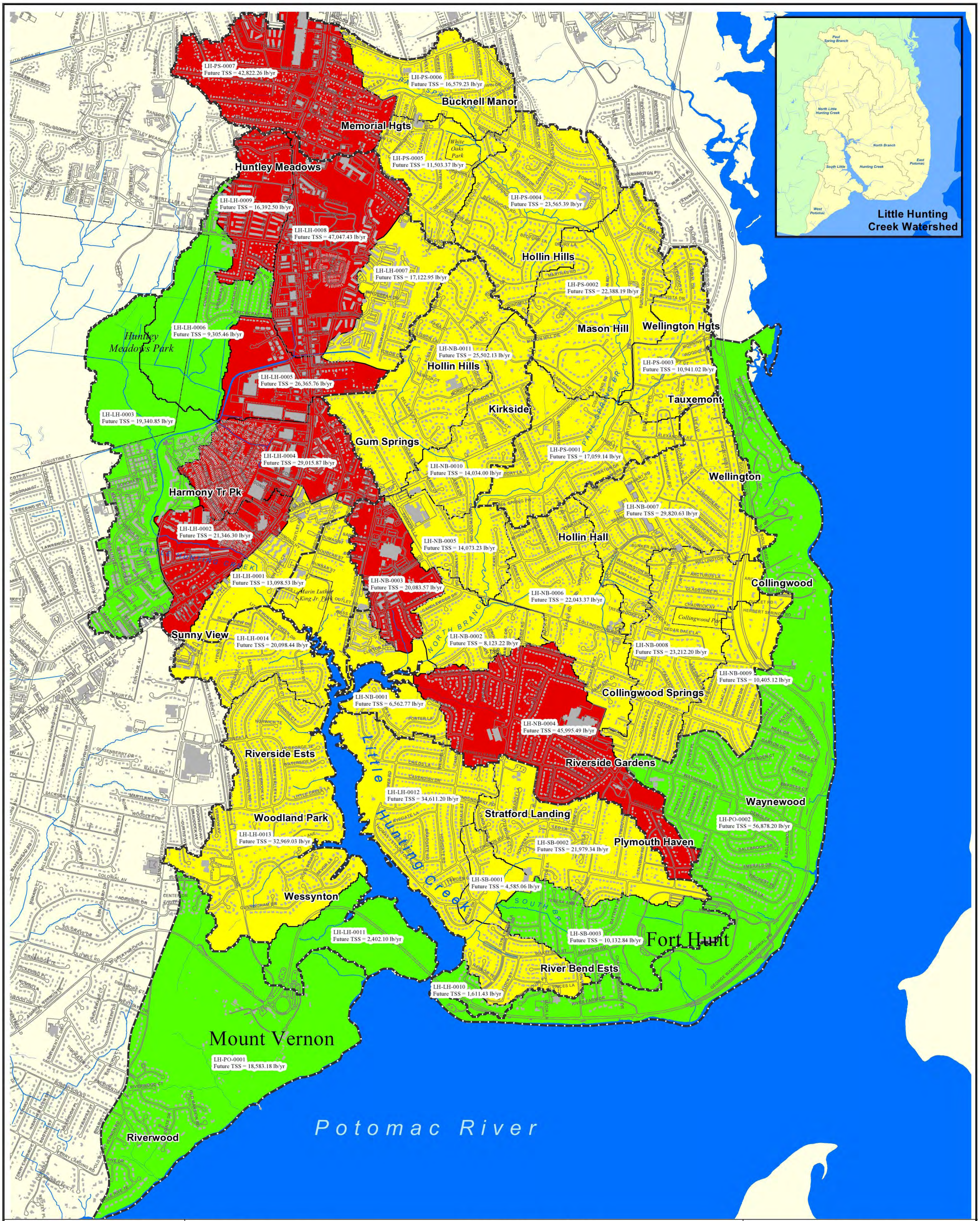
Subwatershed Boundary
Buildings
Roads
Water
Creeks/Streams
Erosion

Future Stream Velocities
0 fps - 3 fps - Good
3 fps - 5 fps - Fair
5 fps and Greater - Poor

Map 2.6
Little Hunting Creek Watershed
Future Stream Velocities

Map 2.7
Little Hunting Creek Watershed
Flood Limit



COUNTY OF FAIRFAX VIRGINIA 1742

0 250 500 1,000 Feet

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Subwatershed Boundary

Buildings

Roads

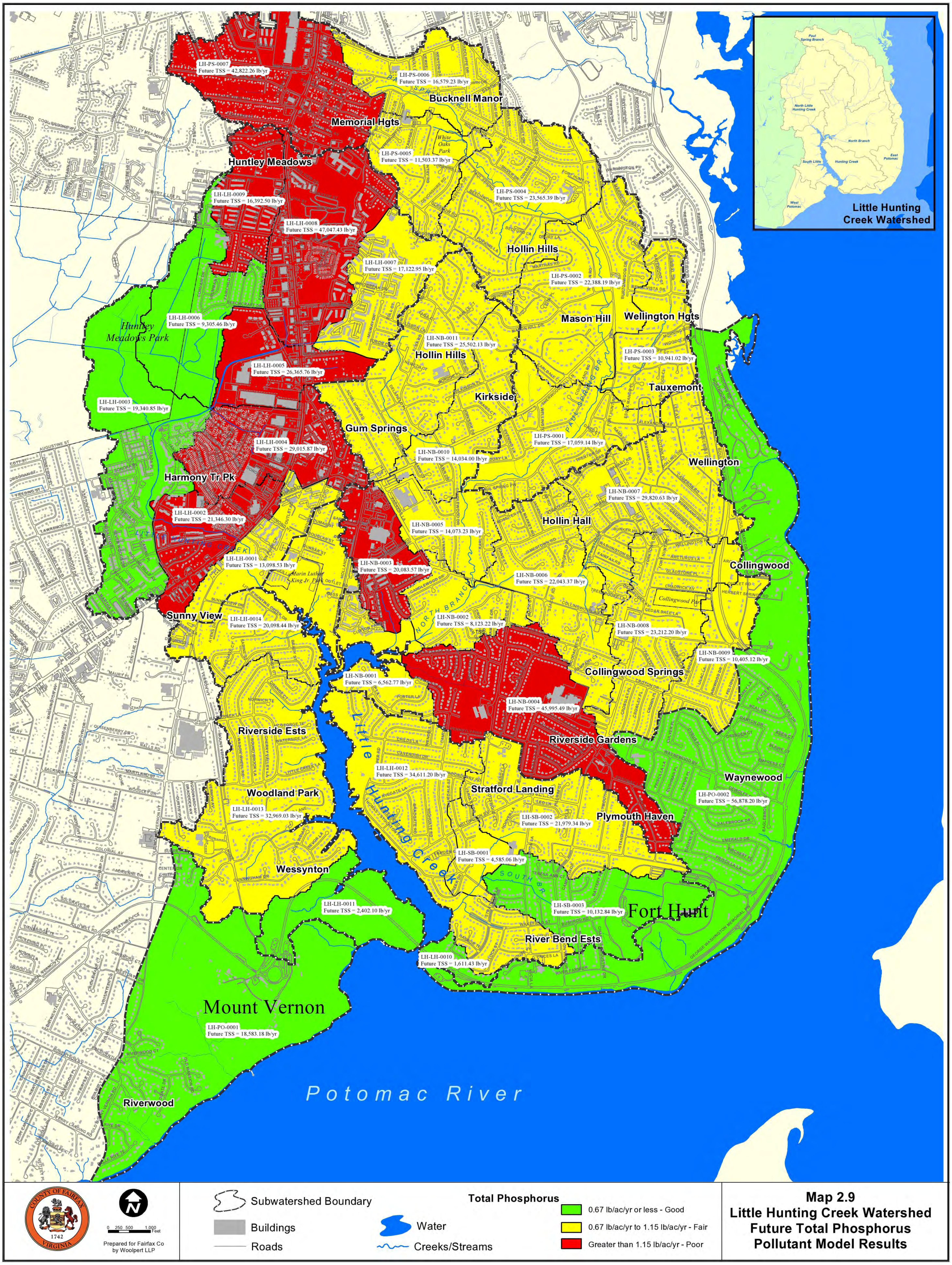
Water

Creeks/Streams

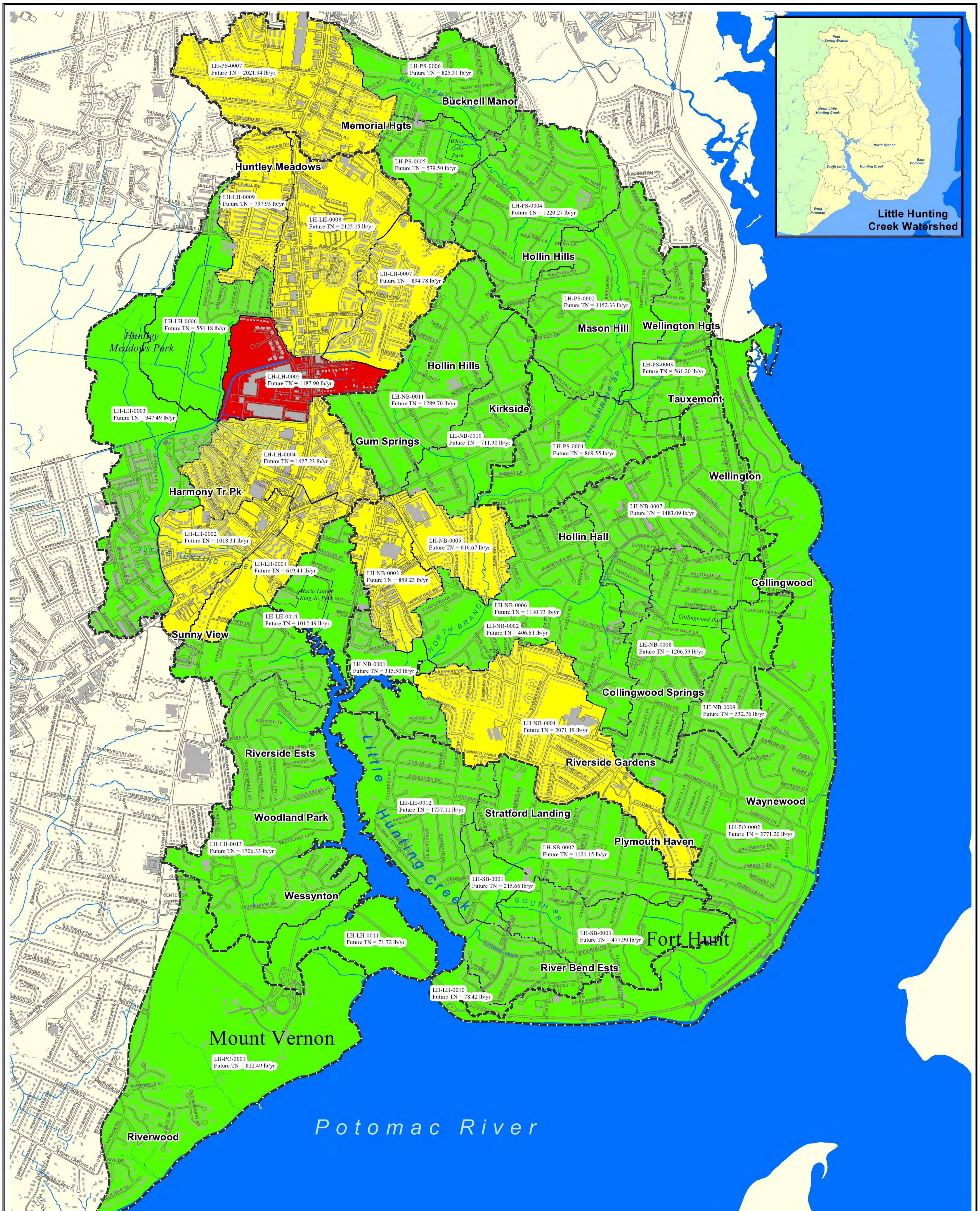
Total Suspended Solids

- 78 lb/ac/yr or less - Good
- 78 lb/ac/yr to 163 lb/ac/yr - Fair
- Greater than 163 lb/ac/yr - Poor

Map 2.8
Little Hunting Creek Watershed
Future Total Suspened Solids
Pollutant Model Results



Map 2.9
Little Hunting Creek Watershed
Future Total Phosphorus
Pollutant Model Results



COUNTY OF FAIRFAX 1742 VIRGINIA

0 250 500 1,000 Feet

Prepared for Fairfax Co by Woolpert LLP

Legend		Total Nitrogen
Subwatershed Boundary		6.5 lb/ac/yr or less - Good
Buildings	Water	6.5 lb/ac/yr to 9.8 lb/ac/yr - Fair
Roads	Creeks/Streams	Greater than 9.8 lb/ac/yr - Poor

Map 2.10
Little Hunting Creek Watershed
Future Total Nitrogen Pollutant Model Results

Chapter 3:
Subwatershed Condition

3.1 North Little Hunting Creek Subwatershed

The North Little Hunting Creek Subwatershed has an area of approximately 1,384 acres and contains the north portion of the Little Hunting Creek main stem. It is bounded to the west by Saul Road, Mariposa Place, and the intersection of Martha Street and Richmond Highway; to the south by Shaw Park Court; to the east by Fordson Road, Boswell Avenue, and Cornith Drive; and to the north by Collard Street and Popkins Lane. This subwatershed drains commercial and high-density residential areas located near Richmond Highway—the most heavily traveled roadway located in this subwatershed. A portion of Huntley Meadows Park is located on the western side of the subwatershed. The North Little Hunting Creek subwatershed is shown on Map 3.1 and its condition is summarized as follows.

North Little Hunting Creek Subwatershed Condition Summary

- Current imperviousness = 34% with majority of land use high-density residential
- Future imperviousness = 37%
- Two of seven crossings have moderate to severe impacts.
- A small number of BMPs (11) are not enough for the amount of paved area.
- The stream has been altered in upstream reaches and downstream reaches are actively widening.
- The habitat quality is poor with inadequate buffers.
- No erosion or head cuts were observed.
- Trash dumps were located at several places.

3.1.1 Subwatershed Characteristics

The stormwater runoff from this subwatershed drains into the northern portion of Little Hunting Creek, otherwise known as North Little Hunting Creek. The headwaters of North Little Hunting Creek begin at a storm drain system outfall located north of the Gum Springs area and east of Richmond Highway. North Little Hunting Creek first flows west to southwest and then changes its direction and flows south to southeast. The length of North Little Hunting Creek from its headwaters to the tidal section of the creek (located near Shaw Park Court) is approximately 2.2 miles.

Numerous smaller tributaries emerging from storm drain outfalls convey flows into North Little Hunting Creek along its length. Of these smaller tributaries, seven are of significant length ranging from 1,000 to 5,000 feet. The terrain in the subwatershed is flat with elevations ranging from 30 to 35 feet in the northern part to elevations of five to 10 feet in the southern part. The creek has a low-gradient slope of less than 0.20%.

The current impervious area in this subwatershed is 34% of the total area. Land use in the subwatershed is predominantly high-density residential and includes Huntley Meadows Park to the northwest and light-industrial and commercial districts along the Richmond Highway corridor. The existing and future land use in the North Little Hunting Creek subwatershed is described in Table 3.1. High-density residential currently comprises 28% of the subwatershed area. In the future, with ultimate buildout conditions, estate residential may be replaced by more dense residential development and the future imperviousness may increase to 37%. Parcels that are currently undeveloped (141 acres) and underutilized (16 acres) consist of more than 11% of the area and primarily have residential zoning. The county's GIS data showed that no wetland areas are located in this subwatershed.

Table 3.1 North Little Hunting Creek Land Use

Land Use Description	Land Use			
	Existing		Future	
	Area (acres)	%	Area (acres)	%
Open space, parks, and recreational areas	191	14	205	15
Estate residential	25	2	0	0
Low-density residential	57	4	0	0
Medium-density residential	140	10	540	39
High-density residential	473	34	317	23
Low-intensity commercial	71	5	62	5
High-intensity commercial	145	11	75	5
Industrial	18	1	4	0
Other	0	0	5	4
Unknown	2	0	2	0
Undeveloped	141	10	0	0
Road right-of-way (including shoulder areas)	121	9	121	9
Wetlands	0	0	0	0
TOTAL	1,384	100	1,384	100

The county's list of master plan drainage projects shows that seven of the eight identified projects in this subwatershed have been completed. Table 3.2 summarizes the type of master plan drainage project, project name/location, and current status. No cost estimates were available for these projects.

Table 3.2 North Little Hunting Creek Master Plan Drainage Projects

Type of Work	Project Name/Location
Completed projects	
Flood study	Little Hunting Creek
Install pipe along tributary LH-10	Little Hunting Creek
3,800 feet storm sewer and 1,650 feet road improvement	Gum Springs Ph. III
3,500 feet storm sewer and road improvement	Gum Springs Ph. III
Storm sewer and road improvement	Gum Springs Ph. V
Storm sewer and road improvement	Gum Springs Ph. IV
Road construction and storm drain	Gum Springs
Inactive project	
Replace culvert at Fordson Road north of Mount Vernon Plaza	Fordson Road

Ten complaints regarding standing water, yard flooding, or other miscellaneous flooding were registered with the county and included in the database files for this subwatershed. The locations of these complaints are shown on Map 3.1. The county has addressed one complaint by cleaning the pipe and the remaining complaints are referred to as private responsibilities. Based on the isolated locations of the complaints, this subwatershed does not appear to have major flooding problems.

The National Resources Conservation Service State Soil Geographic (STATSGO) database assigns a weighted hydrologic soil group index of 2.4 in the headwater region and a weighted hydrologic soil group index of 2.2 for the remainder of the subwatershed. This soil group index indicates that the soils in this subwatershed exhibit characteristics of hydrologic soil groups B and C. The hydrologic soil group classifications of A, B, C, and D explain the characterics of soil texture, permeability, and infiltration rate. Based on the soil group index values, the soils are more similar to hydrologic soil group B with moderately coarse texture and moderate infiltration rates. The county's GIS coverage for soils is incomplete for this subwatershed and shows small pockets of hydrologic soil groups C and D located in this subwatershed.

3.1.2 Storm Drain System Infrastructure

The subwatershed areas located east and west of Richmond Highway are drained through a network of storm drain pipe systems. The storm drain systems from this area have outfalls located at various smaller tributaries flowing into North Little Hunting Creek. These outfalls vary in size, ranging from 60 inches in diameter to a seven-foot by 10-foot box culvert. Most segments of the outfall channels have been altered with concrete lining or with riprap bed and bank protection. A network of storm drain pipe systems also serves most of the area surrounding the southern portion of the subwatershed. Huntley Meadows Park and Audubon Estates Mobile Home Park are drained by open channel systems.

Map 3.2 shows the location of all crossings and their impacts on the stream. The major road crossings in this subwatershed, starting from the upstream end of North Little Hunting Creek, are described as follows:

- Richmond Highway: The Gum Springs area storm drain system pipe outfall is located downstream of the Richmond Highway crossing. No impact on the stream was noted.

- Fordson Road: Stormwater runoff from neighborhood areas of Mount Vernon Square, Millway Meadows, and Hybla Valley Farms is collected and conveyed through a storm drain pipe system and the outfall, a double eight-foot by eight-foot box culvert, is located under Fordson Road. No impact on the stream was observed due to concrete lined channels on the downstream side as shown in Photo 3.1.
- Pelican Place: A double six-foot by six-foot box culvert does not appear to impact the stream.
- Audubon Avenue: A double six-foot by six-foot box culvert does not appear to impact the stream.
- Janna Lee Avenue: A 20-foot high concrete bridge with three, 50-foot spans had debris and sediment on the downstream side with a moderate impact as shown in Photo 3.2.
- Richmond Highway: An eight-foot high concrete bridge with a single, 40-foot span has no impact.
- East of Huntley Meadows Park: Two crossings are located in a new subdivision being constructed east of Huntley Meadows Park. One of the crossings is a 24-inch (diameter) concrete pipe that has a moderate to severe impact on the stream with debris, sediment, and bank erosion upstream of the pipe. The other crossing is a temporary stone construction road crossing with a minor impact on the stream.

Twenty-six storm drain pipes discharge to North Little Hunting Creek. All outfall pipe material is concrete and the pipes range in size from 15 to 96 inches in diameter. Most pipe outfalls have minor erosion due to discharges from the pipes. The locations of all pipe impacts are shown on Map 3.2.

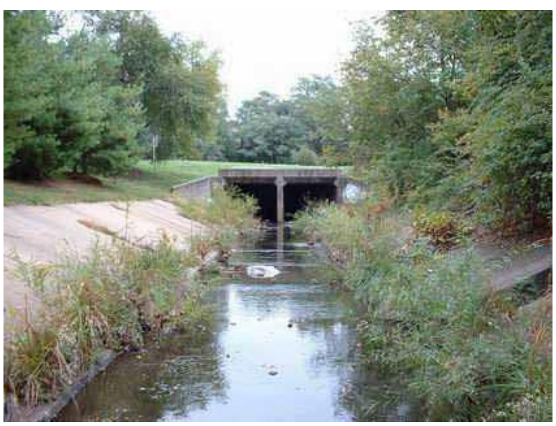


Photo 3.1 Double 8′ x 8′ outfall box culvert located under Fordson Road

Photo 3.2 Sediment and debris causing a moderate impact downstream of Janna Lee Avenue bridge crossing

Nine private and two public stormwater management facilities are located in the subwatershed and included in the county's database. Four of the private facilities and one public facility are located in the Gum Springs area. The other stormwater management facilities are located throughout the rest of the subwatershed. The type of facility and area served are provided in

Table 3.3. The locations of the known stormwater management facilities in the subwatershed are also shown on Map 3.2.

Table 3.3 North Little Hunting Creek Stormwater Management Facilities

Location	Type of Facility	Parcel Area (Acres)
Privately Owned		
North of Holly Hill Road	Infiltration trench	1.02
South of Stone Hedge Drive	Underground facility	0.30
Located in the area bounded by Fordson Road, Richmond Highway, and Lockheed Boulevard	Underground facility	1.20
Southwest of the Lockheed Boulevard and Richmond Highway intersection	Manufactured BMP	0.49
Southeast of the Fordson Road and Beechcraft Drive intersection	Rooftop	1.98
Southwest of the Fordson Road and Joseph Makell Court intersection	Infiltration trench	1.33
Northwest of the Sherwood Hall Lane and Fordson Road intersection	Dry pond	3.98
Southeast of the Sherwood Hall Lane and Fordson Road intersection	Underground facility	0.93
East of the Sherwood Hall Lane and Kingland Road intersection	Dry pond	1.75
Publicly Owned		
At Kings Village Road in Gum Springs area	Dry pond	5.34
Southeast of Buckman Road and Roxbury Place	Dry pond	0.91

3.1.3 Stream Geomorphology

The geomorphology of the stream segments of the North Little Hunting Creek can be summarized as follows:

- The dominant substrate in all stream segments is sand.
- The downstream reaches are of CEM type 3, referring to nearly vertical stream bank slopes, active widening, and accelerated bend migration. It was observed that the channel has been dredged and altered.
- The upstream segments are paved with concrete, hence no geomorphic assessment was performed.
- The tributaries flowing from the west to North Little Hunting Creek, north of Janna Lee Road crossing, are of CEM type 2, referring to a deep incised channel formed by head cutting of the stream bed. It was observed that construction and clear cutting in the area would result in accelerating the bank slope destabilization and widening the channel.

Map 3.3 shows the stream segment CEM type in the subwatershed. Fallen trees and debris obstructing the flow were observed at two locations in the upstream reaches. The impact of this debris on the stream is moderate and can be seen in Photo 3.3. In the downstream stream segment, the stream is littered with shopping carts, trash, and a camper shell. Photos

3.4 and 3.5 show dumpsites in the downstream segments. The locations of the dumpsites identified during the stream physical assessment are shown on Map 3.3. Two additional dumpsites have been identified in the area behind the Hybla Valley Shopping Center. A partially buried 12-inch sanitary sewer pipe crosses the stream in the downstream segment and does not cause a significant impact. A raised sanitary sewer manhole is located in the upstream stream segment north of Audubon Avenue and has little impact on the stream as shown in Photo 3.6.

Photo 3.3 Dump observed in the downstream channel near Richmond Highway

Photo 3.4 Trash dump and littering in the downstream segment near Richmond Highway

Photo 3.5 Trash located upstream of Fordson Road

Photo 3.6 Raised manhole obstructing the flow of the tributary located north of Audubon Avenue

3.1.4 Stream Quality

The stream reaches of North Little Hunting Creek have low-gradient slopes and are classified as the glide pool prevalent stream type. A glide pool is an area in a stream characterized by calm water that typically follows a riffle. The habitat assessment for North Little Hunting Creek can be summarized as follows:

- In most of the stream reaches, at least three habitat types were common for less than 50% of the reach.
- Two upstream channel reaches are made of concrete, hence no habitat was assessed.
- The majority of the pools are large and shallow except in the tidal portion of North Little Hunting Creek. Most pools in the stream reaches have sand bottoms and showed no submerged vegetation. Little to no root mat was present.

- Sediment deposition is mainly sand and/or gravel with 40% to 50% of the stream bottom affected in the downstream segments and 50% to 60% of the stream bottom affected in the upstream segments.
- Approximately 70% of the stream segments have alteration of the channel or banks. The tributaries located on the west side of the subwatershed north of the Janna Lee Road culvert crossing exhibit little channel disturbance.
- North Little Hunting Creek exhibits mostly straight channel reaches and uniform depth of flow, causing fewer habitat types to be found in the stream.
- For most of the creek, the water fills approximately 80% 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 60% of the banks covered by thin vegetative cover and scattered grasses, non-grass plants, and shrubs. Fifty to 60% of the banks have erosion.
- The majority of the stream buffer consists of lawn grass with less than 25 feet of buffer width. The tributaries that flow from the west side from Huntley Meadows Park to North Little Hunting Creek exhibit a buffer width of 50 to 100 feet or greater with minimal disturbance.
- Fifty-one percent of North Little Hunting Creek exhibits poor habitat quality and 33% of the creek exhibits very poor habitat quality as depicted on Map 3.4. Flows were observed in the stream channel for the majority of the creek and no erosion and/or head cuts were observed. The majority of the stream segments 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 general characteristics of the stream water quality were assessed and can be described as follows:

- Water in the downstream reaches appears turbid with the rest of upstream flows appearing clear.
- In the downstream reaches, a rotten egg smell was noted in both the water and the sediment. The upstream reaches were odor free.
- Small fish of one to two inches in length were observed in the farthest downstream reaches. In addition, aquatic plants were observed in the stream margin in less than 10% of the entire stream bank area. The locations of fish observance in the stream segments are shown on Map 3.4.
- Green algae of light density with a slimy coating and green filamentous algae were observed in the downstream stream segments. The upstream stream segments were free of algae.

At several locations in the downstream stream segments, there is a severe to extreme impact due to a lack of natural forested buffer as shown in Photo 3.7. At one location in the upstream stream segments, the buffer zone is covered with a parking lot and roadway, causing the severe impact shown in Photo 3.8. Overall, North Little Hunting Creek does not have adequate natural buffer widths of 100 feet. The locations of deficient buffer areas along the stream corridor are shown on Map 3.4.

Photo 3.7 Lack of natural forested buffer upstream of Richmond Highway

Photo 3.8 Paved surface in the buffer zone upstream of Fordson Road crossing

3.1.5 Problem Areas from Public Forum

Problem areas were identified by the stakeholders in the watershed forum held on July 19, 2003; the locations are shown on Map 3.1. The majority of the complaints for this subwatershed were trash and dumpsites. The impact of the future Richmond Highway roadway widening on the creek is also a stakeholder concern.

Table 3.4 North Little Hunting Creek Problem Areas from Public Forum

Problem ID	Description
A1	A large trash dumping area begins at the border of Huntley Meadows Park and Richmond Highway. The 45-acre land area (with unknown ownership) is used by vagrants and people who dump trash.
B1	There is a trash dump near the mouth of Little Hunting Creek at Old Mount Vernon Parkway and the Sunny View neighborhood.
C5	An animal passageway at Richmond Highway and Little Hunting Creek leads to frequent roadkill.
C7	A major trash dumpsite is located on the Little Hunting Creek main stem behind the trailer park community on Pace Lane.
D3	Stream bank erosion exists at the intersection of Mount Vernon Highway and Richmond Highway.
E2	A trash and dumpsite in the backyard of a property at Mount Vernon Highway and the Sunny View neighborhood is filling in the tributary stream.
E6	The widening of Richmond Highway to eight lanes from Hybla Valley to Woodrow Wilson Bridge will have a major impact on the Little Hunting Creek Watershed.

3.1.6 Modeling Results

The hydrology developed for this subwatershed produced stormwater runoff that is fairly high with respect to the size of the watershed. Over one-third of this subwatershed is covered by impervious surfaces and over half of the land use is residential or commercial of moderate to high density/intensity. This land use results in peak discharges that are relatively high for the two- and 10-year rainfall events. This subwatershed has the most significant increase in stormwater discharge due to the potential development of vacant parcels and the increase in medium-density residential land use, especially in the area located east of Huntley Meadows

Park. Please see Table 3.5 for a comparison of the existing and future two-and 10-year peak discharges for each sub-basin.

During the stream physical assessment, no erosion or head cuts were observed in North Little Hunting Creek that corresponded to the modeling results; however, there may be some areas with significant erosion potential. The velocities produced by the two-year rainfall event in North Little Hunting Creek are generally low through its upper portions and increase as it flows south near the Richmond Highway crossing. The model indicated a few areas of higher velocity north of Richmond Highway that correspond to the stream habitat assessment results that described the stream bank area as having 70% to 90% erosion.

The two-year peak discharge is contained within the main channel banks for the upper third of North Little Hunting Creek. The two-year event overtops the channel banks but stays within the floodplain for most of the remainder of the creek to the north end of the South Little Hunting Creek Subwatershed. The 10-year peak discharge is well outside the main channel banks and into the floodplain area for the length of North Little Hunting Creek, except where the channel has steep side slopes and relatively no natural floodplain area. The model showed some minor flooding of the Harmony Trailer Park for the 10-year rainfall event.

The water quality modeling results for North Little Hunting Creek show that the average sediment loading rate exceeds the tributary strategy target level for sediment for both the existing and future land use conditions. The North Little Hunting Creek Subwatershed has a higher sediment loading rate than the other four subwatersheds due to the higher percentage of commercial area, such as along Route 1. For existing and future conditions, the four sub-basins located along Route 1 are identified as having a greater sediment loading rate than the other sub-basins in the North Little Hunting Creek Subwatershed. For future land use conditions, the average sediment loading rates are predicted to increase by 12%.

The existing and future average phosphorus loading rates for North Little Hunting Creek exceed the tributary strategy target levels. The North Little Hunting Creek Subwatershed has the greatest annual pollutant loading for total phosphorus of the five subwatersheds. This can be attributed to the relatively high percentage of developed land in the watershed. For total phosphorus, the greater the proportion of medium- and high-density residential area compared to the other land uses, the greater the phosphorus loading for the watershed. The predicted increase in the phosphorus loading rate for the future is 28%, which corresponds to an increase in medium-density residential land use in the subwatershed.

For North Little Hunting Creek, the average total nitrogen loading rate exceeds the tributary strategy target level. Large areas of commercial development cause higher nitrogen pollutant loading rates. As with sediment, the higher loading rates are found in the sub-basins located along the Route 1 commercial corridor. For existing conditions, four sub-basins exceed the tributary strategy nitrogen target value. For future conditions, six sub-basins are predicted to exceed the tributary strategy target limit. The sub-basin with the Mount Vernon Plaza commercial area is predicted to exceed the poor nitrogen pollutant loading rates.

Table 3.5 North Little Hunting Creek Peak Runoff Flows

Sub-basin	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
LH-LH-0001	77	89	17%	143	166	16%
LH-LH-0002	173	185	7%	316	337	7%
LH-LH-0003	209	215	3%	383	393	3%
LH-LH-0004	214	221	3%	387	398	3%
LH-LH-0005	143	145	1%	258	262	2%
LH-LH-0006	77	77	0%	154	154	0%
LH-LH-0007	154	162	5%	286	300	5%
LH-LH-0008	288	317	10%	523	570	9%
LH-LH-0009	153	168	10%	284	311	10%

3.2 South Little Hunting Creek Subwatershed

The South Little Hunting Creek Subwatershed has an area of approximately 1,404 acres. It is bounded to the west by Wagon Wheel Road, to the north by Shaw Park Court and Pennsylvania Boulevard, to the east by Carter Farm Court, to the south and southeast by the George Washington Memorial Parkway and Prices Lane, and to the southwest by the intersection of Mount Vernon Highway and George Washington Memorial Parkway.

The South Little Hunting Creek Subwatershed contains the southern portion of Little Hunting Creek, seen in Photo 3.9, and South Branch, a tributary of Little Hunting Creek located on the east side of the creek. Other smaller streams are located on the west side of the subwatershed and discharge directly into Little Hunting Creek as shown on Map 3.5. The South Little Hunting Creek Subwatershed's condition is summarized as follows.

South Little Hunting Creek Subwatershed Condition Summary

- Current imperviousness = 22% with majority of land use medium-density residential
- Future imperviousness = 23%
- Twelve crossings create minor impacts.
- No BMPs currently exist.
- The stream has been altered with concrete lining in portions of Wessynton and South Branch.
- The stream has poor habitat quality with inadequate buffers.
- No erosion or headcuts were observed except for the stream located south of George Washington Memorial Parkway.
- No trash dumps were located.
- Sedimentation of South Little Hunting Creek is a problem.
- Development adjacent to the creek negatively impacts the wetlands and buffer area.
- PCBs and chlordane are contaminants found in the sediments.

3.2.1 Subwatershed Characteristics

Photo 3.9 Tidal portion of Little Hunting Creek

The main stem of Little Hunting Creek included in this subwatershed is tidal and has a length of approximately 2.1 miles. The headwaters of South Branch emerge from a storm drain system outfall located east of Vernon View Road. South Branch has a length of less than 0.6 miles and a low-gradient slope of 0.50%. The ground surface elevation at the eastern portion of the subwatershed is 45 feet and gradually slopes with less than 0.70% gradient to an elevation of five feet near the Creek Drive and Camden Street intersection. In the western part of the subwatershed, the ground surface slopes are greater, with slopes exceeding 3.0%. The ground surface elevation at the western portion of the subwatershed is 90 to 95 feet and the surface slopes down to an elevation of five feet.

The existing impervious area in this subwatershed is 22% of the total area. Land use in the subwatershed is predominantly medium-density residential comprising 42% of the subwatershed area as shown on Table 3.5. Parks and recreational facilities comprise 20% of the area, including a portion of Fort Hunt located in the South Little Hunting Creek Subwatershed. The total area of the undeveloped parcels in the subwatershed is 54 acres. The majority of the zoning for the undeveloped and underutilized parcels is medium-density residential as shown by the increase in this future land use in Table 3.5. As shown on Map 3.5, the open water area of the main stem of Little Hunting Creek is approximately 117 acres, and tidal wetlands comprise approximately 3.0% of the subwatershed area.

Table 3.6 South Little Hunting Creek Land Use

Land Use Description	Land Use			
	Existing		Future	
	Area (acres)	%	Area (acres	%
Open space, parks, and recreational areas	275	20	314	22
Estate residential	26	2	0	0
Low-density residential	155	11	0	0
Medium-density residential	596	42	824	59
High-density residential	14	1	5	1
Low-intensity commercial	44	3	30	2
High-intensity commercial	1	0	0	0
Industrial	8	1	0	0
Unknown	6	0	6	0
Undeveloped	54	4	0	0
Road right-of-way (including shoulder areas)	181	13	181	13
Wetlands	44	3	44	3
TOTAL	1,404	100	1,404	100

Twenty-one complaints regarding standing water, yard flooding, or other miscellaneous flooding were registered with the county and included in the database files for this subwatershed. The locations of these complaints are shown on Map 3.5. The county addressed two standing water complaints by clearing blockages from the drainage system and considered the other flooding complaints private responsibilities. The flooding complaints were at isolated locations and do not indicate a widespread flooding problem in this subwatershed. The county's master plan drainage projects listed the completed Wessynton Way cul-de-sac drainage improvements as the only project for this subwatershed.

The National Resources Conservation Service STATSGO has a weighted hydrologic soil group index of 2.2 for the entire subwatershed. This weighted index indicates that the soils in this subwatershed have a moderately coarse texture with moderate infiltration rates. The hydrologic soil group classifications of A, B, C, and D explain the characterics of soil texture, permeability, and rate of infiltration. The county's GIS coverage for soils is incomplete and shows small pockets of hydrologic soil group B, C, and D located in the subwatershed.

3.2.2 Storm Drain System Infrastructure

The South Little Hunting Creek Subwatershed has many independent storm drain systems that discharge directly into Little Hunting Creek. The area located east of Linton Lane is drained by a storm drain system with pipe outfalls to South Branch at two different locations. The outfalls include double 54-inch (diameter) pipes at one location and a single 72-inch (diameter) pipe at the other location. Twelve stream crossings are located in this subwatershed and all had minor impacts on the stream as shown on Map 3.6. The impacts can be described as follows:

- Brady Street: The five-foot diameter concrete pipe drains to the tributary located on the west side of South Little Hunting Creek as shown in Photo 3.10.
- Linton Lane: Five-foot and three-foot (diameter) concrete pipes drain to South Branch as shown in Photo 3.11.
- Linton Lane: A triple six-foot by three-foot concrete box culvert drains to South Branch.
- East of Linton Lane: Two wooden foot bridges, each 12 feet long with four-foot openings, and four wooden foot bridges, each eight feet long with four-foot openings, are located on South Branch between Linton Lane and Vernon View Drive.

Photo 3.10 5' diameter concrete pipe located under Brady Street

Photo 3.11 5' and 3' diameter pipes located under Linton Lane

- South of Wessynton Way: A wooden foot bridge, eight feet long with a four-foot opening, is located on a tributary on the west side of South Little Hunting Creek.
- Wessynton Way: A two-foot (diameter) concrete culvert is located on a tributary on the west side of South Little Hunting Creek as shown in Photo 3.12.
- East of Doeg Indian Court: Five-foot, three-foot, and two-foot (diameter) concrete pipes are located on a tributary on the west side of South Little Hunting Creek.
- East of Doeg Indian Court: A wooden foot bridge, 10 feet long with a four-foot opening, is located on a tributary on the west side of South Little Hunting Creek.

Four storm drain outfall pipes discharge into South Branch. All outfall pipe material is concrete and the pipes range in size from 15 to 36 inches in diameter. Double 36-inch (diameter) outfall pipes located under Vernon View Drive discharge runoff collected from the River Bend Estates subdivision and are shown in Photo 3.13. These pipe outfalls are causing minor erosion but are not of significant concern. No private or public stormwater management facilities are listed in the county's inventory for this subwatershed.


Photo 3.12 2' (diameter) concrete pipe located under Wessynton Way


Photo 3.13 Double 3' (diameter) concrete pipes located west of Vernon View Drive

3.2.3 Stream Geomorphology

A geomorphic stream assessment was not performed for South Branch stream segments because of wetlands and paved channels. The geomorphology of the two tributaries discharging to South Little Hunting Creek on the west side of Little Hunting Creek was assessed. The results are shown on Map 3.7 and summarized as follows:

- The tributary located near Brady Street has a dominant substrate of gravel and is classified as CEM type 4, referring to a stabilizing stream bank and channel. The stream will widen if encroachment in the stream corridor continues to increase.
- The tributary located near Wessynton Way has a dominant substrate of sand and is beginning to show the characteristics of CEM type 2, referring to a deep, incised channel formed by head cutting of the stream bed.
- Flow obstructions or trash/debris were not observed in the South Little Hunting Creek stream segments, and there are no utility crossings located in this subwatershed (as shown on Map 3.7). A private industrial dumpsite is located east of Martin Luther King, Jr. Park with piles of construction debris, several pieces of earthmoving equipment, and large industrial

size drums with unknown contents that have a chemical smell. The debris and some of the drums are adjacent to a stream that drains into South Little Hunting Creek.

3.2.4 Stream Quality

Habitat assessment was not performed for South Branch due to wetlands and paved channels. During drought conditions, no flow was observed in South Branch or in the tributary (LHLH012) located on the west side of South Little Hunting Creek near Wessynton Way. The tributary (LHLH011) located near Brady Street had flow present during the drought. Both stream tributaries located on the west side of the subwatershed have low-gradient slopes and are classified as the glide pool prevalent stream type. The habitat assessment of the tributaries can be summarized as follows:

- At least three or four habitat types were common for less than 50% of the stream.
- The majority of the pools at LHLH011 are large and shallow with clay bottoms and greater than 10% of habitat structure available.
- The majority of pools at LHLH012 are small and shallow with sand bottoms and less than 10% of habitat structure available.
- For LHLH011, 30% of the channel reach has been straightened, dredged, or otherwise altered and for LHLH012, 50% of the channel reach has been altered.
- The sediment deposition is sand and/or silt with 60% to 70% of the bottom affected for LHLH011 and with 20% to 30% of the bottom affected for LHLH012.
- The stream segments are essentially straight with uniform depth of flow.
- For LHLH011, the water in the channel fills approximately 80% of the available cross section during normal flow periods. For LHLH012, the water in the channel fills approximately 35% to 40% of the available cross section during normal flow periods.
- Most of the channel banks for both streams have thick vegetative cover with a few barren spots and are moderately stable with 15% of the bank area exhibiting erosion.
- For LHLH011, the stream banks exhibit a five- to 25-foot width of forested buffer with lawn grass beyond the forested buffer. For LHLH012, the stream banks exhibit a 50- to 100-foot width of forested vegetative buffer with lawn grass beyond the forested buffer.

Habitat quality is considered fair for LHLH011 and poor for LHLH012 as shown on Map 3.8. An adequate buffer width does not exist along most of the stream corridors of the tributaries in the South Little Hunting Creek Subwatershed due to residential development in the area. Photo 3.14 shows planted lawns located in the buffer zone along the north branch of South Branch, west of Linton Lane; Photo 3.15 shows deficient buffer along the tributary LHLH012 located on the west side of South Little Hunting Creek. The impact of deficient buffer areas on the streams in this subwatershed is moderate. The stream segments of South Branch and the tributary (LHLH011) located near Brady Street are ideal candidates for stream restoration projects because each individual project would be of adequate stream length, would not involve easement acquisition, and would appear to have good access for construction. No head cuts or erosion of the stream bed and banks were observed as part of the stream physical assessment. An eroded area with large trees along the banks being undercut was identified at a stream tributary on the west side of South Little Hunting Creek near the George Washington Memorial Parkway.

Photo 3.14 Deficient buffer zone with planted lawn grass west of Linton Lane along the north branch of South Branch

Photo 3.15 Deficient buffer zone along the tributary LHLH012 located on the west side of South Little Hunting Creek

The stream characteristics assessment for the South Little Hunting Creek Subwatershed can be summarized as follows:

- The sediment and water in all of the streams were odor free.
- No fish were observed in South Branch or in the tributary near Wessynton Way. LHLH011 had small fish.
- No aquatic plants and/or algae were observed in any of the streams.

The amount of wetlands lost in the subwatershed is difficult to quantify as there is no data on the area of wetlands in the past. The water and sediment quality of the main stem of South Little Hunting Creek has been tested by the Virginia DEQ. The Virginia DEQ stated that aquatic life is threatened by the presence of excessive algae measured in the tidal waters of Little Hunting Creek. Algae blooms can be evidence of too much nitrogen and phosphorous in the water. Little Hunting Creek has been designated by the Virginia DEQ as nutrient enriched waters.

Little Hunting Creek is included in a segment of the Potomac River listed as an impaired water in the 2002 303(D) priority list prepared by the Virginia DEQ. The impairment classification is due to a health advisory issued by the Virginia Department of Health (VDH) for fish consumption based on high levels of PCBs found in the fish tissue. Fish tissue analysis has revealed exceedances of the human health-risk based screening value of 54 ppb of PCBs. Five different types of fish taken from Little Hunting Creek in 2000 had concentrations between 81 ppb and 682 ppb of PCBs.

Sediment samples taken in 2000 from the tidal portion of Little Hunting Creek contained 7.57 ppb of chlordane which is above the 6 ppb concentration that can threaten aquatic life. The five fish taken from Little Hunting Creek in 2000 were analyzed for chlordane in their tissue and had results below the DEQ screening value of 300 ppb. The sources of chlordane and PCBs are listed as unknown.

3.2.5 Problem Areas from Public Forum

Problem areas were identified by the stakeholders in the watershed forum held on July 19, 2003, and the locations are shown on Map 3.5. The majority of the problem areas included sedimentation of the creek, loss of forested buffer, and alteration of the streams.

Table 3.7 South Little Hunting Creek Problem Areas from Public Forum

Problem ID	Description
A2	South Branch: At the end of Wakefield Drive there is sewer rehabilitation project that is not using any erosion controls. It is unclear if this is a county project.
A5	South Branch: At the end of Orange Court there was an old dumpsite. While the debris has likely since been removed, there may be toxic or harmful elements still buried at the site.
A6	South Little Hunting Creek: The tide used to flush out the sediment years ago when there were discharges from the sewage treatment pump station that is now closed. In 1980, depths were four feet, but today they are only two feet.
A8	South Branch: A concrete pipe flows directly into the creek carrying stormwater into the main stem without any treatment for volume or quality.
B2	South Little Hunting Creek: A concrete channel filled with trash results in poor drainage at Martin Luther King Jr. Park.
B3 & D2	South Little Hunting Creek: Sedimentation has made Little Hunting Creek unnavigable near Woodland Heights.
B4	South Little Hunting Creek: High amounts of sedimentation have made the channel smaller near the George Washington Memorial Parkway Bridge. Several drownings have occurred here.
C4	South Branch: The channel near Creek Drive is filled with sediment and is no longer navigable.
C6	South Little Hunting Creek: A hardened shoreline exists near Carter Farm Court.
D1	South Little Hunting Creek: There is a loss of wooded floodplain at private land on Linton Lane, Camden Lane, and Fort Hunt Park.
D4	South Little Hunting Creek: There is development of land adjacent to South Little Hunting Creek on Stockton Parkway.
D6	South Little Hunting Creek: Sedimentation of the creek exists near the Wessynton subdivision.
E3	South Little Hunting Creek: The concrete-lined stream channel that ends at Linton Lane leads to sediment build-up and high discharge velocities on the downstream side.

3.2.6 Modeling Results

The hydrologic model for the South Little Hunting Creek Subwatershed consists of the entire subwatershed area. The hydraulic model for this subwatershed consists of only South Branch and not the tidal portion of Little Hunting Creek.

The hydrology developed for this subwatershed produced stormwater runoff that is fairly high with respect to the size of the watershed. Over 20% of this subwatershed is covered by impervious surfaces and over half of the land use is residential with moderate to high density. This results in peak discharges that are relatively high for the two- and 10-year rainfall events. The potential future development for this watershed will increase the density of residential land use, mainly through redevelopment of low-density residential parcels and medium-density residential development on currently undeveloped parcels. This development will result in relatively minor increases in stormwater peak discharges. Please see Table 3.8 for a comparison of existing and future two-and 10-year peak discharges for each sub-basin.

The velocities produced by the two-year rainfall event in South Branch are generally slow to moderate. During the stream physical assessment, no erosion or head cuts were observed in South Branch that corresponded to the slow to moderate velocities from hydraulic model. Erosion was observed in the stream located south of George Washington Memorial Parkway; however, this stream was not included in the hydraulic modeling.

The main reaches of South Branch have little or no natural floodplain areas mainly due to significant manmade improvements, which essentially extend the limits of the main channel. As a result, the two- and 10-year peak discharges are almost entirely contained within the extended channel banks for both reaches of South Branch. There are no roadway overtopping locations for the two- or 10-year storm event along any reach of South Branch.

The water quality modeling results for South Little Hunting Creek show that the average sediment loading rate exceeds the tributary strategy target level for sediment. Three of the sub-basins have sediment loading rates less than the tributary strategy target level for sediment. For future land use conditions, the average sediment loading rate is predicted to increase by 16% due to the increase in medium-density residential land use and the decrease in undeveloped area.

The average total phosphorus loading rate for the South Little Hunting Creek watershed exceeds the tributary strategy levels. At 32%, South Little Hunting Creek has the greatest increase in phosphorus pollutant loading from existing to future conditions of the five subwatersheds. This increase corresponds to the 60% increase in medium-density residential land use in the subwatershed.

For the South Little Hunting Creek Subwatershed, the average total nitrogen loading rate for existing and future conditions is less than the tributary strategy target value. None of the sub-basins exceeds the tributary strategy nitrogen target levels for either existing or future land use conditions. The relatively low values for nitrogen when compared to the other subwatersheds can be attributed to the higher percentage of open space and residential land use, which accounts for roughly 80% of the existing and future land uses in the subwatershed. The expected increase in nitrogen for the future land use conditions in the subwatershed is 25%.

Table 3.8 South Little Hunting Creek Peak Runoff Flows

Sub-basin	Two-Year Rainfall Event Existing Peak Flow (cfs)	Two-Year Rainfall Event Future Peak Flow (cfs)	Two-Year Rainfall Event % Peak Flow Increase	Ten-Year Rainfall Event Existing Peak Flow (cfs)	Ten-Year Rainfall Event Future Peak Flow (cfs)	Ten-Year Rainfall Event % Peak Flow Increase
LH-LH-0010	27	27	0%	54	54	0%
LH-LH-0011	102	102	0%	224	224	0%
LH-LH-0012	288	294	2%	544	555	2%
LH-LH-0013	361	366	1%	694	702	1%
LH-LH-0014	166	183	10%	319	348	9%
LH-SB-0001	59	59	0%	117	118	1%
LH-SB-0002	155	160	3%	283	292	3%
LH-SB-0003	89	90	1%	166	168	1%

3.3 Paul Spring Branch Subwatershed

The Paul Spring Branch Subwatershed is approximately 1,262 acres and is bounded to the west by the intersection of Harrison Street and Groveton Lane; to the southwest by Collard Street, Popkins Lane, the intersection of Sherwood Hall Lane and Evening Lane, and the Paul Spring Branch confluence with North Branch; to the southeast by Rossiter Place and Baltimore Road; to the east by the intersection of Belle Vista Drive and Park Terrace Drive; and to the northeast by the intersection of Beacon Hill Road and Quander Road and the intersection of Rollins Drive and Marlan Drive. Paul Spring Branch is a tributary to North Branch and drains a portion of the commercial area located along Richmond Highway including Beacon Mall. The Paul Spring Branch Subwatershed is shown on Map 3.9, and its condition is summarized as follows:

Paul Spring Branch Subwatershed Condition Summary

- Current impervious area = 26% with majority of land use medium-density residential
- Future impervious = 28%
- Severe to moderate impacts were observed at two crossings.
- Eight BMPs exist in the subwatershed.
- Eighty percent of the stream in the upstream reaches has been altered.
- The subwatershed exhibits poor habitat quality with inadequate buffers.
- Severe to extreme erosion was found at two pipe outfalls.
- Most of the channel has widened and bank slopes are stabilizing.
- The stream is obstructed, with fallen trees and debris at several locations.
- Sedimentation of the stream affects an average of 50% of the bottom.
- Uncontrolled runoff from developed areas negatively impacts the stream with severe bank erosion at several locations.

3.3.1 Subwatershed Characteristics

The headwaters of Paul Spring Branch emerge from a storm drain system outfall located in the Groveton area east of Maple Street. The stream first flows southeast and then changes its direction downstream of Sherwood Hall Lane and flows southwest. The total length of Paul Spring Branch, from its beginning to its confluence with North Branch, is approximately 3.25 miles. The stream slopes gently with a gradient of 0.81%.

The ground surface slopes are typically greater than 5% with ground elevation ranging from 220 to 240 feet in the Groveton area in the northern part of the subwatershed. The ground surface slopes down to an elevation of 150 to 160 feet at the headwaters of Paul Spring Branch and then gradually slopes to an elevation of 15 to 20 feet near its confluence with North Branch.

Storm drain pipe outfalls discharge to small tributaries draining to Paul Spring Branch at various locations along its length. A stream physical assessment was performed for the main stem of Paul Spring Branch and for a main tributary of Paul Spring Branch that is approximately 3,500 feet in length and drains the eastern portion of the subwatershed.

The impervious area in this subwatershed is 26% of the total area with predominately medium-density residential land use that makes up 41% of the subwatershed area as shown in Table 3.7. Commercial and industrial land uses are located near the Richmond Highway corridor and total approximately 6% of the subwatershed area. For ultimate future buildout conditions, medium-density residential land use may increase by 23% from potential development of undeveloped and underutilized parcels. The future imperviousness with ultimate buildout conditions is projected at 28%.

Table 3.9 Paul Spring Branch Land Use

Land Use Description	Land Use			
	Existing		Future	
	Area (acres)	%	Area (acres)	%
Open space, parks, and recreational areas	42	3	137	11
Estate residential	48	4	0	0
Low-density residential	217	17	0	0
Medium-density residential	516	41	800	64
High-density residential	73	6	67	5
Low-intensity commercial	35	3	25	2
High-intensity commercial	34	3	30	2
Industrial	6	0	0	0
Unknown	0	0	0	0
Undeveloped	89	7	0	0
Road right-of-way (including shoulder areas)	202	16	202	16
Wetlands	0	0	0	0
TOTAL	1,262	100	1,261	100

There are no wetlands in the county's GIS data for the Paul Spring Branch Subwatershed. The stream physical assessment of the Paul Spring Branch segment identified a potential wetland BMP area of 150 feet by 150 feet near the intersection of Paul Spring Road and Rippon Road. This potential wetland BMP site is near a large, private, dry detention stormwater management facility located to the northeast of the intersection.

In the Paul Spring Branch Subwatershed, seven of the 17 identified master plan drainage projects have been completed, and the remaining 10 projects are listed as inactive due to insufficient funds. The master plan drainage projects include stream bank stabilization, storm sewer improvements, and/or culvert replacements; these are summarized in Table 3.8.

Table 3.10 Paul Spring Branch Master Plan Drainage Projects

Type of Work	Project Name/Location
Completed projects	
Install gabions at Paul Spring Road	Paul Spring Road
Raise road and replace culvert at Clayborne Avenue	Clayborne Avenue
Improve drainage at Schooley Drive	Schooley Drive
Purchase house in floodplain	1801 Paul Spring Road
Install riprap at Kenyon Drive	Paul Spring Branch II
Install 200 feet of gabion and riprap	Paul Spring Branch II Install
350 feet of riprap at Paul Spring Parkway	Paul Spring Parkway
Construct 300 feet of storm sewer	Hollindale Drive
Inactive Projects	
Replace culvert at Woodcliff Drive	Woodcliff Drive
Replace culvert at Morningside Lane	Morningside Lane
Replace culvert at Lyndale Drive	Lyndale Drive
Replace culvert at Admiral Road	Admiral Road
Raise road and replace culvert at Paul Spring Road	Paul Spring Road
Replace culvert at Paul Spring and Rippon Road	Paul Spring Road
Stabilize 900 feet of stream at Fort Hunt Road	Fort Hunt Road
Stabilize 600 feet of stream bank at Fort Hunt Road	Fort Hunt Road
Replace culvert at Fort Hunt Road	Fort Hunt Road

Twenty-eight yard flooding and miscellaneous flooding complaints were registered with the county and included in the database files for this subwatershed. The locations of some of the complaints are shown on Map 3.9. Most of the complaints were yard flooding problems at isolated locations. This type of complaint is typically considered by the county to be a private responsibility.

The National Resources Conservation Service STATSGO database has a weighted hydrologic soil group index of 2.4 for most parts of the watershed and a value of 2.2 for a small area near its confluence with North Branch. This weighted index indicates that the soils in this subwatershed have moderately fine texture with low infiltration rates. The hydrologic soil group classifications of A, B, C, and D explain the characterics of soil texture, permeability, and rate of infiltration. The county's GIS soil layer has incomplete coverage and shows small pockets of hydrologic soil group C and D located in the subwatershed.

3.3.2 Storm Drain System Infrastructure

The Groveton area, located east of Maple Street, is drained by an extensive storm drain pipe system that discharges through double 72-inch (diameter) pipes into the headwaters of Paul Spring Branch. The rest of the Paul Spring Branch Subwatershed is drained by smaller, independent storm drain systems that discharge directly into the stream. These storm drain outfalls include open channels and pipes that vary in size from 18 to 33 inches in diameter. Thirteen stream crossings are located in this subwatershed, and all but two of the crossings had minor impacts to the stream as shown on Map 3.10. The impacts from the crossings can be described as follows:

- Mary Baldwin Drive: Two four-foot (diameter) corrugated metal pipes causes severe erosion of the bed and banks on the downstream side. The bank erosion is six feet high as shown in Photo 3.16. A wooden footbridge crossing the stream is located downstream of Mary Baldwin Drive and has minor impact on the stream.
- Paul Spring Road: A five and one-half-foot by four-foot elliptical pipe and a four-foot (diameter) circular pipe does not impact the stream. A wooden footbridge crossing the stream is located upstream of Paul Spring Road and has no impact on the stream.
- Mason Hill Drive: Three 10-foot by 12-foot concrete box culverts have no impact on the stream.
- Private Road South of Mason Hill Drive: A concrete arch bridge with a 15-foot by five-foot opening has no impact on the stream.
- Sherwood Hall Lane: Four 10-foot by six-foot concrete box culverts, shown in Photo 3.17, with downstream bank erosion of four feet in height, cause a moderate impact on the stream.

Photo 3.16 Severe erosion downstream of the Mary Baldwin Drive crossing

Photo 3.17 Four 10'x 6' concrete box culverts located under Sherwood Hall Lane

- Fort Hunt Road: A three-foot (diameter) concrete pipe under the roadway and two three-foot (diameter) concrete pipes under the trail impact the stream.
- Woodcliff Court: A three-foot (diameter) concrete pipe has no impact on the stream.

- Lyndale Drive: A two-foot (diameter) concrete pipe has a minor impact on the stream. A wooden footbridge crosses the downstream of Lyndale Drive and has a minor impact on the stream.
- Admiral Road: A two-foot (diameter) concrete pipe has a minor impact on the stream.

There are 11 storm drain pipe outfalls discharging to Paul Spring Branch as shown on Map 3.10. The outfall pipe materials include concrete, corrugated metal, plastic, and rubber, and the pipes range in size from 12 to 60 inches in diameter. The stream physical assessment noted moderate to severe erosion caused by a 53-inch by 34-inch (diameter) elliptical concrete outfall pipe located north of Devonshire Road as shown in Photo 3.18. Discharges from an 18-inch (diameter) outfall pipe located west of Mary Baldwin Drive and a 24-inch (diameter) outfall pipe located north of Wellington Road have caused severe to extreme erosion (shown in Photos 3.19 and 3.20).

Discharges from four pipe outfalls have caused moderate erosion to the stream, and discharges from the remaining eight outfall pipes have caused minor erosion. The sites of severe to extreme erosion are of significant concern and will need immediate attention. The four ditches that discharge to Paul Spring Branch have caused minor to moderate erosion of the stream, and as an example, the ditch outfall located near the intersection of Paul Spring Road and Pickwick Lane is shown in Photo 3.21.

Photo 3.18 Discharge from 53"x 34" elliptical pipe outfall north of Devonshire Road caused moderate erosion on the downstream side

Photo 3.19 Severe erosion caused by discharge from an 18" pipe outfall west of the Mary Baldwin Drive crossing

Photo 3.20 Severe erosion caused by discharge from 24" pipe outfall located north of Wellington Road

Photo 3.21 Minor erosion of the right bank at the ditch outfall north of the intersection of Paul Spring Road and Pickwick Lane

Four private and two public stormwater management facilities are listed in the county's inventory for this subwatershed. A large dry detention basin located at the intersection of Paul Spring Road and Fort Hunt Road discharges directly into Paul Spring Branch. Table 3.9 describes the stormwater management facilities in the subwatershed.

Table 3.11 Paul Spring Branch Stormwater Management Facilities

Location	Type of Facility	Parcel Area (Acres)
Privately Owned		
Southeast of Richmond Highway and Schooley Drive intersection at 6733 Richmond Highway (not shown on Map 3.10)	Dry pond	0.86
Northwest of Paul Spring Road and Fort Hunt Road intersection	Dry pond	12.21
North of Mason Hill Drive and south of Windmill Lane at Mount Vernon Unitarian Church	Dry pond	7.71
Southeast of the intersection of Sherwood Hall Lane and Wellington Road at the Mount Vernon Presbyterian Church	Bioretention	1.20
Parking lot south of the Jemal/Metrocall Building at 6910 Richmond Highway	Underground Retention	Unknown
Publicly Owned		
Northeast of Bryant Towne Court and Popkins Lane intersection (not shown Map 3.10)	Dry pond	1.31
Southwest of Popkins Lane near the intersection of Popkins Lane and Devonshire Road	Infiltration trench	0.30
North of Windmill Lane near the intersection of Windmill Lane and Windmill Court	Dry pond	0.37
Southwest of Admiral Drive and Essex Manor Place intersection	Dry pond	1.00

3.3.3 Stream Geomorphology

The geomorphology of Paul Spring Branch and the tributary located on the east side of Paul Spring Branch near Admiral Drive was assessed. The results are shown on Map 3.11 and can be summarized as follows:

- Cobble is the dominant substrate in the stream reaches located upstream of Mason Hill Drive, and gravel is the dominant substrate in the stream reaches located between Mason Hill Drive and the intersection of Fort Hunt Road and Paul Spring Parkway. Sand is the dominant substrate in the downstream reaches of Paul Spring Branch near its confluence with North Branch.
- The majority of the stream reaches are CEM type 4, referring to widening of the channel with stabilizing bank slopes.

Photo 3.22 Fallen trees and eroding banks causing severe impact to Paul Spring Branch north of Fairfax Road

- At the headwaters of Paul Spring Branch east of Maple Street, the channel reach is CEM type 2, referring to a deep, incised channel formed by head cutting of the stream bed.

Fallen trees, dumps, and debris obstructing the flow were observed at many locations in Paul Spring Branch as shown in Photo 3.22. The stream corridor is also littered with lawn waste and

Photo 3.23 Concrete blocks obstructing the flow south of the intersection of Rollins Drive and Radcliff Drive

Photo 3.24 Partially buried telephone line south of the intersection of Rollins Drive and Radcliff Drive

trash as shown in Photo 3.23. At three locations, partially buried utility lines crossing the stream bed have caused a minor impact to the stream as shown in Photo 3.24. The locations of obstructions, dumpsites, and utility lines crossing the stream are shown on Map 3.11.

3.3.4 Stream Quality

Paul Spring Branch has a low-gradient slope and is classified as a glide pool prevalent stream type. The habitat assessment for Paul Spring Branch can be summarized as follows:

- The majority of the stream has four to five habitat types found in more than 50% of the reach length, except for the farthest upstream reach which has three habitat types for less than 50% of the reach length.
- Soft sand, mud, and clay characterize the pool substrate and help in providing suitable soil for subaqueous plants.
- The stream bottom is covered with more than 10% of habitat structure consisting of organic debris, root mats, and/or submerged vegetation.
- In the downstream segment of Paul Spring Branch, near its confluence with North Branch, the pools are evenly mixed in size. The majority of the pools found in the upstream segments of Paul Spring Branch are large and deep.
- In the downstream segments, the channel bed and banks exhibit minor manmade distur- bances. As you travel upstream, the reaches exhibit increasingly more manmade distur- bances with 80% of the reach having been altered near the headwaters.
- Sediment deposition in the downstream reaches is mainly gravel and/or sand with 40% to 50% of the stream bottom affected. Sediment deposition in the upstream segments consists mainly of sand and/or silt with 50% to 70% of the stream bottom affected.
- Most of the stream reaches exhibit infrequent bends and variable bottom contours that may

provide some habitat.

- During normal flow conditions, water fills approximately 65% to 75% of the available channel cross section, and during drought conditions, the water is mostly present as standing pools.
- For the majority of the stream, vegetation covers 60% to 70% of the channel bank surface with scattered shrubs, grasses, and forbes.
- Most of the stream reaches have moderately unstable banks with 40% to 60% of the bank surface exhibiting erosional areas.
- The forested vegetated buffer width is 25 to 50 feet with significant impervious areas beyond the buffer zone for the majority of the stream.

Photo 3.25 Head cutting of 2' of stream bed on the tributary to Paul Spring Branch west of Lyndale Drive

The habitat quality is fair for 53% of Paul Spring Branch and poor for 47% of the stream. The habitat quality is fair for the stream segments located between the Paul Spring Branch/North Branch confluence and Mason Hill Drive. The habitat quality is poor in the stream segments located upstream from Mason Hill Drive to the headwaters (shown on Map 3.12). In the tributary to Paul Spring Branch, two feet of head cutting of the stream bed was observed causing minor impacts to stream as shown in Photo 3.25.

Approximately 1,500 feet upstream of its confluence with North Branch, there is severe erosion of the left bank (six feet high) as shown in Photo 3.26. Downstream of Mason Hill Drive and upstream of the tributary flowing into Paul Spring Branch, moderate to severe erosion with four- to six-foot height of bank erosion was observed at three locations (as shown at one location in Photo 3.27). Downstream of Mary Baldwin Drive, severe erosion of the right bank with eight-foot height of erosion was observed. This erosion problem will require immediate attention.

Photo 3.26 Severe erosion of 6' height was observed west of Admiral Drive

Photo 3.27 Severe erosion of 6' height observed upstream of confluence with North Branch

The upstream segments of Paul Spring Branch 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. In the downstream segments of Paul Spring Branch, minor bank stabilization would be appropriate to protect adjacent properties from future problems.

The general characteristics of the stream water quality were assessed and can be described as follows:

- Water in the downstream pools of Paul Spring Branch appears clear, and in the upstream reaches, the water appears green in color.
- A petroleum or methane smell was observed in both the water and sediment of the downstream segment near the confluence with North Branch. The upstream segments were odor free.
- Medium fish of three to six inches in length were observed in some of the stream segments as shown on Map 3.12.
- No aquatic plants or algae were observed in Paul Spring Branch stream segments.
- The buffer width is inadequate along the majority of Paul Spring Branch due to residential development in the area. The impact of deficient buffer areas on the stream segment is

Photo 3.28 Deficient buffer area at the upstream segment of Paul Spring Branch west of Kenyon Drive

Photo 3.29 Deficient buffer area along the downstream segment of Paul Spring Branch north of Sherwood Hall Lane

moderate and the locations of deficient buffer areas are shown on Map 3.12. Typical deficient buffer areas in the upstream and farthest downstream segments of Paul Spring Branch are shown in Photos 3.28 and 3.29.

3.3.5 Problem Areas from Public Forum

Problem areas were identified by the stakeholders in the watershed forum held on July 19, 2003, and the locations are shown on Map 3.9 (except as noted). The majority of the problems include uncontrolled runoff to the stream, erosion, and loss of forested buffer.

Table 3.12 Paul Spring Branch Problem Areas from Public Forum

Problem ID	Description
A7	Excessive flooding in the forested areas is due to road and parking lot runoff.
C3	There are obstructions with trees on Paul Springs Branch near Paul Springs Parkway.
D5	Large impervious areas consisting of commercial parking lots are located at Beacon Hill Mall.
E4	A dry detention pond located near Preston Avenue and Bryant Towne Court doesn't work. Approximately 12 years ago, Popkins Lane was widened and storm sewers created more inflow to the stream.
E5	Several new homes built five years ago near Schooley Drive and East Side Drive are too close to the creek and the riparian buffer was lost when vegetation was stripped from the lots. At the low point of Memorial Street (east), there are possible illicit discharges from car repair and painting.
E8	Stream bank erosion exists Paul Spring Branch in the Hollin Hall area.

3.3.6 Modeling Results

The hydrology developed for this subwatershed produced stormwater runoff that is fairly high with respect to the size of the watershed. Over 25% of this subwatershed is covered by impervious surfaces and almost two-thirds of the land use is residential of moderate to high density. This development results in peak discharges that are high for the two- and 10-year rainfall events relative to the size of the drainage area. The planned development in this watershed will result in a slight increase in impervious surfaces, mainly due to redevelopment of low-density residential parcels into medium-density residential areas and will result in minor increases in stormwater peak discharges which may lead to erosion and sedimentation in the stream. Please see Table 3.13 for a comparison of existing and future two-and 10-year peak discharges for each sub-basin.

The velocities produced by the two-year rainfall event in Paul Spring Branch are generally moderate throughout its length with several areas of notably high velocity. Locations of erosion ranging from moderate to severe were observed in Paul Spring Branch during the stream physical assessment, which correspond to the locations of high velocity from the hydraulic model. Severe to extreme erosion was observed at two pipe outfalls which also correspond to the hydraulic model.

The two-year peak discharge overtops the main channel but is contained within the floodplain for the majority of the length of Paul Spring Branch. The 10-year peak discharge overtops the channel banks but is contained within the floodplain for the majority of Paul Spring Branch. The two-year storm overtops Paul Spring Road, and the 10-year storm overtops the roadway at Mary Baldwin Drive and Paul Spring Road.

The water quality modeling results for Paul Spring Branch show that the average sediment loading rates exceed the tributary strategy target levels for sediment for both existing and future land use conditions. The Paul Spring Branch Subwatershed has a relatively high residential density and the Route 1 commercial corridor is located in the headwaters of the subwatershed. The sub-basins located in the headwaters have the highest sediment loading rates in the subwatershed and the sediment loading rates exceed the poor values for future land use conditions. The average sediment loading rate is predicted to increase by 7% in the future due to the increase in medium-density residential area and the decrease in undeveloped land.

The average total phosphorus loading rate for the Paul Spring Subwatershed exceeds the tributary strategy target levels. The average increase in the future phosphorus loading rate is 21%, which can be attributed to the 23% increase in medium-density residential land use and the development of all existing undeveloped property. All sub-basins for the existing and future conditions exceed the phosphorus tributary strategy levels. For future conditions, the highest phosphorus loading rate is associated with sub-basin LH-PS-0007, which is the sub-basin with the greatest density of development in the subwatershed. The predicted future loading rates for all sub-basins exceed the tributary strategy target level for phosphorus.

The average total nitrogen rate for the subwatershed is less than the tributary strategy target level. For existing and future conditions, sub-basin LH-PS-0007, located in the headwaters of the Paul Spring Subwatershed, is predicted to exceed the tributary strategy target level. The higher rate for this sub-basin is attributed to the high percentage of commercial area and the increase in medium-density residential land use. The expected increase in the future nitrogen loading rate for the entire subwatershed is 13%.

Table 3.13 Paul Spring Branch Peak Runoff Flows

	Two-Year Rainfall Event			Ten-Year Rainfall Event		
Sub-basin	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase
	(cfs)	(cfs)		(cfs)	(cfs)	
LH-PS-0001	216	230	6%	437	454	4%
LH-PS-0002	261	271	4%	531	542	2%
LH-PS-0003	96	99	2%	185	188	2%
LH-PS-0004	205	208	1%	390	395	1%
LH-PS-0005	120	121	1%	234	236	1%
LH-PS-0006	165	166	1%	313	315	1%
LH-PS-0007	297	310	4%	541	564	4%

3.4 North Branch Subwatershed

The North Branch Subwatershed has an area of 1,760 acres and contains North Branch, a tributary to Little Hunting Creek located on the east side of the creek. The subwatershed is bounded to the west by Cornith Drive and Holland Road; to the south by Stirrup Lane and Alden Road; to the east by George Washington Memorial Parkway; and to the north by the intersection of Martha Road and Popkins Lane, the North Branch and Paul Spring Branch confluence, and Custis Street. Sherwood Hall Lane and Collingwood Road are two major roads located in this subwatershed. The North Branch Subwatershed is shown on Map 3.13, and its condition is summarized as follows:

North Branch Subwatershed Condition Summary

- Current imperviousness = 26% with majority of land use medium-density residential
- Future imperviousness = 27%
- Road crossings create minor impacts on the stream.
- There are 11 existing BMPs—the largest one is at the Mount Vernon Hospital.
- The stream has extensive, manmade alterations.
- Poor habitat quality was noted in 82% of the stream with inadequate buffers.
- One head cut location was observed.
- One obstruction with a moderate impact was found on a tributary.
- The stream is CEM type 3 with active widening.

3.4.1 Subwatershed Characteristics

The headwaters of North Branch emerge from a 36-inch (diameter) storm drain pipe outfall serving the area north of Lisbon Lane. The stream has a low gradient slope of 0.40%. The length of North Branch to its confluence with Little Hunting Creek is approximately 2.5 miles. Paul Spring Branch is a tributary of North Branch located on the east side of North Branch. It is a separate subwatershed described in Section 3.3. There are two other major tributaries of significant length. Tributary Reach LHNB001 is located approximately 1,500 feet upstream of the North Branch confluence with Little Hunting Creek and is over 1,500 feet in length. Tributary Reach LHNB008 is located 2,500 feet downstream of the North Branch and Paul Spring Branch confluence and is approximately 5,000 feet in length.

Most of the land in this subwatershed is relatively flat with ground surface slopes greater than 10% found in the headwater region of the subwatershed. Elevations at the northern edge of the subwatershed are approximately 200 feet. The ground surface slopes steeply down to an elevation of 50 feet at the beginning of North Branch and then gradually slopes to an elevation of five feet at the confluence of North Branch and Little Hunting Creek.

The impervious area in this subwatershed is 26% of the total area with a predominate land use of medium-density residential as shown in Table 3.11. The low-density, medium-density, and high-density residential land uses comprise 61% of the subwatershed area. The subwatershed area contains approximately 59 acres of undeveloped land, and the projected future land use for the subwatershed will remain predominately medium-density residential with open space and park land use increasing by 44 acres.The wetland area is approximately 1% of the total subwatershed area and is shown on Map 3.13.

Table 3.14 North Branch Land Use

Land Use Description	Land Use			
	Existing		Future	
	Area (acres)	%	Area (acres)	%
Open space, parks, and recreational areas	113	6	157	9
Estate residential	48	3	0	0
Low-density residential	279	16	0	0
Medium-density residential	781	44	1143	65
High-density residential	20	1	2	0
Low-intensity commercial	167	10	167	10
High-intensity commercial	8	1	7	0
Industrial	2	0	0	0
Unknown	5	0	6	0
Undeveloped	59	3	0	0
Road right-of-way (including shoulder areas)	255	15	255	15
Wetlands	23	1	23	1
TOTAL	1,760	100	1,760	100

In the North Branch Subwatershed, nine of the 16 identified master plan drainage projects have been completed and the remaining 10 projects are listed as inactive due to insufficient funds. The master plan drainage projects include storm drain system improvements and culvert replacements and are summarized in Table 3.12.

Table 3.15 North Branch Master Plan Drainage Projects

Type of Work	Project Name/Location
Completed projects	
Install 1,100 feet of storm sewer	Greenway Road
Install a storm sewer	Greenway Road
Replace culvert at Greenway Road	Greenway Road
Install a storm sewer system	Boswell Avenue
Perform flood control	Stacey Road
Raise Collingwood Road and replace two culverts	Little Hunting Creek
Improve 2,000 feet of drainage	Hollin Hall phase II
Improved storm drains	Hollin Hall phase I
Raise road and replace culvert at Collingwood Road	Collingwood Road
Inactive projects	
Raise Bainbridge Road	Bainbridge Road
Floodwall at Sherwood Hall Lane	Sherwood Hall Lane
Floodwall at Collingwood Road	Collingwood Road
Candlewood Road	Candlewood Road
Stabilize 200 feet of stream bank	Candlewood Road
Install an additional culvert at Sherwood Hall Lane	Sherwood Hall Lane
Flood protection	Davenport Street

For this subwatershed, 33 miscellaneous flooding and yard flooding complaints were registered with the county and listed in the database files. The locations of some of these complaints are shown on Map 3.13. Most of the complaints were yard flooding problems at isolated locations and are typically considered by the county to be private responsibilities.

The National Resources Conservation Service STATSGO database has a weighted hydrologic soil group index of 2.4 in the headwater region and a value of 2.2 for the remainder of the subwatershed. This weighted index indicates that the soils in this subwatershed have a moderately coarse texture with moderate infiltration rates. The hydrologic soil group classifications of A, B, C, and D explain the characterics of soil texture, permeability, and rate of infiltration. The county's GIS soil layer has incomplete coverage and shows small pockets of hydrologic soil group C located in the subwatershed.

3.4.2 Storm Drain System Infrastructure

The North Branch Subwatershed is drained by a network of storm drain pipe systems except for the Kirkside subdivision (which is drained by open channels). The storm drain pipe outfalls vary in size ranging from 18 to 72 inches in diameter. There are five road crossings, two driveway and trail crossings, and nine footbridge crossings in this subwatershed as shown on Map 3.14. There are minor to no impacts on the stream from the driveway, trail, and footbridge crossings. The road crossings are described as follows:

- Davenport Street: Three 60-inch (diameter) corrugated metal pipe culverts with minor stream bed erosion of two-foot height were observed downstream of the pipe as shown in Photo 3.30.

- Sherwood Hall Lane: Two 72-inch (diameter) corrugated metal pipe culverts have no impact on the stream as shown in Photo 3.31.
- Collingwood Road: Five 12-foot by eight-foot box culverts, shown in Photo 3.32, cause minor stream bed erosion upstream of the crossing.
- Collingwood Road: Four 10-foot by 15-foot concrete box culverts, shown in Photo 3.33, with sedimentation upstream of the crossing, are causing a moderate impact on the stream.
- Stacey Road: Four elliptical, five-foot by three-foot corrugated metal pipe culverts are causing minor downstream bed erosion.

Photo 3.30 Triple 60″ corrugated metal pipe culverts located under Davenport Street

Photo 3.31 Double 72″ corrugated metal pipe culverts located under Sherwood Hall Lane

Photo 3.32 Five 12′ x 8′ concrete box culverts located under Collingwood Road to convey North Branch main stem flows

Photo 3.33 Four 10′ x 15′ concrete box culverts located under Collingwood Road to convey flows of the eastern tributary

Fifteen concrete pipe outfalls discharge to North Branch and its tributaries. They range in size from 12 to 72 inches in diameter. Photo 3.34 shows a 60-inch concrete pipe outfall located at the headwaters of the tributary LHNB001 to North Branch. Discharges from the majority of pipe outfalls are causing only minor erosion and their locations are shown on Map 3.14. Downstream of the confluence with Paul Spring Branch, a small ditch with an 18-inch width discharges into the stream and causes moderate erosion (shown in Photo 3.35).

Photo 3.34 A 60" diameter concrete pipe outfall at the headwaters of the tributary to North Branch

Photo 3.35 A small ditch, 18' wide, discharges to North Branch just south of the confluence with Paul Spring Branch

There are 10 public (no private) stormwater management facilities located in the subwatershed and listed in the county's inventory. One of the largest stormwater management facilities is a detention basin located at the Mount Vernon Hospital that serves an area of approximately 38 acres. The stormwater management facilities are described in Table 3.13 and shown on Map 3.14.

Table 3.16 North Branch Publicly Owned Stormwater Management Facilities

Location	Type of Facility	Parcel Area (Acres)
Northeast of the Holland Road and Hinson Farm Road intersection	Wet retention	33.35
North of Rampart Court	Dry pond	0.65
Northwest of the Sherwood Hall Lane/Midday Lane intersection near Traies Court	Underground tank	0.71
North of Collingridge Court	Underground tank	0.37
South of Lakeshire Drive at Marble Dale Court	Extended detention	1.17
South of Hinson Farm Road	Dry pond	0.45
Southeast of the Holland Road and Hinson Farm Road intersection	Dry pond	4.56
East of Stacey Road south of Collingwood Road	Dry pond	0.23
Southwest of the intersection of Collingwood Road and Collingwood Court	Underground tank	0.28
West of Noral Place	Extended detention	0.15
Southeast of Riverton Lane	Extended detention	0.34

3.4.3 Stream Geomorphology

The geomorphology of North Branch and its tributaries was assessed and is shown on Map 3.15. The results of the geomorphologic assessment can be summarized as follows:

- The dominant substrates in all stream segments are sand and silt.
- All stream segments of North Branch are CEM type 3, referring to near vertical stream bank

slopes, active widening, and accelerated bend migration. It was observed that the channel has been dredged and altered.

- No geomorphologic assessment was made of the downstream segment due to wetlands.

Downstream of the North Branch confluence with Paul Spring Branch, a fallen tree obstructed the fish passage without much of an impact on the stream (shown in Photo 3.36). Tributary LHNB001 has fallen trees obstructing the channel flow at two locations as shown in Photo 3.37. In the upstream segments of North Branch, the channel is littered with lawn waste consisting of grass and leaves. Partially buried or fully encased sanitary sewer pipes cross North Branch at four different locations and cause minor impacts on the stream. The location of all obstructions, dumpsites, and utility crossings impacting the stream are shown on Map 3.15.

Photo 3.36 Flow obstruction downstream of the North Branch/Paul Spring Branch confluence

Photo 3.37 Flow obstruction in Tributary LHNB001 upstream of North Branch outfall to Little Hunting Creek

3.4.4 Stream Quality

North Branch is a low-gradient stream and is classified as the glide pool prevalent stream type. The habitat assessment for North Branch can be summarized as follows:

- In the stream segment located downstream of the North Branch confluence with Paul Spring Branch, six habitat types are common. In Tributary LHNB008, one to three habitat types are common. In the other stream segments, three to four habitat types are common.
- The majority of the pool substrate is characterized by a mud/clay bottom with less than 10% habitat structure.
- No habitat assessment was performed for the farthest downstream segment of North Branch because of wetlands.
- In the downstream tidal reaches, the pools are large and deep, and in the upstream segments, the pools are large and shallow. Tributary LHNB008 has pools that are shallow and small.
- Channel disturbance was 100% of the stream segment lengths in Tributary LHNB008. Significant disturbance of approximately 70% of the stream length was observed in other segments of North Branch.
- Pools are completely absent due to sediment affecting 90% to 100% of the bottom in the downstream portion of Tributary LHNB008. The other stream segments show 50% to 80% of the bottom being affected by sediment deposition of sand and/or silt.

- Except in the segment immediately downstream of the North Branch confluence with Paul Spring Branch, the stream segments have straight reaches with uniform depth of flow.
- During normal flow conditions, water fills approximately 80% to 90% of the available channel cross section for the majority of the stream.
- Vegetation covers approximately 50% to 70% of the channel bank area and consists of shrubs, grasses, and forbes.
- Most of the channel banks are moderately unstable with 50% to 60% of the bank having erosional areas with high erosion potential during floods. Tributary LHNB008 has slightly more stable banks.
- The majority of the vegetated buffer is 25 to 50 feet wide with impervious areas located beyond the buffer. The buffer width is less than the desired width of 100 feet.

The habitat quality is poor for 82% of the North Branch stream segments as shown on Map 3.16. No erosion problems were observed for the stream bed and banks. Head cutting up to two feet of stream bed was observed in Tributary LHNB001 with a minor impact on the stream as shown in Photo 3.38.

Photo 3.38 Head cutting of the stream bed on Tributary LHNB001

The majority of North Branch stream segments are not ideal candidates for stream restoration projects because each individual project would not be of adequate size and would have access issues Minimal bank stabilization would be appropriate to protect adjacent properties from future problems.

The general characteristics of the stream water quality were assessed and can be described as follows:

- The water and sediment in the North Branch stream segments were odor free.
- In the stream segments downstream of the North Branch confluence with Paul Spring Branch, fish of three to six inches in length were observed (locations shown on Map 3.16).
- Aquatic plants attached to the stream margin were observed in less than 10% of the area in Tributary LHNB008.
- Orange filamentous algae were observed in stream segments located downstream of the North Branch confluence with Paul Spring Branch. Tributary LHNB008 exhibited green filamentous algae.

In the North Branch stream segments located immediately upstream and downstream of the North Branch/Paul Spring Branch confluence, the buffer area is covered with lawn causing a severe to extreme impact as shown in Photo 3.39. The downstream segments of Tributary LHNB001 have inadequate buffers adjoining pavement, causing a severe impact on the stream as shown in Photo 3.40. Overall, the North Branch stream segments do not have adequate natural buffer widths of 100 feet. The locations of deficient buffer areas along the stream corridor are shown on Map 3.16.

Photo 3.39 Lawn in the buffer zone downstream of Paul Spring Branch confluence

Photo 3.40 Buffer zone next to Collingwood Road on the eastern tributary to North Branch

3.4.5 Problem Areas from Public Forum

Problem areas were identified by the stakeholders in the watershed forum held on July 19, 2003, and the locations are shown on Map 3.13 and in Table 3.14. The majority of the problem areas identified at the forum included sedimentation and stream bank erosion of North Branch.

Table 3.17 North Branch Problem Areas from Public Forum

Problem ID	Description
A3	There is a blocked culvert at Collingwood Road. The creek is still tidal up to Collingwood Road.
A4 & C2	At North Branch near Collingwood Road, VDOT is clearing away sediment. However, their efforts are ineffectual because their methods don't take into account that the creek is still tidal at this location. The area is smelly and prone to flooding, and there are concerns about West Nile Virus.
B5	Massive stream bank erosion was reported on North Branch near Candlewood Drive.
C1	The beaver dam near Stirrup Lane was destroyed a few years ago due to flooding problems, reestablish the retention pond.
E7	There is stream bank erosion near the Collingwood Road crossing.

3.4.6 Modeling Results

The hydrology developed for this subwatershed produced stormwater runoff that is fairly high with respect to the size of the watershed. Over 25% of this subwatershed is covered by impervious surfaces with the majority of land use being low- to medium-density residential and low-intensity commercial. This amount of imperviousness produces peak discharges that are relatively high for the two- and 10-year rainfall events. The potential development in this watershed will result in an overall slight increase in impervious surfaces, as future land uses are almost exclusively medium-density residential and low-intensity commercial. This potential development will produce peak discharges for the two- and 10-year rainfall events that are slightly higher than they are currently. Please see Table 3.18 for a comparison of existing and future two-and 10-year peak discharges for each sub-basin.

The velocities produced by the two-year rainfall event in North Branch are generally moderate throughout its length with several areas of higher velocity. No erosion or head cuts were observed in North Branch during the stream physical assessment that corresponds to the slow to moderate velocities from hydraulic model.

The two-year peak discharge overtops the main channel but is contained within the floodplain for the majority of the length of North Branch. There are several locations where the two-year discharge overtops the channel banks and inundates the floodplain area. The 10-year peak discharge overtops the channel banks throughout the length of North Branch but is contained within the floodplain for the majority of the channel. There are no roadway overtopping locations for the two- or 10-year storm event along any reach of North Branch.

The water quality modeling results for North Branch show that the average sediment loading rates for existing and future land use conditions exceed the tributary strategy target level for sediment. For future land use conditions, the average sediment loading is predicted to increase by 5% and is attributed to the slight increase in medium-density residential land use in the subwatershed and the decrease in undeveloped land. The sub-basin containing Mount Vernon Hospital and the commercial area just south of Sherwood Hall Lane has the highest sediment loading rates for the subwatershed. In addition, the sub-basin LH-NB-0004 that contains the Carl Sandburg Middle School and the Stratford Landing Elementary School is expected to have a high sediment loading rate for future land use conditions compared to the other sub-basins in the subwatershed.

The average total phosphorus loading rate for existing and future land use conditions for the North Branch Subwatershed exceeds the tributary strategy target value for all sub-basins. For future land use conditions, the relatively high percentage of medium-density land use, low-intensity commercial land use, and the low percentage of open space contribute to the high level of phosphorus loading.

For the existing and future land use conditions in the subwatershed, the average total nitrogen loading rate for North Branch is less than the tributary strategy target value. Sub-basin LH-NB-0003, located at the downstream end of North Branch, is predicted to exceed the tributary strategy nitrogen target value due to the high commercial land use of the sub-basin for existing and future conditions. This sub-basin contains the Mount Vernon Hospital as well as other large commercial areas. The expected increase in the future nitrogen loading rate for the entire subwatershed is 11%.

Table 3.18 North Branch Peak Runoff Flows

Sub-basin	Two-Year Rainfall Event			10-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
LH-NB-0001	108	108	0%	216	216	0%
LH-NB-0002	96	97	1%	190	192	1%
LH-NB-0003	54	54	0%	94	93	0%
LH-NB-0004	175	178	2%	324	330	2%
LH-NB-0005	118	118	0%	223	223	0%
LH-NB-0006	147	161	10%	277	302	9%
LH-NB-0007	217	222	2%	402	409	2%
LH-NB-0008	225	233	4%	427	440	3%
LH-NB-0009	87	97	11%	164	179	9%
LH-NB-0010	131	136	4%	248	255	3%
LH-NB-0011	197	202	3%	374	384	3%

3.5 Potomac River Subwatershed

The Potomac River Subwatershed is a narrow band of land bordering the Potomac River and located adjacent to the east and west sides of the Little Hunting Creek Watershed as shown on Maps 3.17 and 3.18. This area does not drain to Little Hunting Creek but was included in this watershed plan. The east and west portions of the subwatershed are referred to as East Potomac and West Potomac in this section. The condition of the subwatershed can be summarized as follows:

Potomac River Subwatershed Condition Summary

- Current imperviousness = 15% with the majority of land use open space and parks
- Future imperviousness = 17%
- The majority of the existing land use is open space, parks, and recreational areas.
- No physical assessment of the streams (except for one tributary) was performed.
- There are no existing BMPs.
- The stream located south of Eaglebrook Court has been altered and has poor habitat quality with inadequate buffers.
- No erosion or head cuts were observed.
- No trash dumps were located.

3.5.1 Subwatershed Characteristics

West Potomac has one large stream and East Potomac has five small streams, all ranging from a few hundred feet to 2,000 feet in length. The streams have a gentle slope of 1.0% to 2.0%. The terrain is mostly flat with elevations of 75 to 80 feet, and steep slopes (25% and greater) are found in the vicinity of the stream bank areas.

The impervious area in this subwatershed is 15% of the total area with a future projected imperviousness of 17%. The predominant existing land use in the subwatershed is open space, parks, and recreational land use as shown in Table 3.15. The West Potomac area of the subwatershed has an area of approximately 496 acres and includes the historic Mount Vernon area and a portion of the Riverwood subdivision. The East Potomac portion of the subwatershed has an area of approximately 761 acres and includes the George Washington Memorial Parkway, a portion of Fort Hunt, and a few small residential subdivisions. The amount of undeveloped land is approximately 43 acres and there is a possible increase in medium-density residential land use with future buildout conditions. The wetland area for the subwatershed totals approximately 18 acres. No drainage complaints were registered with the county and no master plan projects were constructed or planned for this subwatershed.

Table 3.19 Potomac River Land Use

Land Use Description	Land Use			
	Existing		Future	
	Area (acres)	%	Area (acres)	%
Open space, parks, and recreational areas	579	46	585	47
Estate residential	72	6	0	0
Low-density residential	144	11	0	0
Medium-density residential	283	23	553	44
High-density residential	1	0	0	0
Low-intensity commercial	19	2	5	0
High-intensity commercial	1	0	0	0
Industrial	1	0	0	0
Unknown	0	0	0	0
Undeveloped	43	3	0	0
Road right-of-way (including shoulder areas)	96	8	96	8
Wetlands	18	1	18	1
TOTAL	1,257	100	1,257	100

For the West Potomac portion of the subwatershed, the National Resources Conservation Service STATSGO database has a weighted hydrologic soil group index of 2.2. For the East Potomac portion of the subwatershed, the STATSGO database has a weighted hydrologic soil group index of 2.4 north of Waynewood Boulevard and a value of 2.2 for the remainder of the area. The weighted index values of 2.2 and 2.4 indicate that the soils in this subwatershed have a moderately coarse texture with moderate infiltration rates. The county's GIS soil layer has incomplete coverage and shows small pockets of hydrologic soil groups C and D located in the subwatershed.

3.5.2 Storm Drain System Infrastructure

The developed areas such as the Waynewood subdivision have storm drain systems that discharge directly into the Potomac River. The major road crossings include a seven-foot by six-foot concrete arch culvert under the George Washington Memorial Parkway (shown in Photo 3.41). This crossing is free of sediment, trash, and obstructions and causes no impact

Photo 3.41 Concrete arch culvert of size 7′ by 6′ located under George Washington Memorial Parkway

Photo 3.42 Concrete pipe outfall located west of Eaglebrook Court

on the stream. A 66-inch (diameter) concrete pipe discharges into one of the streams in the East Potomac portion of the subwatershed without causing any erosion (shown in Photo 3.42). There are no private or public stormwater management facilities in this subwatershed.

3.5.3 Stream Geomorphology

The geomorphology of the stream located south of Eaglebrook Court and north of Emerald Drive in the East Potomac portion of the subwatershed was assessed. Sand is the dominant substrate and the stream segment is CEM type 3, referring to near vertical stream bank slopes, active widening, and accelerated bend migration. Encroachment from the adjacent residential subdivision is causing the stream to widen and degrade. The stream segments are free of any obstructions and dumpsites. There are no utility crossings in the stream segments.

3.5.4 Stream Quality

The stream located south of Eaglebrook Court has a low-gradient slope and is classified as the glide pool prevalent stream type. The stream habitat assessment can be summarized as follows:

- The stream has three habitat types for less than 50% of the length.
- The pools have mud or clay bottoms with less than 10% habitat structure.
- Large and small shallow pools are evenly mixed.
- More than 60% of the channel has been altered.
- Sediment deposition is mainly sand and/or silt with 70% to 80% of the bottom affected.
- The stream has very little sinuosity and is essentially straight with a uniform depth.
- During normal flow conditions, water fills approximately 75% of the available channel cross section.
- Forty percent of the stream bank surface is covered with vegetation, though there are many bare spots and rocks. The trees and shrubs are isolated or in widely scattered clumps.
- The stream banks are moderately unstable with 50% to 60% of the banks having eroded areas. There is high erosion potential during floods.
- The vegetated buffer is 25 to 50 feet wide with greater than 25% imperviousness beyond the 50-foot buffer zone width.

The entire stream was assessed with poor habitat quality based on the extensive channel alterations and lack of vegetated buffer. The water and sediment in the stream were odor free and the water appeared clear. No head cuts along the stream bed or erosion of the stream bed and banks were observed. Minor bank stabilization would be appropriate to protect adjacent properties from future bank erosion problems.

The general characteristics of the water quality for the stream located south of Eaglebrook Court were assessed and can be described as follows:

- Small fish of one to two inches in length were observed.
- No aquatic plants and/or algae were observed.

The natural buffer zone has been altered with planted lawns causing minor impacts on the stream as shown in Photo 3.43.

Photo 3.43 Lawn grass in the buffer zone along the stream located south of Eaglebrook Court

3.5.5 Problem Areas from Public Forum

No problem areas were identified by the stakeholders in the watershed forum held on July 19, 2003.

3.5.6 Modeling Results

The Potomac River Subwatershed hydrology was evaluated and peak discharges were estimated; however, no hydraulic modeling was performed for the small streams located in the Potomac River Subwatershed.

The hydrology developed for this subwatershed produced stormwater runoff that is moderate with respect to the size of the watershed. Almost half of this subwatershed is comprised of open spaces, parks, and recreational areas while the majority of the remainder of the watershed consists of low- to medium- density residential land use. The existing land use produces peak discharges that are moderate for the two- and 10-year rainfall events. The future land use for this subwatershed is planned to be medium-density residential, which will produce minor increases in peak discharges. Please see Table 3.20 for a comparison of existing and future two-and 10-year peak discharges for each sub-basin.

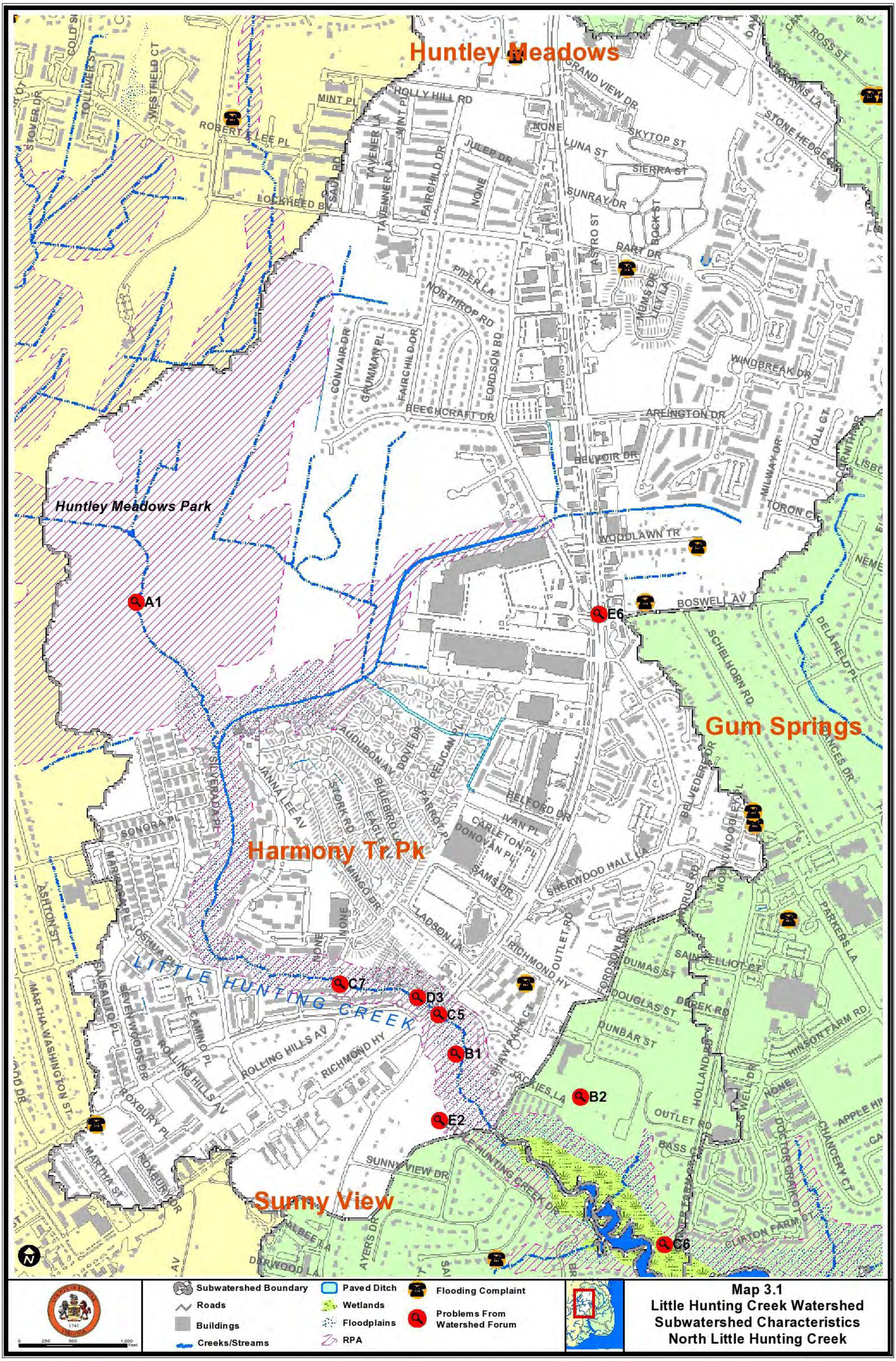
The water quality modeling results for the Potomac River Subwatershed show that the average sediment loading rates for existing and future land use conditions were less than the tributary strategy target level for sediment. For future land use conditions, the average sediment loading is predicted to increase by 15%, which can be attributed to the future development of the low-density residential and the estate residential land use and the 20% increase in medium-density residential land use subwatershed-wide. The low sediment loading rates for the subwatershed can be attributed to the high percentage of open space in the watershed at 46%.

The average total phosphorus loading rate for existing and future land use conditions for the Potomac River Subwatershed is predicted to not exceed the phosphorus tributary strategy target value. The average subwatershed phosphorus loading rate for future conditions is predicted to increase by 27%, which can be attributed to the 21% increase in medium-density residential land use which has a relatively higher phosphorus loading rate in relation to the existing land uses in the subwatershed.

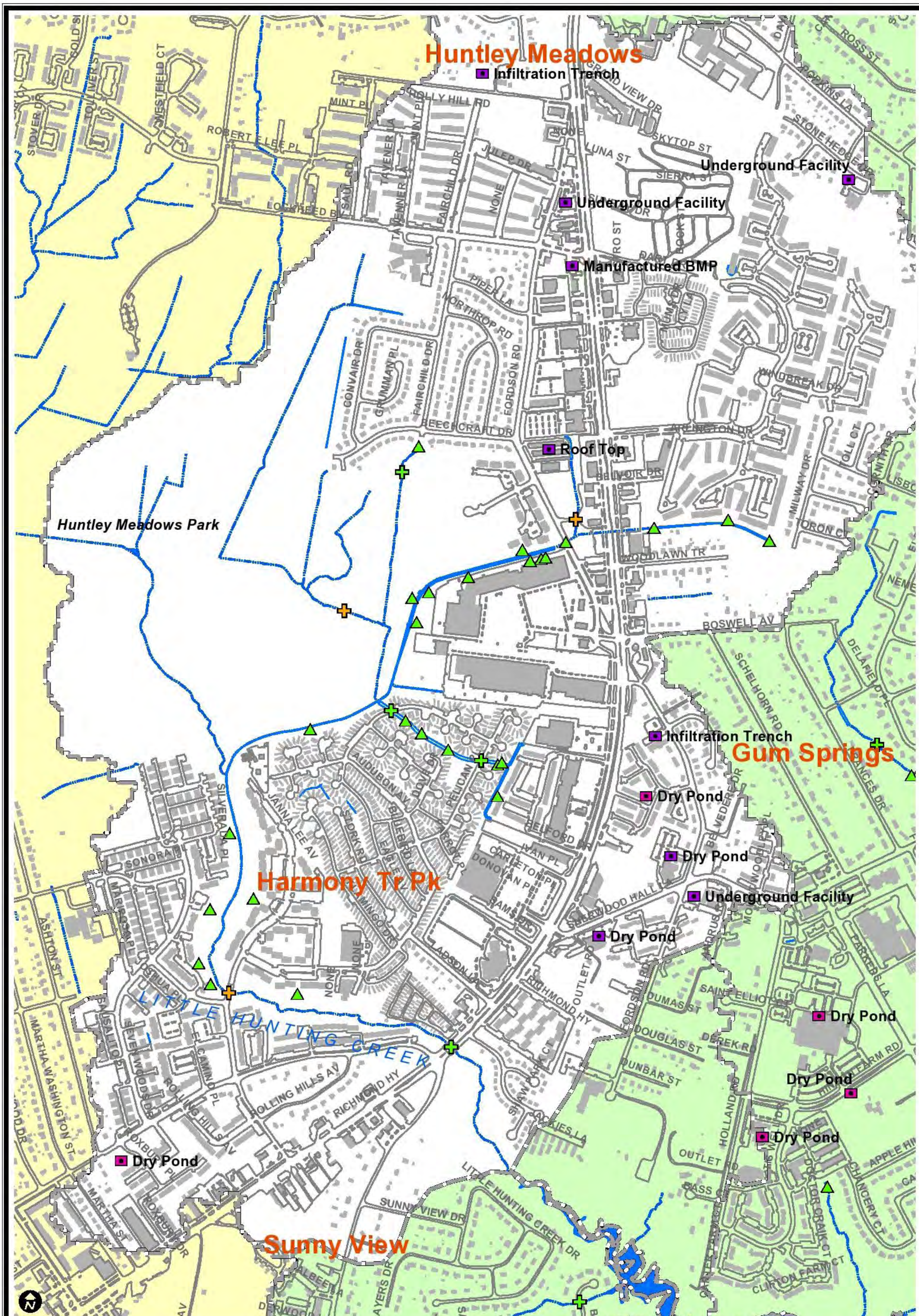
The average total nitrogen loading rate will be less than the tributary strategy target level. Two sub-basins are not predicted to exceed the nitrogen levels for either existing or future conditions. The expected increase in the future nitrogen loading rate for the subwatershed is 22%.

Table 3.20 Potomac River Peak Runoff Flows

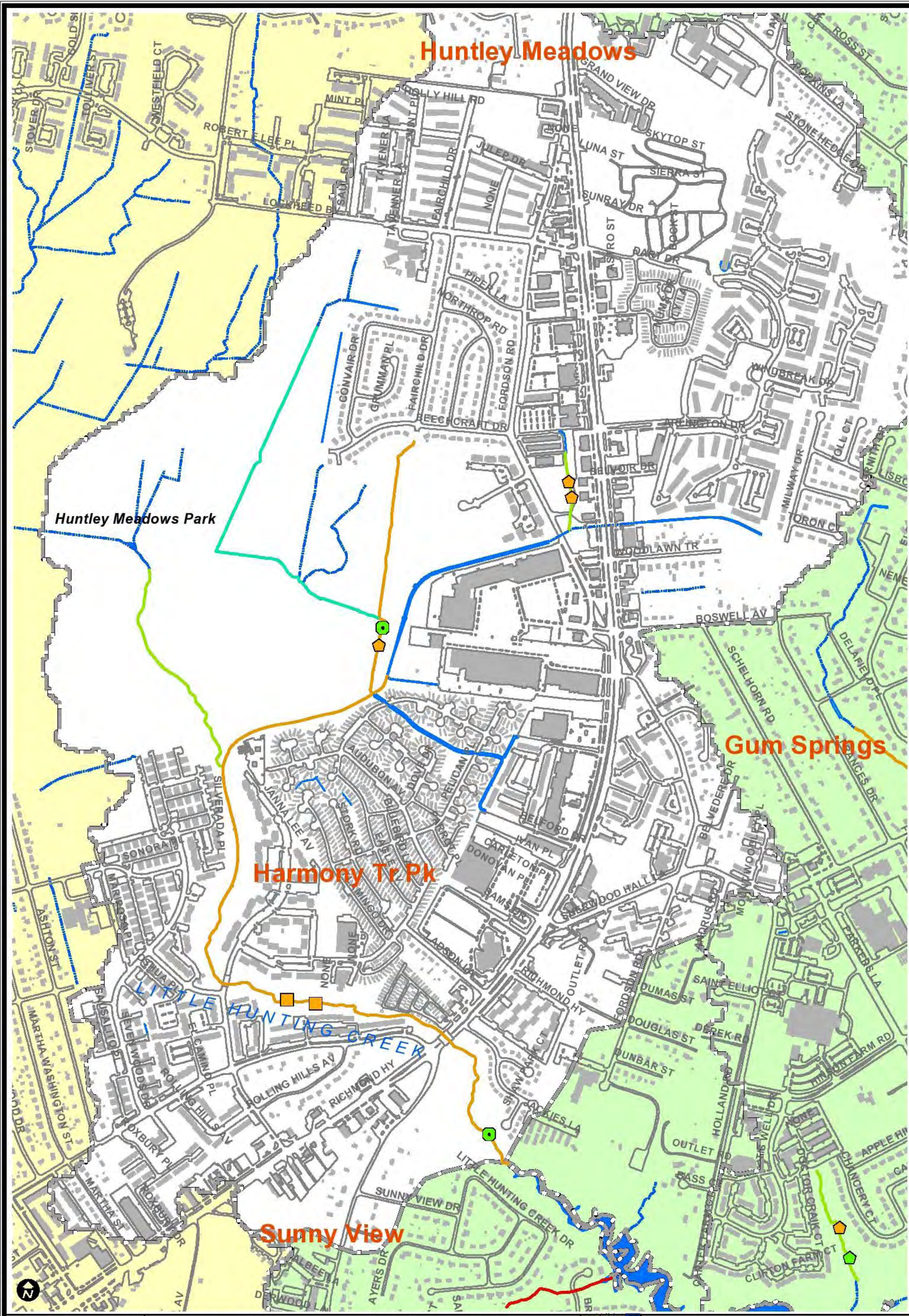
	Two-Year Rainfall Event			Ten-Year Rainfall Event		
Sub-basin	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase	Existing Peak Flow	Future Peak Flow	% Peak Flow Increase
	(cfs)	(cfs)		(cfs)	(cfs)	
LH-PO-0001	244	253	4%	514	528	3%
LH-PO-0002	472	525	11%	872	966	11%



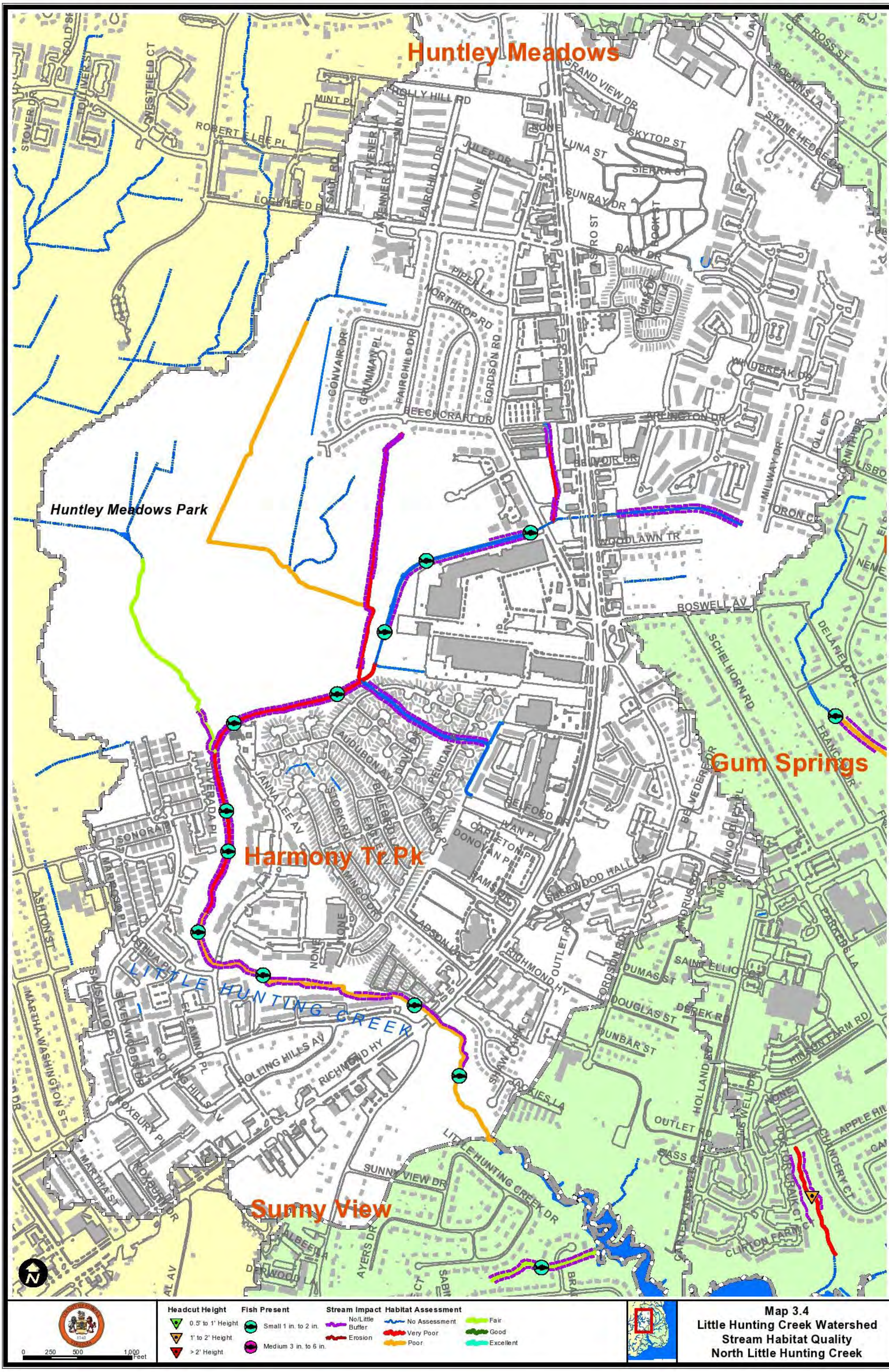
Map 3.1
Little Hunting Creek Watershed
Subwatershed Characteristics
North Little Hunting Creek



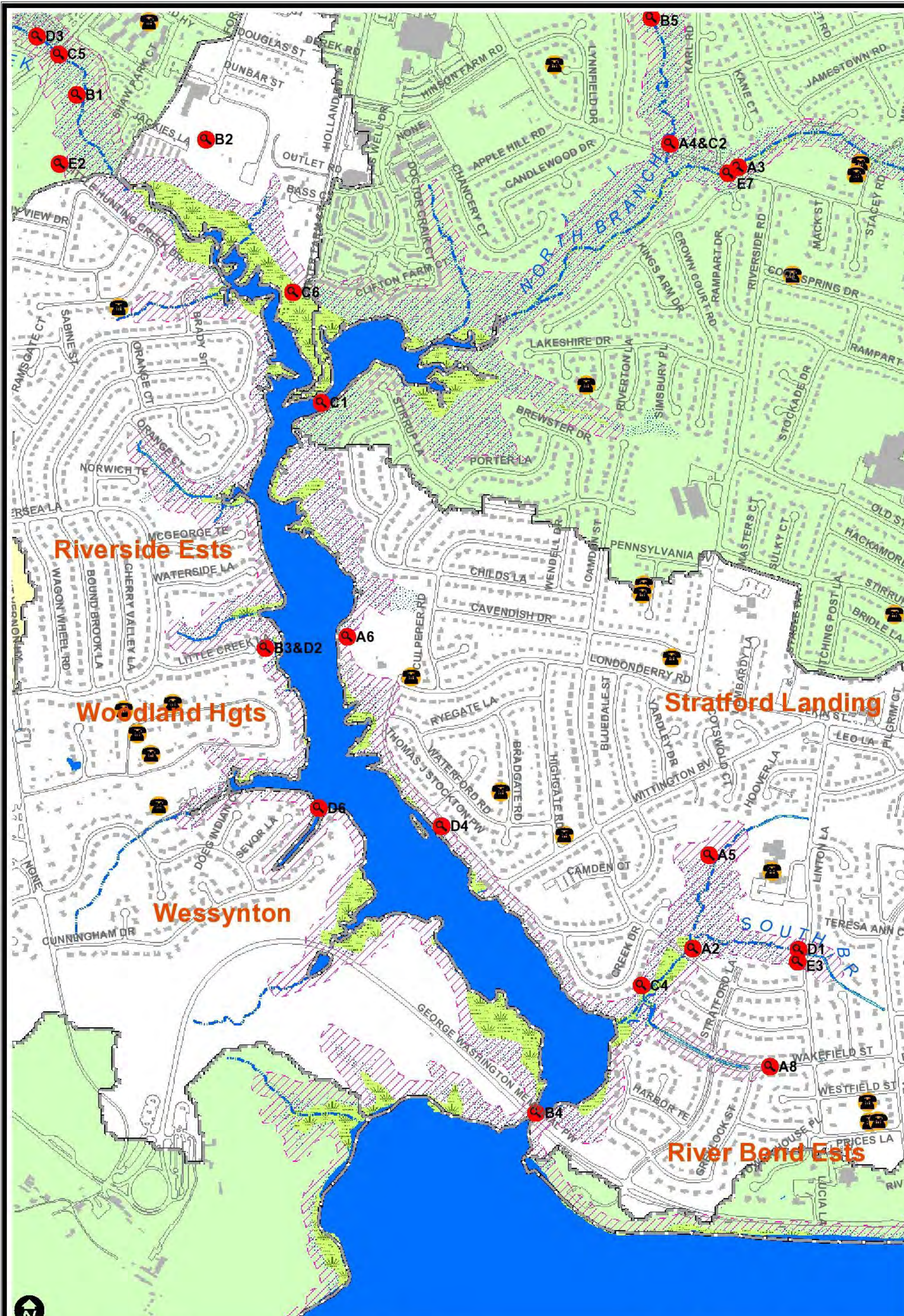
Map 3.2
Little Hunting Creek Watershed
Storm Drain Infrastructure
North Little Hunting Creek



Map 3.3
Little Hunting Creek Watershed
Stream Geomorphology
North Little Hunting Creek



Map 3.4
Little Hunting Creek Watershed
Stream Habitat Quality
North Little Hunting Creek



Subwatershed Boundary

Roads

Buildings

Creeks/Streams

Paved Ditch

Wetlands

Floodplains

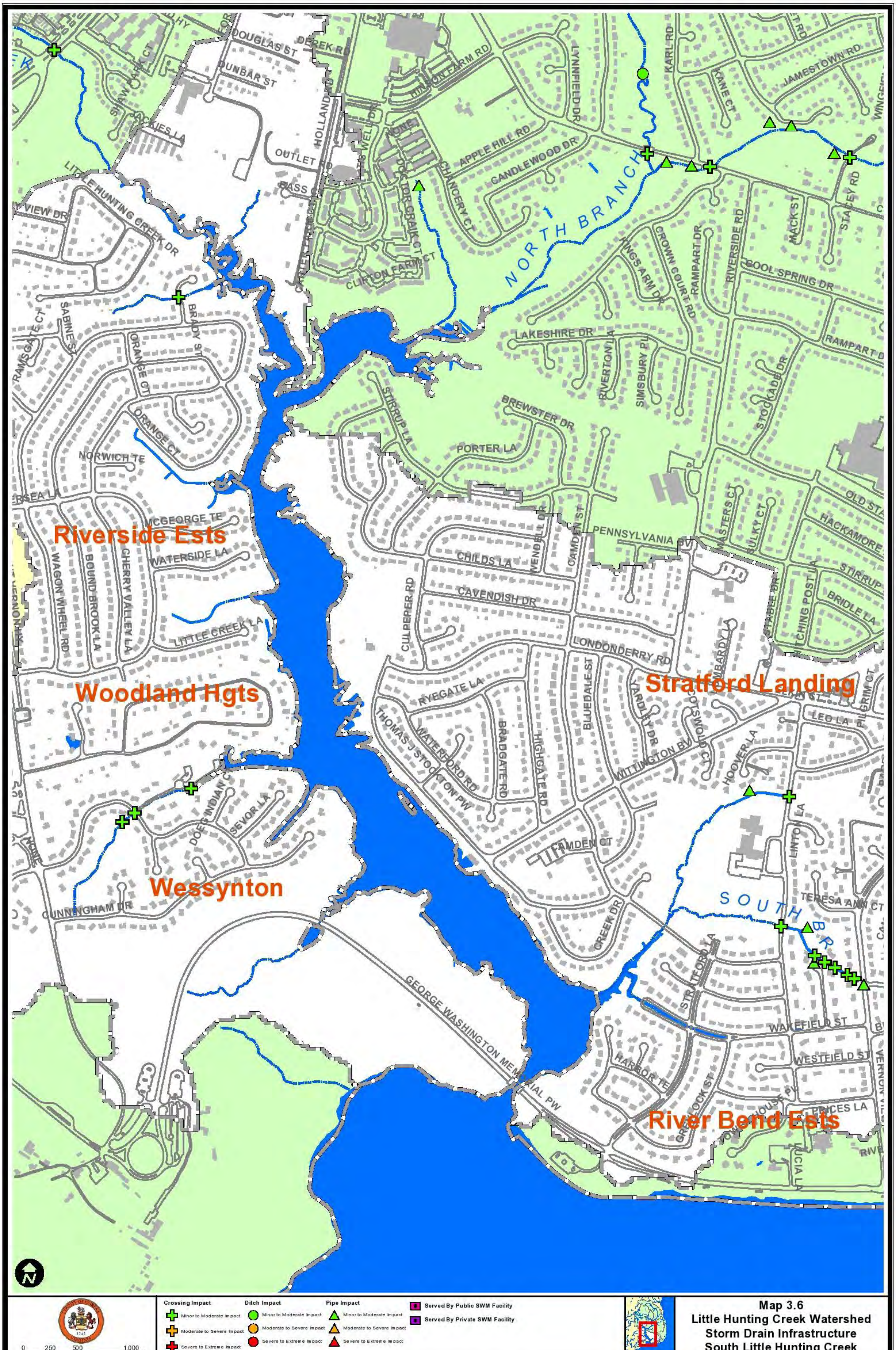
RPA

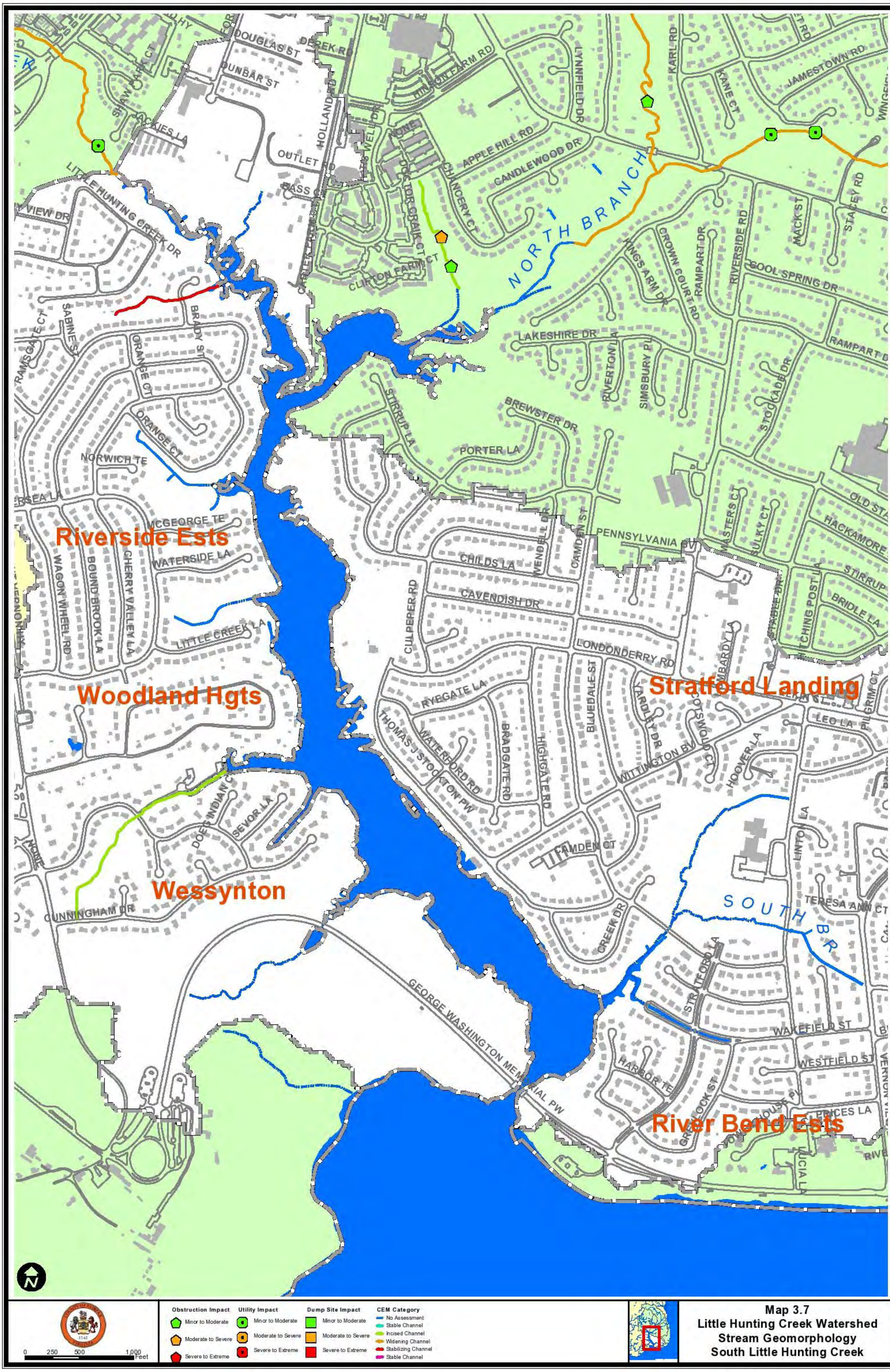
Flooding Complaint

Problems From Watershed Forum

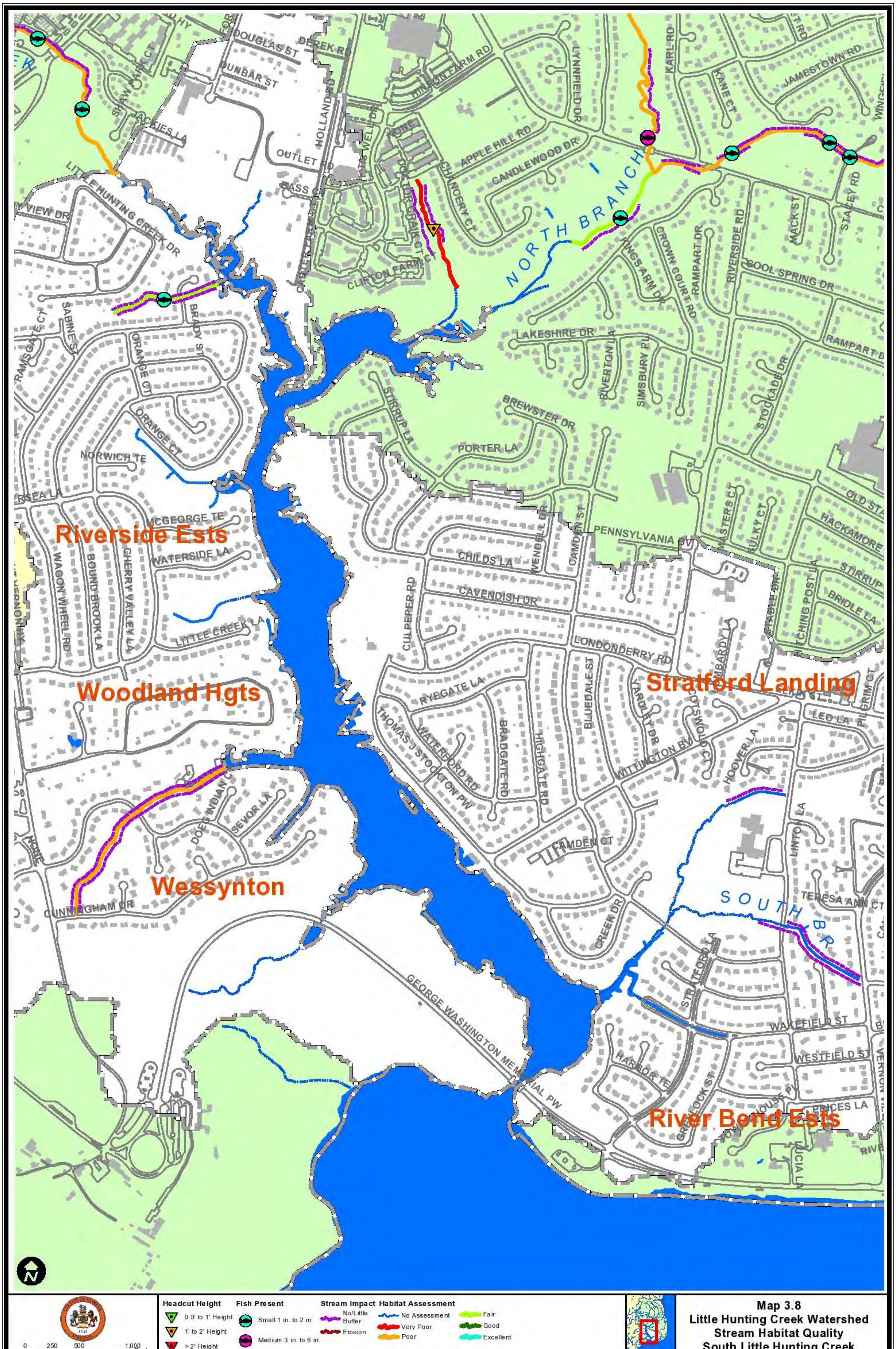
0 250 500 1,000 Feet

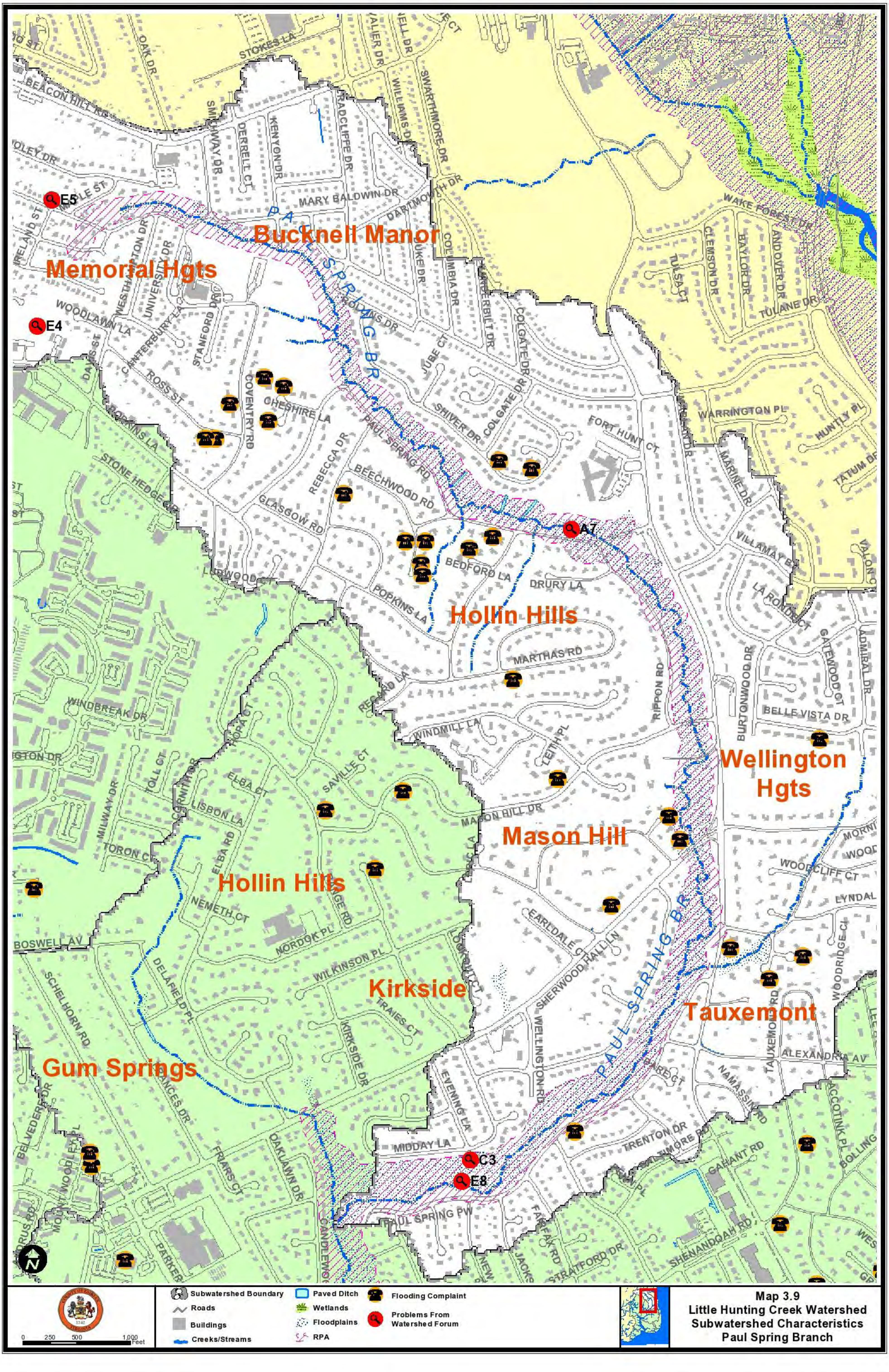
Map 3.5
Little Hunting Creek Watershed
Subwatershed Characteristics
South Little Hunting Creek

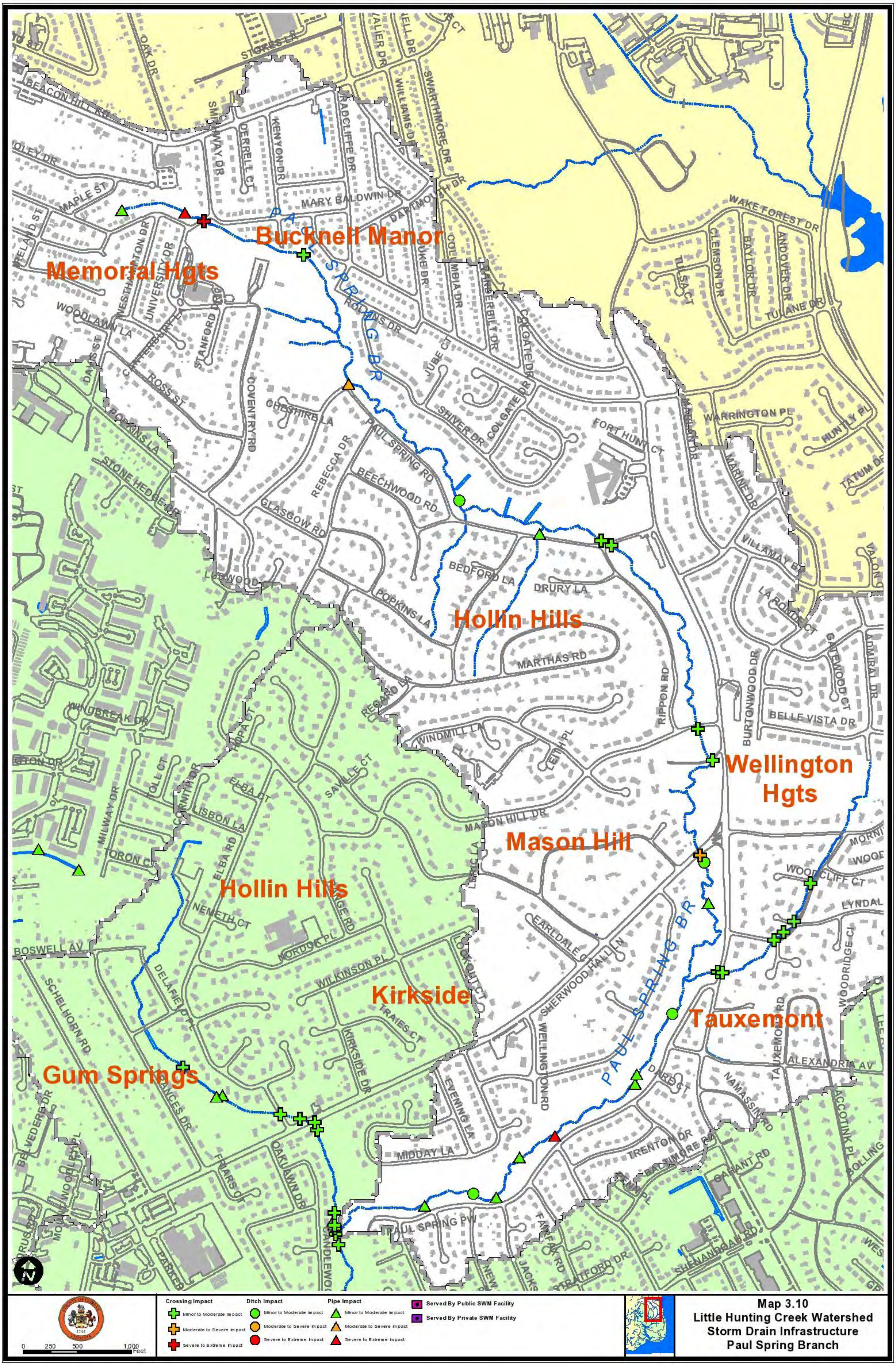

Riverside Ests
Woodland Hgts
Wessynton
Stratford Landing
River Bend Ests
NORTH BRANCH
SOUTH BR
GEORGE WASHINGTON MEMORIAL PW
Crossing Impact
Minor to Moderate Impact
Moderate to Severe Impact
Severe to Extreme Impact
Ditch Impact
Minor to Moderate Impact
Moderate to Severe Impact
Severe to Extreme Impact
Pipe Impact
Minor to Moderate Impact
Moderate to Severe Impact
Severe to Extreme Impact
Served By Public SWM Facility
Served By Private SWM Facility
0 250 500 1,000 Feet
Map 3.6
Little Hunting Creek Watershed
Storm Drain Infrastructure
South Little Hunting Creek



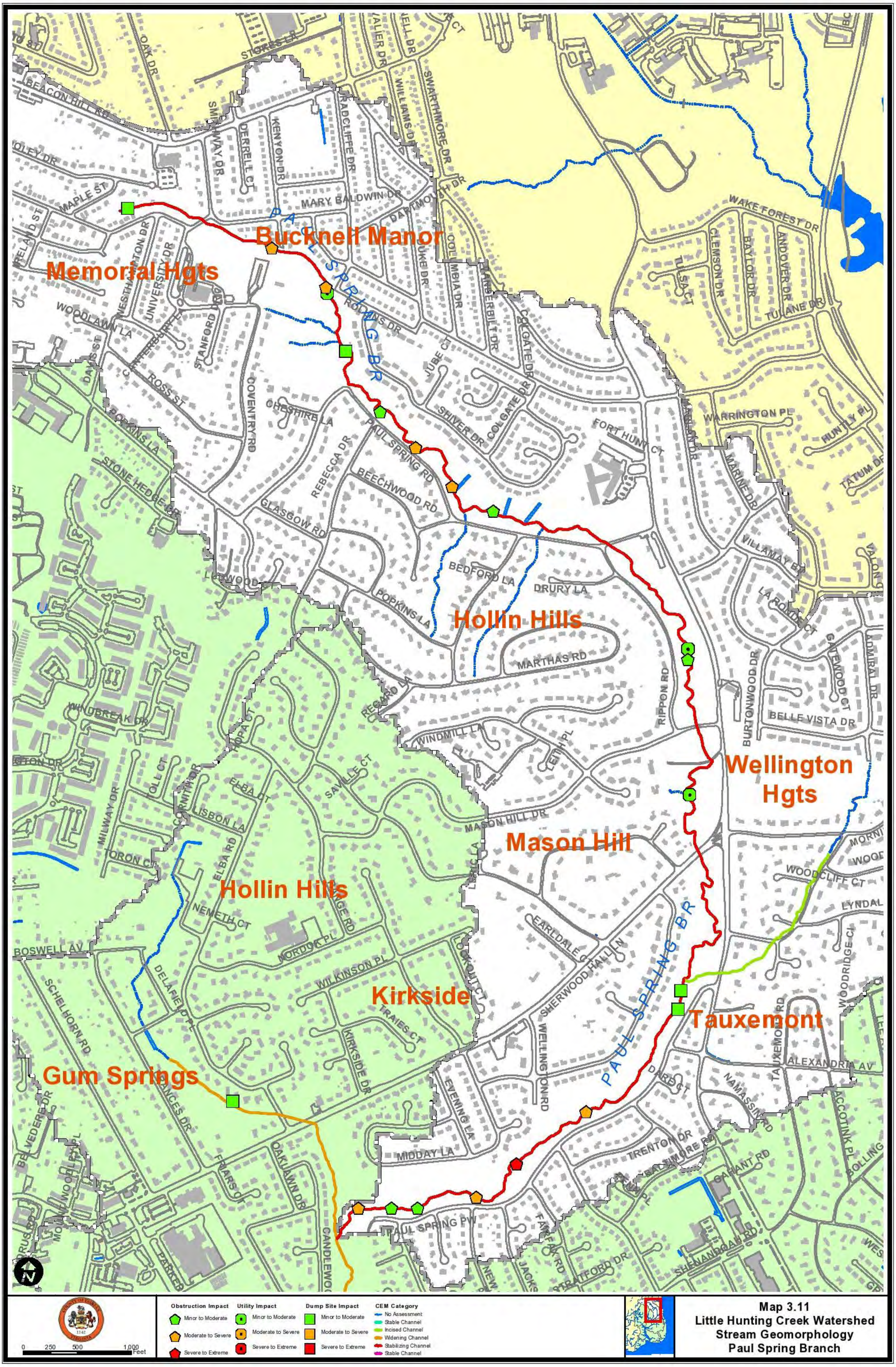
Riverside Ests
Woodland Hgts
Wessynton
Stratford Landing
River Bend Ests
NORTH BRANCH
SOUTH BR
LITTLE HUNTING CREEK DR
GEORGE WASHINGTON MEMORIAL PW
PENNSYLVANIA BV
WITTINGTON BV
LONDONDERRY RD
CHILDS LA
CAVENDISH DR
CUNNINGHAM DR
APPLE HILL RD
CANDLEWOOD DR
BREWSTER DR
PORTER LA
LAKESHIRE DR
COOL SPRING DR
RAMPART DR
Obstruction Impact
Minor to Moderate
Moderate to Severe
Severe to Extreme
Utility Impact
Minor to Moderate
Moderate to Severe
Severe to Extreme
Dump Site Impact
Minor to Moderate
Moderate to Severe
Severe to Extreme
CEM Category
No Assessment
Stable Channel
Incised Channel
Widening Channel
Stabilizing Channel
Stable Channel
0 250 500 1,000 Feet
Map 3.7
Little Hunting Creek Watershed
Stream Geomorphology
South Little Hunting Creek


Riverside Ests
Woodland Hgts
Wessynton
Stratford Landing
River Bend Ests
NORTH BRANCH
SOUTH BR
GEORGE WASHINGTON MEMORIAL PW
Headcut Height
0.5' to 1' Height
1' to 2' Height
> 2' Height
Fish Present
Small 1 in. to 2 in.
Medium 3 in. to 6 in.
Stream Impact
No/Little Buffer
Erosion
Habitat Assessment
No Assessment
Very Poor
Poor
Fair
Good
Excellent
0 250 500 1,000 Feet
Map 3.8
Little Hunting Creek Watershed
Stream Habitat Quality
South Little Hunting Creek

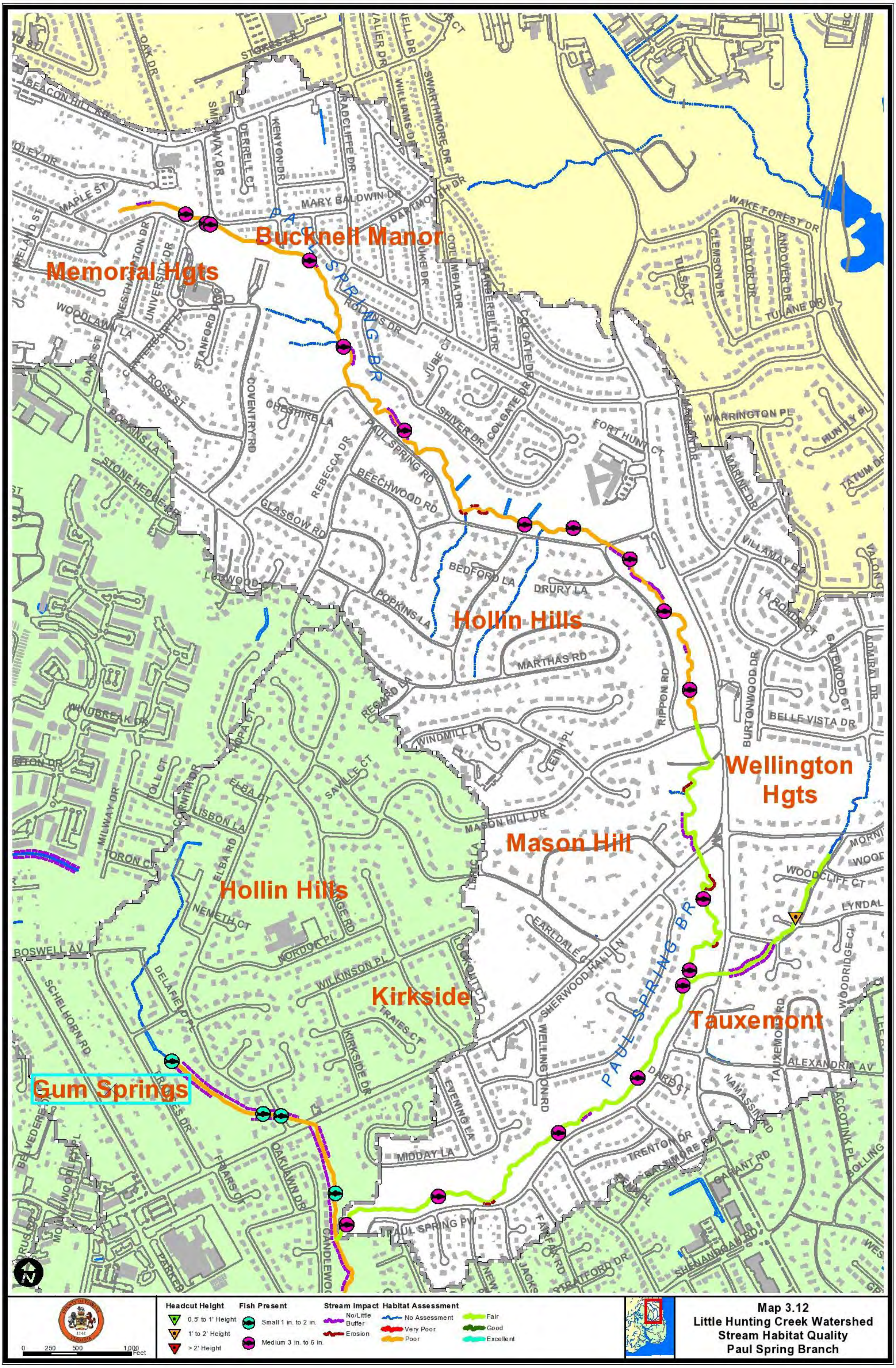

Bucknell Manor
Memorial Hgts
Hollin Hills
Hollin Hills
Wellington Hgts
Mason Hill
Kirkside
Tauxemont
Gum Springs
PAUL SPRING BR
E5
E4
A7
C3
E8
Subwatershed Boundary
Roads
Buildings
Creeks/Streams
Paved Ditch
Wetlands
Floodplains
RPA
Flooding Complaint
Problems From Watershed Forum
0 250 500 1,000 Feet
Map 3.9
Little Hunting Creek Watershed
Subwatershed Characteristics
Paul Spring Branch



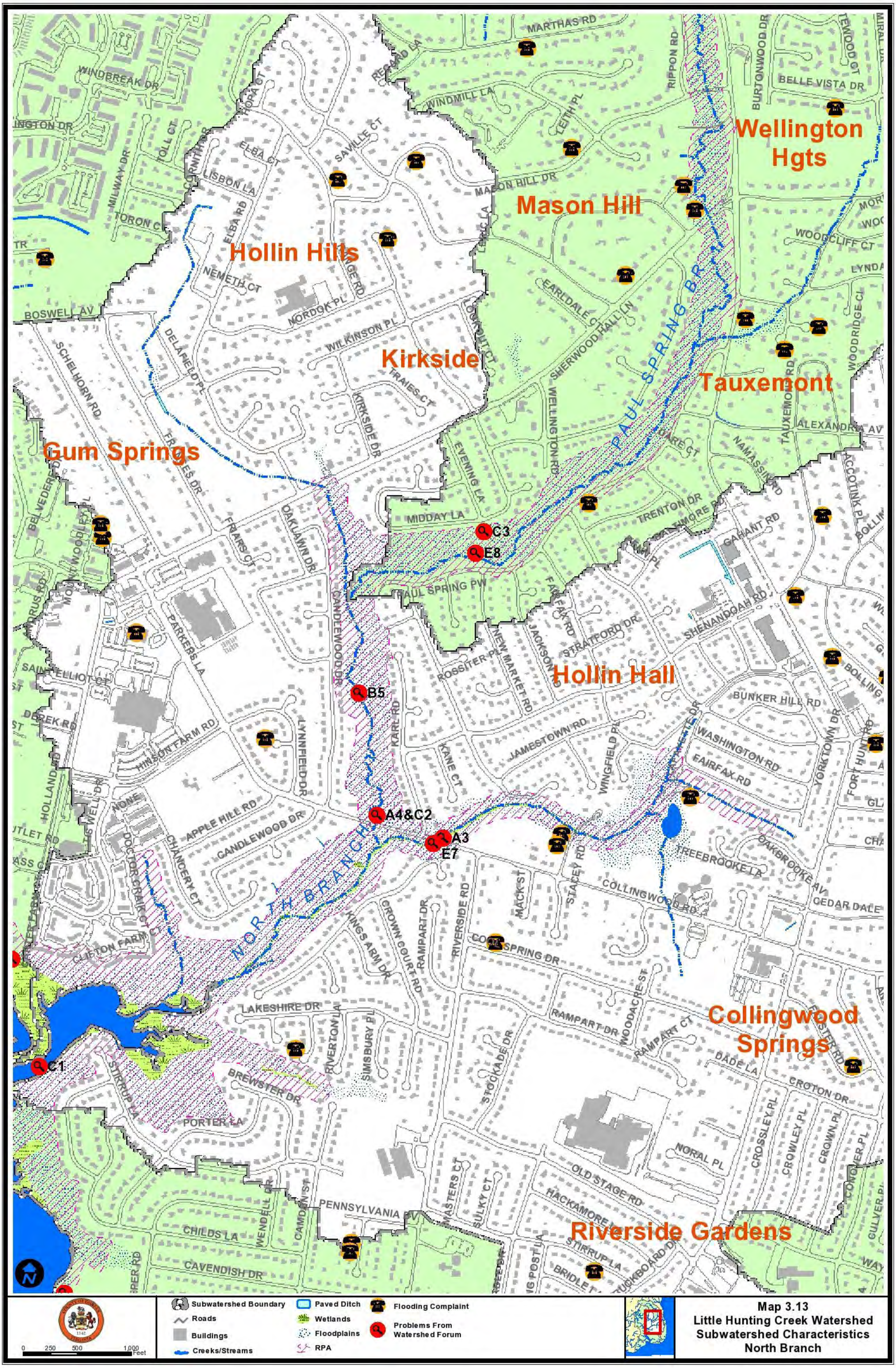
Map 3.10
Little Hunting Creek Watershed
Storm Drain Infrastructure
Paul Spring Branch



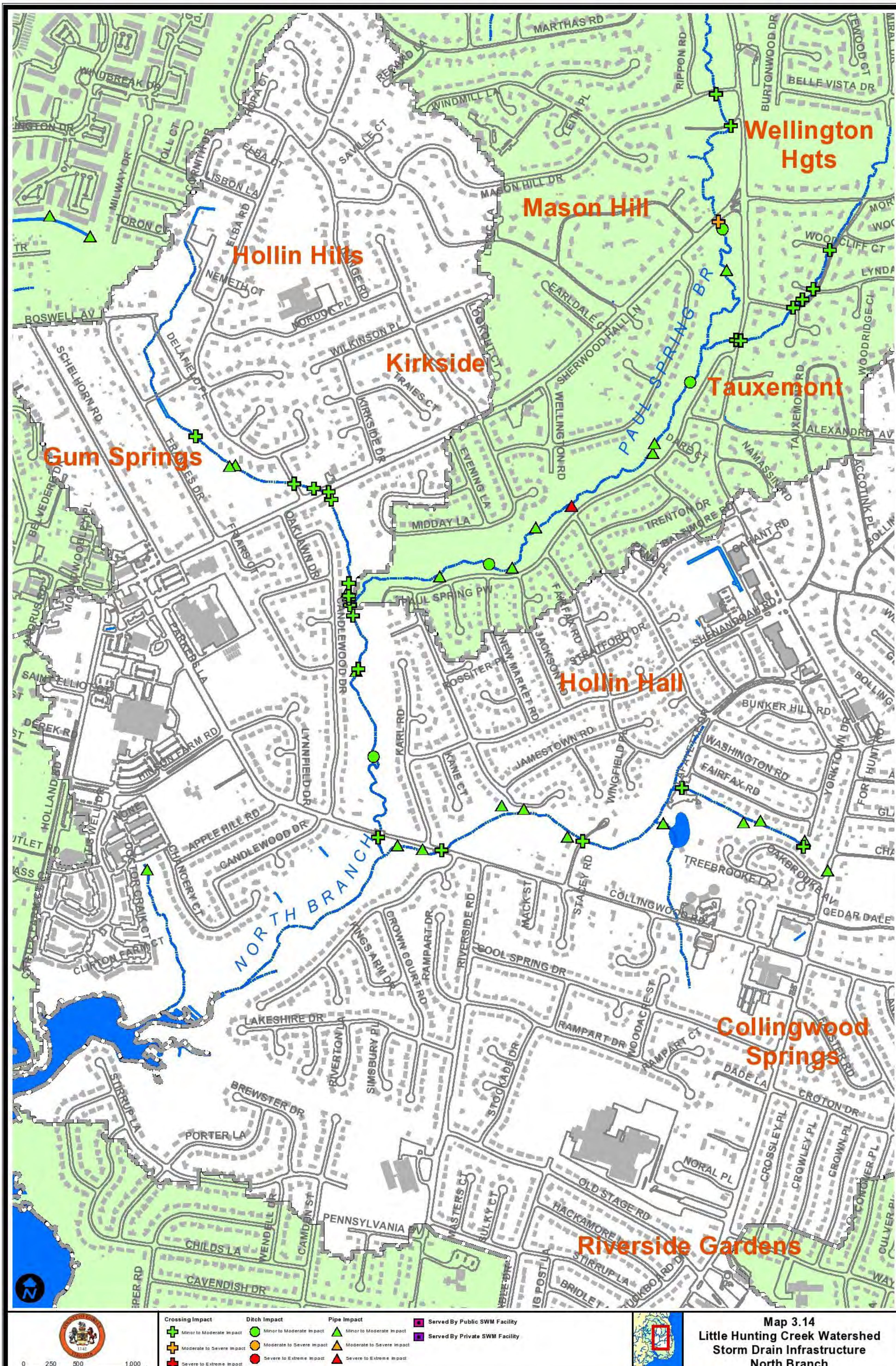
Map 3.11
Little Hunting Creek Watershed
Stream Geomorphology
Paul Spring Branch



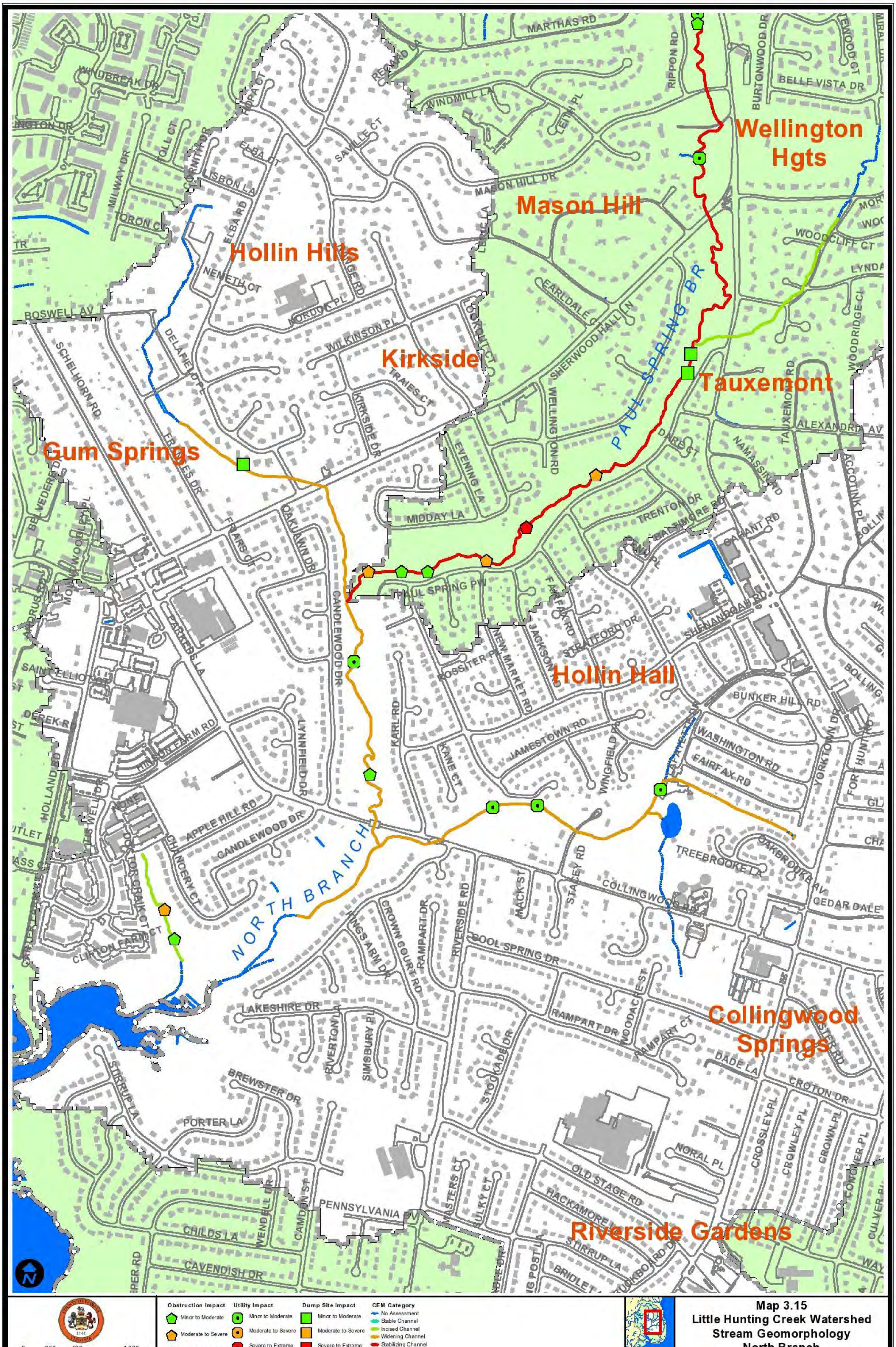
Map 3.12
Little Hunting Creek Watershed
Stream Habitat Quality
Paul Spring Branch



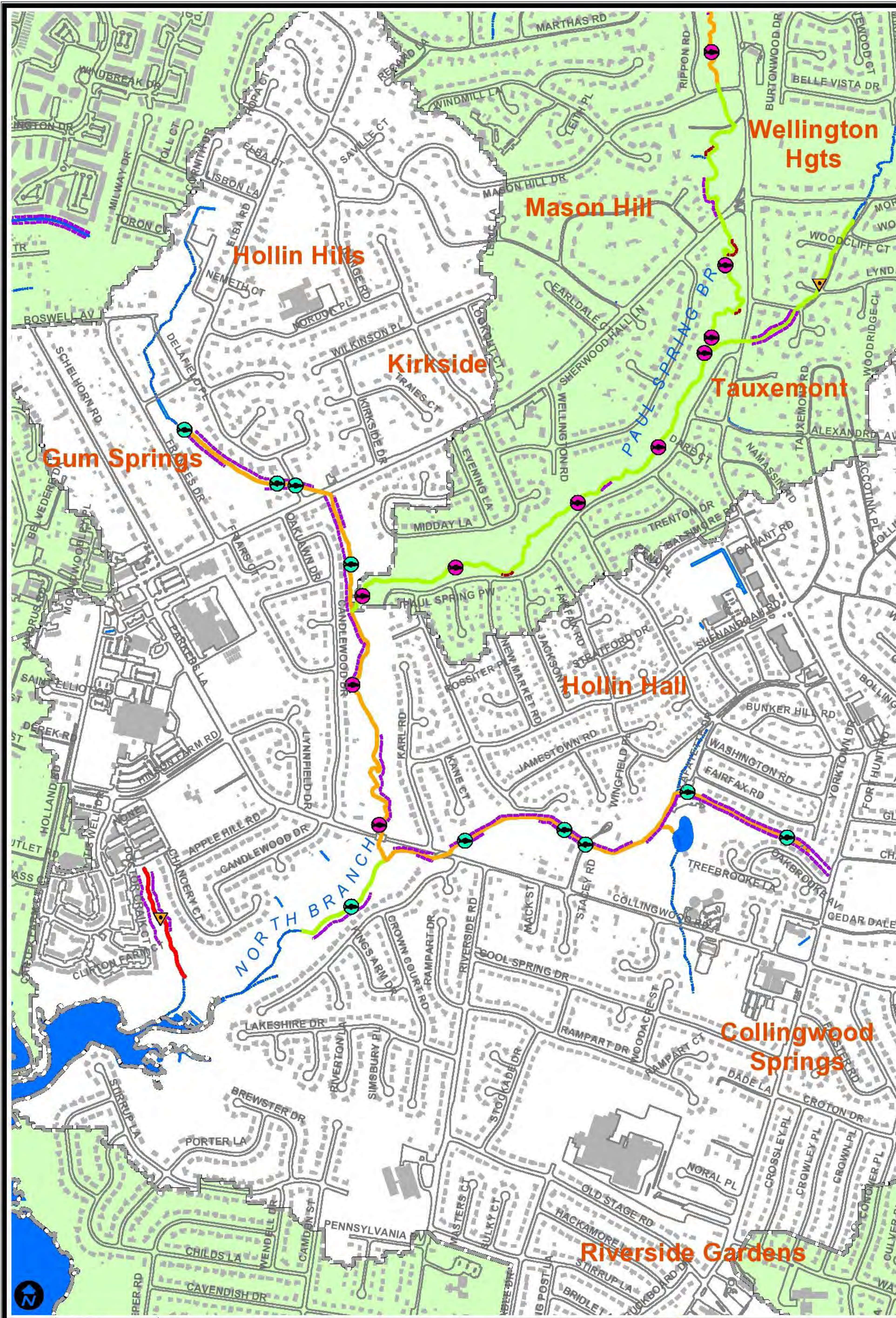
Map 3.13
Little Hunting Creek Watershed
Subwatershed Characteristics
North Branch



Map 3.14
Little Hunting Creek Watershed
Storm Drain Infrastructure
North Branch



Map 3.15
Little Hunting Creek Watershed
Stream Geomorphology
North Branch



Headcut Height: 0.5' to 1' Height; 1' to 2' Height; > 2' Height

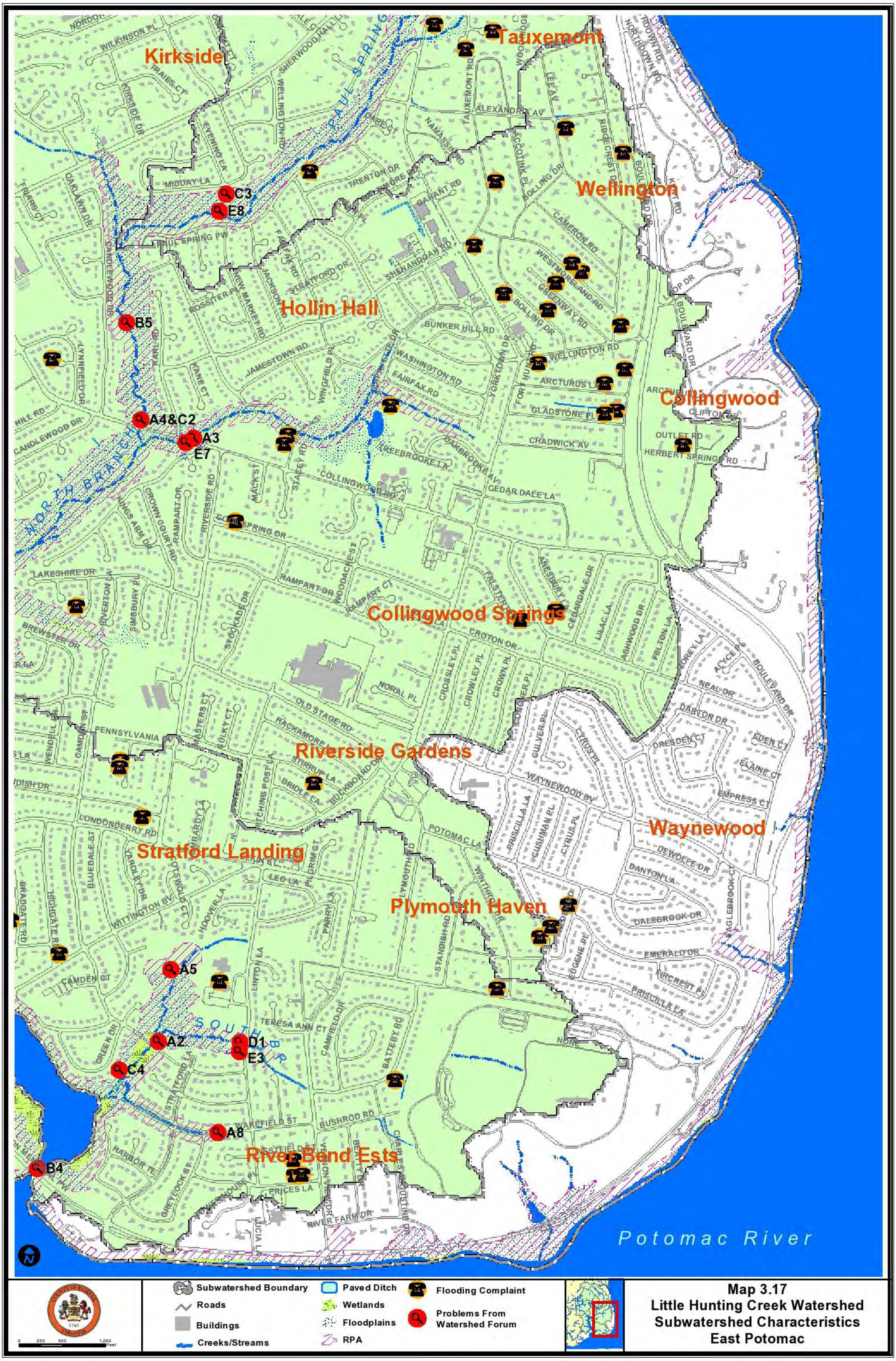
Fish Present: Small 1 in. to 2 in.; Medium 3 in. to 6 in.

Stream Impact: No/Little Buffer; Erosion

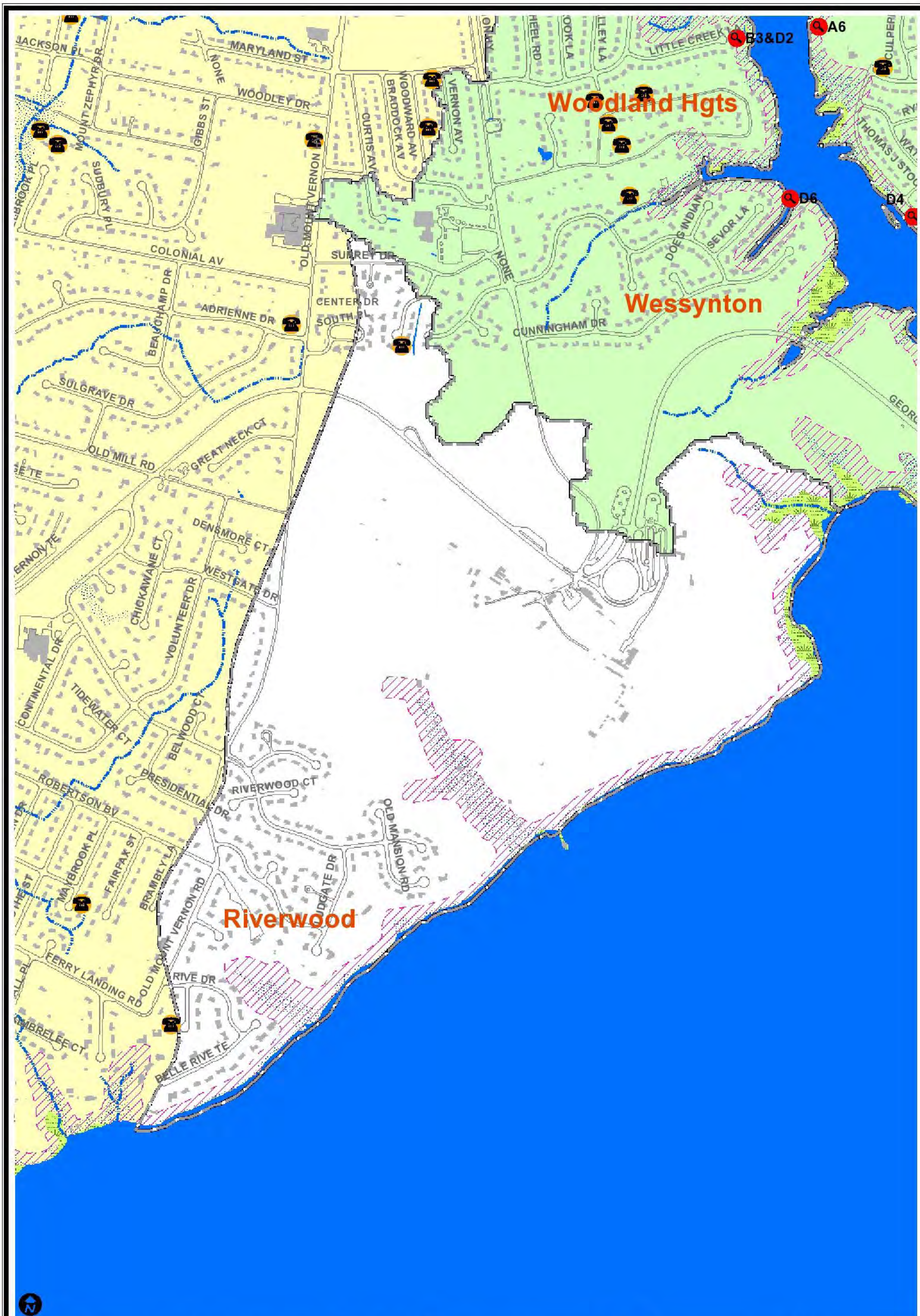
Habitat Assessment: No Assessment; Very Poor; Poor; Fair; Good; Excellent

0 250 500 1,000 Feet

Map 3.16
Little Hunting Creek Watershed
Stream Habitat Quality
North Branch



Map 3.17
Little Hunting Creek Watershed
Subwatershed Characteristics
East Potomac



Subwatershed Boundary
Roads
Buildings
Creeks/Streams
Paved Ditch
Wetlands
Floodplains
RPA
Flooding Complaint
Problems From Watershed Forum

Map 3.18
Little Hunting Creek Watershed
Subwatershed Characteristics
West Potomac

Chapter 4:
Plan Strategy

4.1 Watershed Plan Vision

Little Hunting Creek and its tributaries provide a diverse set of valuable resources to the community. The Little Hunting Creek Watershed Management Plan offers a vision for the watershed with strategies to work towards achieving the goals and objectives that support the vision.

> "The vision of the Little Hunting Creek Watershed Management Plan is to integrate environmental management, natural resource protection, and community goals to minimize runoff, reduce pollution, and restore the quality of Little Hunting Creek for the community's benefit."

The watershed plan's vision is consistent with Fairfax County's Policy Plan (the countywide 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 as well as Virginia's commitment to the Chesapeake Bay Act. The county (encompassing all county government entities) and other stakeholders of the Little Hunting Creek Watershed are committed to protecting Little Hunting Creek from future degradation and promoting watershed-wide management actions that work to restore the creek 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. Current stream conditions throughout the watershed are generally poor, and this plan proposes a comprehensive strategy for improving these conditions. The plan was written to manage future changes in the watershed to protect the creek so it 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.

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 Little Hunting Creek Steering Committee was convened as an advisory committee for the Little Hunting Creek Watershed 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 watershed and provide recommendations for addressing the issues.

The Little Hunting Creek Steering Committee developed the following guiding principles to aid in formulating the actions and strategies for implementing the objectives of the plan:

- Seek solutions that can be implemented at the local level and reality-test all ideas.
- Individuals are key players, but not the only ones. Review policies, history, land use management, and other factors that have led to the watershed's current condition and address solutions to those factors.
- Prioritize actions and investments based on those that are anticipated to have high returns.
- Integrate the watershed plan with existing plans (e.g., the Richmond Highway realignment) and with new opportunities to establish early cooperation at the conceptual stage.
- Scale solutions so they can be implemented at multiple levels—from individuals to neighborhoods to the entire watershed.
- Use best management practices (BMPs) that provide multiple benefits and values such as economic cost savings, aesthetics, and environmental quality.
- Provide opportunities for environmental education at different levels—from elementary school children to adults.
- Address problems as close to the source as possible rather than treating multiple problems at one site or downstream.
- What is done for the Little Hunting Creek Watershed should be a model for all the other watersheds.

It is understood that some local solutions may require state- or national- level action. In order to reality-test ideas, they should be reviewed from a realistic implementation perspective and perhaps implemented in an appropriate pilot area. These guiding principles provide a set of guidelines for implementing the goals and objectives.

4.2 Goals, Objectives, and Actions

The goals of the Little Hunting Creek Watershed Management Plan were derived from the issues identified by the community and the county's consultants based on their analysis of the watershed condition. The issues driving each goal are explained in greater detail with the supporting reasons for the goal. Objectives for the goals provide direction on how to achieve the goals, and the rationale for each objective describes why it is important to the plan. The actions for each objective describe the strategy for accomplishing the objective.

The actions and strategies identified by the consultant and the community were revised according to the comments from the steering committee and public workshop. 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
3. Land use recommendations

Structural and non-structural recommendations are described in this chapter. Policy and/or land use recommendations are described in Chapter 5. 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 current planned approach for processing the policy recommendations from the Little Hunting Creek Watershed Management Plan is to integrate these recommendations with similar recommendations developed with the Popes Head Creek, Cameron Run, Cub Run, and Difficult Run Watershed management plans over the next few years. 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. Land use recommendations are grouped with the policy actions and will be further evaluated as part of the county's comprehensive plan area plan review (APR) process. Land use recommendations adopted through the APR process would become part of the comprehensive plan.

One of the frequent questions 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 stormwater environmental utility fee. 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 wetlands. Since the mid-1990s, the county has been considering the feasibility of a stormwater user fee. In the July 2004 preliminary report prepared for the county, Watershed Community Needs Assessment and Funding Options, various alternatives to support an enhanced countywide stormwater program, including a stormwater environmental utility fee, were evaluated. In this report, program costs starting at $28 million per year and increasing to $52 million per year within five years were recommended. Through the input of a board-appointed stormwater advisory committee, the report will be finalized in 2005. The county will also maintain a list of all projects in the plan that is suitable for proffer by developers to facilitate the construction of the recommended projects.

Goal A: Reduce stormwater impacts on the Little Hunting Creek Watershed from impervious areas to help restore and protect the streams.

The increased volume of polluted stormwater runoff from impervious surfaces is the primary cause of most of the problems in the watershed. The watershed has 25% imperviousness with approximately 6,245 acres of developed land not controlled by any stormwater management facilities (e.g. dry detention ponds). The primary reason for this is that the Little Hunting Creek Watershed was developed before the Clean Water Act's stormwater management requirements were enacted. Only 12% of the watershed's developed land is controlled by stormwater management facilities. The result of the increased peak rates and volume of stormwater runoff is the alteration of the stream channel by erosion of stream banks and deepening of stream bottoms to accommodate the increased flow. The channel degrades as increased storm flows lead to stream bank instability and subsequent collapse of riparian trees. Sediment from eroded banks is deposited in the streambed and carried downstream, destroying aquatic habitat for insects and fish. Properties may be damaged if the eroding stream bank is close to structures. This goal seeks to reduce the impact of the increased peak rates and volume of stormwater runoff to help in reducing the amount of erosion and habitat degradation in the streams.

Objectives A1 and A2: See Chapter 5

Objective A3: Increase the effectiveness and use of BMPs to reduce impacts from impervious areas.

Rationale: Existing privately owned stormwater basins (both dry and wet) may not function as intended because of inadequate design and/or maintenance. For example, the stormwater basin next to Gold's Gym at 7770 Richmond Highway is nonfunctional and in disrepair. In addition, the county has identified the need to increase the number and type of BMPs on its list of approved practices (see Industry Letter 01-11). The environment section of the county's Policy Plan, Objective 2, Policy "b" states, "Update Best Management Practice requirements as newer, more effective strategies become available." Policy "f" under Objective 2 also relates to BMP effectiveness, stating, "Where practical and feasible, retrofit older stormwater management facilities to perform water quality functions to better protect downstream areas from degradation."

Action A3.6: Retrofit suitable existing stormwater management facilities and BMPs to make them more effective. Retrofitting these facilities is intended to meet the goals and objectives of this plan which will exceed the performance criteria or standards that were used to design the facility.

Strategy to Achieve Action: The existing stormwater management facilities and BMPs could be structurally retrofitted by various means. Increasing the area draining to the facility may also be desirable to increase the overall area mitigated by a 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 constructed to redirect and convey runoff to the existing facility. The stormwater facility would likely need to be enlarged if more runoff is directed to the facility. One of the goals of retrofitting a stormwater management facility would be to reduce peak runoff downstream of the facility. Retrofits could also be performed to enhance water quality treatment; these retrofits are discussed in Action C2.2. These capital projects should be offered by the county to developers as items appropriate for proffers. This would allow the county to take a more programmed approach, by way of using proffers, to address stormwater management in the watershed instead of requiring onsite mitigation for each project. Any retrofit projects constructed by the county or others should minimize the disturbance to adjacent properties to the maximum extent practical and restore the landscaping of the affected properties to pre-construction conditions. The disturbance of existing trees should also be minimized.

Retrofit options that may be suitable for implementation include:

1. Increase detention storage by means of additional excavation and grading. The majority of the stormwater management facilities in this watershed have very little room for additional grading; therefore, these improvements will limit expanding facility width and focus on adding additional depth through excavation. Any additional storage volume should be obtained within the limits of the existing facility or its easement, if possible, and there should be no increase in dam height.
2. Modify or replace 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.
3. Add infiltration features such as trenches or bioretention to promote greater peak flow reduction and groundwater recharge and improve water quality treatment. A soil survey of the existing facility would be required to verify that this retrofit is suitable.
4. Modify basins that are currently "short circuiting" (i.e., having length-to-width ratios less than 2:1 or inflow points in close proximity to basin outlets). These basins can be modified by adding baffles or meandering low-flow channels that also help reduce peak flows for smaller storm events.
5. Redirect additional drainage areas to an existing stormwater management facility to provide water quantity control and water quality treatment to a greater area. Improvements to the existing stormwater conveyance system will be required to redirect additional drainage areas. This would consist of relocating existing storm drains and ditches and redirecting existing outfalls to drain to the retrofit facilities.
6. Providing water quality improvements to facilities that currently provide only water quantity control. These facilities could be retrofitted to provide water quality treatment by installing a new water quality opening or adding a wetlands bench.

Retrofit options should be implemented at most of the existing stormwater management facilities located in the watershed. These improvements should result in the facilities being able to provide the necessary routed storage for the one-year storm for 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 reduce downstream erosion by controlling frequent, small storms and provide volume control benefits for larger, less-frequent storms. Possible locations of existing stormwater management facilities and BMPs that may be suitable for retrofit projects are described as follows and shown on Map 4.1.

North Little Hunting Creek

- Privately owned dry detention basin located adjacent to Gold's Gym at 7770 Richmond Highway (Map No. NLHC2). Implementation Period: FY 2020 - FY 2024, Capital Cost: $90,000
- Privately owned dry detention basin located at the Bethlehem Baptist Church at 7836 Fordson Road, northwest of the Sherwood Hall Lane and Fordson Road intersection (Map No. NLHC3). Implementation Period: FY 2025 - FY 2029, Capital Cost: $60,000
- Privately owned dry detention basin located at 3115 Sherwood Hall Lane, east of the Sherwood Hall Lane and Kingland Road intersection (Map No. NLHC4). Implementation Period: FY 2010 - FY 2014, Capital Cost: $30,000
- Publicly owned dry detention basin located at 7851 Gum Springs Village Drive (Map No. NLHC5). Implementation Period: FY 2020 - FY 2024, Capital Cost: $110,000
- Publicly owned dry detention basin located opposite of 3910 Buckman Road, southeast of Buckman Road and Roxbury Place (Map No. NLHC6). Implementation Period: FY 2010 - FY 2014, Capital Cost: $70,000

South Little Hunting Creek

- Publicly owned dry detention BMP located opposite of 3301 Woodland Lane (Map No. SLHC16). Implementation Period: FY 2025 - FY 2029, Capital Cost: $60,000

Paul Spring Branch

- Publicly owned dry detention basin located at 7001 Bryant Towne Court, northeast of the Bryant Towne Court and Popkins Lane intersection (Map No. PSB3). Implementation Period: FY 2020 - FY 2024, Capital Cost: $50,000
- Publicly owned dry detention basin located at 7628 Essex Manor Place, southwest of the Admiral Drive and Essex Manor Place intersection (Map No. PSB4). Implementation Period: FY 2008 - FY 2009, Capital Cost: $110,000
- Privately owned dry detention basin located near the intersection of Memorial Heights and Preston Avenue (Map No. PSB5). Implementation Period: FY 2020 - FY 2024, Capital Cost: $60,000
- Privately owned dry detention basin located at 6733 Richmond Highway, northeast of the Richmond Highway and Schooley Drive intersection (Map No. PSB6). Implementation Period: FY 2020 - FY 2024, Capital Cost: $70,000
- Privately owned dry detention basin located at 7116 Fort Hunt Road, northwest of the Paul Spring Road and Fort Hunt Road intersection (Map No. PSB7). Implementation Period: FY 2009 - FY 2010, Capital Cost: $110,000
- Privately owned dry detention basin located at 1909 Windmill Lane, north of Mason Hill Drive and south of Windmill Lane (Map No. PSB8). Implementation Period: FY 2005 - FY 2007, Capital Cost: $60,000

- Publicly owned dry detention basin located at 2004 Windmill Lane, northwest of the intersection of Windmill Lane and Windmill Court (Map No. PSB23). Implementation Period: FY 2025 - FY 2029, Capital Cost: $80,000 (This project should also include the investigation of localized ponding in the vicinity of the BMP and surrounding properties.)

North Branch

- Publicly owned dry detention basins located opposite of 7920 Holland Road, southeast of the Sherwood Hall Lane and Holland Road intersection (Map No. NB2). Implementation Period: FY 2010 - FY 2014, Capital Cost: $250,000
- Publicly owned dry detention basin located at 8306 Rampart Court (Map No. NB3). Implementation Period: FY 2015 - FY 2019, Capital Cost: $60,000
- Publicly owned extended dry detention basin located at 8306 Marble Dale Court (Map No. NB4). Implementation Period: FY 2020 - FY 2024, Capital Cost: $80,000
- Publicly owned extended dry detention basin located at 8313 Riverton Lane (Map No. NB5). Implementation Period: FY 2020 - FY 2024, Capital Cost: $90,000
- Publicly owned extended dry detention basin located at 8225 Stacey Road (Map No. NB9). Implementation Period: FY 2015 - FY 2019, Capital Cost: $90,000
- Publicly owned extended dry detention basin located at 1614 Noral Place (Map No. NB10). Implementation Period: FY 2020 - FY 2024, Capital Cost: $30,000

Existing stormwater management facilities, such as infiltration trenches and underground storage facilities, were not considered for retrofits due to constructability issues and small benefits with great construction costs.

Table 4.1 summarizes the quantified two-year peak flow reduction benefit for the recommended retrofit options. The retrofit option numbers correspond to directly to the numbered options listed above. The storage volumes to be added to the existing BMPs and the drainage areas contributing to the BMPs are shown in Table 4.1. The peak flow reduction benefits for this action are included in the total peak flow reductions shown on Map 4.2.

Table 4.1 Benefits of Stormwater Management Facility and BMP Retrofits

Map No./ Project ID	Subbasin	Retrofit Options	Additional Storage Volume (cy)	Proposed Drainage Area (acres)	Peak Flow Reduction (cfs)
North Little Hunting Creek					
NLHC2	LH-LH-0004	1,2,3,5,6	650	7.5	1.9
NLHC3	LH-LH-0004	1,2,3,6	400	4.7	1.2
NLHC4	LH-LH-0001	1,2,3,6	150	1.8	13.0
NLHC5	LH-LH-0004	1,2,3,5,6	850	10.3	2.6
NLHC6	LH-LH-0003	1,2,3,5	450	9.0	5.0
			Subtotal	33.3	
South Little Hunting Creek					
SLHC16	LH-LH-0013	1,2,3,5	250	4.9	1.0
			Subtotal	4.9	
Paul Spring Branch					
PSB3	LH-PS-0007	1,2,3,4,6	100	1.6	1.6
PSB4	LH-PS-0003	1,2,3,5,6	700	13.6	12.3
PSB5	LH-PS-0007	1,2,3,6	100	1.7	1.6
PSB6	LH-PS-0007	1,2,3,5,6	150	1.5	1.6
PSB7	LH-PS-0004	1,2,3,5,6	950	21.1	20.3
PSB8	LH-PS-0002	1,2,3,6	400	4.5	4.1
PSB23	LH-PS-0004	1,2,3,5,6	450	8.7	9.8
			Subtotal	52.7	
North Branch					
NB2	LH-NB-0003	1,2,3,5,6	2600	31.7	6.0
NB3	LH-NB-0006	1,2,3,5,6	450	8.9	2.2
NB4	LH-NB-0004	1,2,3,5	550	10.5	0.5
NB5	LH-NB-0004	1,2,3,5,6	650	12.9	0.5
NB9	LH-NB-0006	1,2,3,5,6	700	13.7	3.4
NB10	LH-NB-0006	1,2,3	50	0.6	0.2
			Subtotal	78.3	
Total Little Hunting Creek				169.2	

Responsible Party: Fairfax County
Implementation Period: See above descriptions
Capital Cost: See above descriptions
Staff: 0.05 staff year equivalent (SYE)

Action A3.7: Construct new public BMPs, including LID practices, to detain the runoff from existing surrounding development that does not currently have stormwater management controls.

Strategy to Achieve Action: This strategy includes projects that may be offered by the county to the development community as items suitable for implementation as proffers that may help in constructing these projects. Property owners and home owner associations should be contacted prior to designing these projects for input and support. The suggested demonstration projects are meant to be a model for others, such as developers, to imitate and should be adequately maintained by the county.

New public BMP options that may be suitable for implementation include wet ponds, dry ponds, shallow wetlands, pond and wetland combinations, infiltration basins, sand filters, bioretention, or manufactured BMP systems. The type of BMP selected for construction will depend on the detailed site conditions and will be decided in conjunction with public input during the design process. The construction of any new BMP should be done to minimize disturbance to surrounding properties and existing stands of mature trees. Potential locations for new public BMPs are described as follows and shown on Map 4.1.

North Little Hunting Creek

- Construct a new, one-year, extended-detention BMP on the county-owned land located between the 7200 and 7300 blocks of Richmond Highway at the northeast corner of the Richmond Highway and Lockheed Boulevard intersection. The BMP should be designed to treat the runoff from the surrounding commercial and high-density residential areas and be an attractive, landscaped amenity for the community (Map No. NLHC1). Implementation Period: FY 2006 - FY 2007, Capital Cost: $430,000
- Reduce runoff from the existing commercial and high-density residential areas along Richmond Highway such as the Mount Vernon Plaza, Hybla Valley Plaza, Multiplex Cinema, and Audubon Estates Mobile Home Park with new LID techniques such as bioretention (including Filterra or similar units), vegetated buffer strips, porous pavement, and disconnected roof drains. This area is likely to be redeveloped to include new buildings and a main street style layout. This could be an opportunity to collectively improve the existing storm drain system as well as have developers install BMPs as proffers (Map No. NLHC9). Implementation Period: FY 2007 - FY 2009, Capital Cost: $590,000
- Construct a new, one-year, extended-detention BMP on the vacant parcel behind the commercial property on the 7000 block of Fordson Road. This facility would reduce runoff from the surrounding commercial areas (Map No. NLHC16). Implementation Period: FY 2006 - FY 2008, Capital Cost: $130,000
- Construct a new, one-year, extended-detention BMP behind the commercial property on the 3500 block of Lockheed Boulevard. This facility may consist of bermed construction to minimize tree loss, and tree removal should be limited to the embankment area. This facility would reduce runoff from the adjacent commercial property (Map No. NLHC17). Implementation Period: FY 2006 - FY 2008, Capital Cost: $110,000
- Construct a new, one-year, extended-detention BMP at the headwaters of North Little Hunting Creek at the storm drain outfall at the end of the 7400 block of Fairchild Drive. Tree removal should only occur at the embankment area. This facility would reduce runoff from the residential properties immediately upstream (Map No. NLHC19). Implementation Period: FY 2010 - FY 2014, Capital Cost: $210,000
- Construct a new, one-year, extended-detention BMP behind the 2600 block of Arlington Drive. The existing storm drain system would need to be modified and possibly a low-flow diversion constructed for this facility to function properly. This facility would reduce runoff from the surrounding residential areas (Map No. NLHC20). Implementation Period: FY 2006 - FY 2007, Capital Cost: $260,000

- Construct a new, one-year, extended-detention BMP at the north end of the 2400 block of Windbreak Drive. Tree removal should only occur at the embankment area. This facility would reduce runoff from the surrounding residential properties (Map No. NLHC23). Implementation Period: FY 2006 - FY 2008, Capital Cost: $110,000
- Construct a multi-stage bioretention system behind the high-density residential properties south of Windbreak Drive. The bioretention areas would be constructed at each yard inlet to reduce runoff from the surrounding commercial properties (Map No. NLHC24). Implementation Period: FY 2009 - FY 2010, Capital Cost: $170,000

Paul Spring Branch

- Create a demonstration project of LID technologies such as green rooftops, porous pavements, buffer strips, and bioretention areas for Beacon Mall (Map No. PSB1). Implementation Period: FY 2005 - FY 2007, Capital Cost: $610,000
- Replace conventional pavement in parking lots with porous pavement for churches (estimate seven in the subwatershed) (Map No. PSB2). Implementation Period: FY 2006 - FY 2009, Capital Cost: $520,000
- Construct a new, one-year, extended-detention BMP at the intersection of Lenclair Street and 6700 Tower Road. The new facility would consist of dual basins on either side of Tower Road with an equalizer pipe to reduce runoff from the property and associated parking areas to the north (Map No. PSB24). Implementation Period: FY 2006 - FY 2007, Capital Cost: $240,000
- Construct a multi-stage bioretention system behind the residential properties between the 3300 and 3400 blocks of Groveton Street and Clayborne Avenue. The bioretention areas would be constructed at each yard inlet to reduce runoff from the surrounding residential properties (Map No. PSB25). Implementation Period: FY 2005 - FY 2006, Capital Cost: $240,000
- Construct a new, one-year, extended-detention BMP south of the Lutheran Church on the 2500 block of Beacon Hill Road. This facility would reduce runoff from the surrounding residential properties and adjacent commercial property (Map No. PSB26). Implementation Period: FY 2008 - FY 2009, Capital Cost: $150,000
- Construct a new, one-year, extended-detention BMP near the headwaters of Paul Spring Branch at the downstream end of the culvert crossing at 2500 Mary Baldwin Drive. The facility would detain low flows by means of a diversion and reduce runoff from the surrounding residential properties (Map No. PSB27). Implementation Period: FY 2015 - FY 2019, Capital Cost: $100,000
- Construct a new, one-year, extended-detention BMP behind the residential properties along the 2500 block of Ross Street. This facility should be laid out and constructed to minimize the disturbance of existing trees. This facility would reduce runoff from the surrounding residential properties (Map No. PSB28). Implementation Period: FY 2015 - FY 2019, Capital Cost: $70,000
- Construct two new, one-year, extended-detention BMPs at the upstream ends of the culverts along the 1900 and 200 blocks of Paul Spring Road. The entrance of the existing culverts could be modified with a weir wall in lieu of a more traditional riser structure. These facilities would reduce runoff from the surrounding residential properties. The existing culvert at the intersection of Stafford Road and Paul Spring Road should also be evaluated for adequacy during the preliminary engineering phase for this project (Map No. PSB29). Implementation Period: FY 2007 - FY 2009, Capital Cost: $260,000
- Construct a new, one-year, extended-detention BMP in the available open area at the headwaters of the unnamed tributary to Paul Spring Branch, south of the 1200 block of Belle Vista Drive. Tree removal should only occur at the embankment area. This facility would

reduce discharges from the residential areas to the north before they enter the unnamed tributary (Map No. PSB30). Implementation Period: FY 2008 - FY 2010, Capital Cost: $210,000

- Construct a new, one-year, extended-detention stormwater management facility in the open space behind the 2300 block of Beacon Hill Road. The existing storm drain system would need to be modified and possibly a low-flow diversion constructed for this facility to function properly. This facility would reduce runoff from the surrounding residential areas (Map No. PSB31). Implementation Period: FY 2006 - FY 2008, Capital Cost: $140,000
- Construct a new, one-year, extended-detention BMP and a new underground storage facility south of the Jemal/Metrocall building at 6910 Richmond Highway and install porous pavement along the parking lot perimeter. The facilities would reduce runoff from the surrounding residential properties and adjacent commercial property. Alternatively, or as a means to gain additional detention storage, the existing underground detention facility beneath the parking lot could be enhanced. This existing condition of the facility should be evaluated for suitability during the preliminary engineering phase (Map No. PSB32). Implementation Period: FY 2006 - FY 2007, Capital Cost: $600,000

North Branch

- Construct a new, one-year, extended-detention BMP behind the 7600 block of Elba Road. The existing storm drain system would need to be modified and possibly a low-flow diversion constructed for this facility to function properly. This facility would reduce runoff from the surrounding residential areas (Map No. NB11). Implementation Period: FY 2005 - FY 2006, Capital Cost: $240,000
- Construct a new, one-year, extended-detention BMP near the end of the 2500 block of Woodlawn Terrace, just south of the parking area. This facility would reduce runoff from the surrounding residential areas (Map No. NB12). Implementation Period: FY 2008 - FY 2009, Capital Cost: $200,000
- Construct a new, one-year, extended-detention BMP behind Whitman Middle School. The existing storm drain system would need to be modified and possibly a low-flow diversion constructed for this facility to function properly. This facility would reduce runoff from the surrounding areas (Map No. NB13). Implementation Period: FY 2010 - FY 2014, Capital Cost: $150,000
- Construct a new, one-year, extended-detention BMP behind the residential properties along the 8200 block of Fort Hunt Road. The existing storm drain system would need to be modified and possibly a low-flow diversion constructed for this facility to function properly. This facility would reduce runoff from the surrounding residential areas (Map No. NB14). Implementation Period: FY 2007 - FY 2008, Capital Cost: $160,000

Other locations were evaluated but not considered feasible for constructing small detention ponds with drainage areas less than 100 acres because of location and construction limitations. Large regional stormwater management facilities were not considered for this watershed because they would likely require the acquisition of private property, mainly in residential areas, which is not considered desirable or practical with respect to the goals of this plan.

Table 4.2 summarizes the quantified two-year peak flow reduction benefit provided by each new BMP project and the peak flow reduction benefits for this action are included in the total peak flow reductions shown on Map 4.2.

Table 4.2 Benefits of New BMPs

Map No./ Project ID	Subbasin	Approx. Storage Volume (cy)	Dam Height (ft)	Proposed Drainage Area (acres)	Water Quantity Reduction (cfs)
North Little Hunting Creek					
NLHC1	LH-LH-0008	3500	5.0	31.1	29.7
NLHC9	LH-LH-0004 and 0005	N/A[1]	N/A[1]	137.7	89.2
NLHC16	LH-LH-0009	850	5.0	10.1	9.6
NLHC17	LH-LH-0006	650	5.0	7.6	4.8
NLHC19	LH-LH-0005	1550	5.0	32.1	20.2
NLHC20	LH-LH-0008	2050	6.0	41.8	39.9
NLHC23	LH-LH-0007	650	7.0	10.8	5.2
NLHC24	LH-LH-0007	400	4.5	14.7	13.5
			Subtotal	285.9	
Paul Spring Branch					
PSB1	LH-PS-007	N/A[1]	N/A[1]	29.1	30.1
PSB2	LH-PS-001, 002, 005, 006, and 007	N/A[1]	N/A[1]	12.1	11.9
PSB24	LH-PS-0007	1700	5.0	20.6	19.0
PSB25	LH-PS-0007	1050	6.0	20.9	18.0
PSB26	LH-PS-0006	1200	5.0	18.2	19.3
PSB27	LH-PS-0006	1750	7.0	18.9	20.0
PSB28	LH-PS-0005	650	5.5	13.3	11.3
PSB29	LH-PS-0004	2900	7.0	59.7	67.0
PSB30	LH-PS-0003	1400	9.5	28.6	25.7
PSB31	LH-PS-0006	850	4.5	16.7	17.7
PSB32	LH-PS-0007	1600	9.5	47.9	49.0
			Subtotal	286.0	
North Branch					
NB11	LH-NB-0011	2400	6.0	49.0	37.8
NB12	LH-NB-0011	1100	8.5	21.7	16.6
NB13	LH-NB-0005	850	6.0	10.0	12.3
NB14	LH-NB-0008	900	4.5	18.6	26.0
			Subtotal	99.3	
Total Little Hunting Creek				671.2	

[1]Commercial LID projects that do not include new ponds.

Responsible Party: Fairfax County
Implementation Period: See above descriptions
Capital Costs: See above descriptions
Staff: 0.10 SYE

Action A3.8: Construct LID demonstration projects at publicly owned locations such as schools, parks, and other county properties. This action has been incorporated into the plan at the request of citizens as part of the Community Watershed Forum process.

Strategy to Achieve Action: The following locations may serve as potential LID demonstration sites and are shown on Map 4.1; however, further coordination with Fairfax County Public Schools will be required during the design phase:

- Construct LID demonstration projects at Bryant Adult Alternative High School and Hybla Valley Elementary School with rain gardens, porous pavement, buffer strips, and Filterra or similar types of drop inlets (Map No. NLHC21). Implementation Period: FY 2006 - FY 2008, Capital Cost: $250,000
- Create rain gardens with student volunteers and install manufactured BMPs at Fort Hunt Elementary School (Map No. SLHC3). Implementation Period: FY 2015 - FY 2019, Capital Cost: $270,000
- Create rain gardens and install rain barrels and cisterns at Bucknell Elementary School (Map No. PSB2). Implementation Period: FY 2006 - FY 2009, Capital Cost: $520,000
- Construct LID demonstration projects at Sherwood Hall Library, Carl Sandburg Middle School, Stratford Landing Elementary School, Whitman Middle School, and Hollin Meadows Elementary School with porous pavement, bioretention, buffer strips, and Filterra or similar types of drop inlets (Map No. NB1). Implementation Period: FY 2007 - FY 2008, Capital Cost: $580,000
- Construct a LID demonstration project at Waynewood Elementary School (Map No. PR3). Implementation Period: FY 2015 - FY 2019. Capital Cost: $80,000

An excellent example of a rain garden successfully installed at a large community facility is at the Presbyterian Church in Paul Springs Branch subwatershed. This site might serve as an example for these and other proposed projects. This strategy includes projects that may be offered by the county to the development community as items suitable for implementation as proffers, which may help in constructing these projects.

Table 4.3 summarizes the two-year peak flow reduction benefit provided by implementing these projects, and the peak flow reduction benefits for this action are included in the total peak flow reductions shown on Map 4.2.

Table 4.3 Benefits of LID Projects at Schools

Map No./ Project ID	Subbasin	Proposed Drainage Area (acres)	Water Quantity Reduction (cfs)
NB1	LH-NB-0004	66.0	46.3
NLHC21	LH-LH-0006 and 0008	32.0	22.2
SLHC3	LH-SB-0001	12.2	11.0
PR3	LH-PO-0002	8.6	4.0
Total =		118.8	

Note: Project PSB2 is included in Table 4.2.

Responsible Party: Fairfax County
Implementation Period: See above descriptions
Capital Costs: See above descriptions
Staff: 0.03 SYE

The final draft plan included "Action A3.12," which consisted of house flood-proofing and/or flood mitigation for dwellings located in the 100-year flooding limits as identified by the modeling effort for the plan. At the request of the Little Hunting Creek Steering Committee, this recommendation has been removed from the watershed plan; however, the flood mitigation project will be designated as part of the county's broader stormwater control program. The total plan implementation cost has been reduced to reflect the removal of this project. The total project estimate for this recommendation was $4,880,000.

Objective A4: Increase the participation of residents in decreasing the amount of stormwater runoff from impervious surfaces in residential areas.

Rationale: The majority of the existing land use in the watershed is residential and contributes to 48% of the total impervious area in the watershed. Reducing the runoff from residential areas will help promote individual stakeholder involvement in improving the condition of the streams.

Action A4.1: Facilitate and provide technical assistance for the construction of LID practices, such as rain gardens, cisterns, and rain barrels, throughout the watershed, initially targeting areas near the headwaters of streams to detain the runoff from residential developments without existing stormwater management controls.

Strategy to Achieve Action: Determine and fund a pilot neighborhood area to test the implementation and success of the rain barrels, cisterns, and rain gardens. An implementation schedule can be developed for the rest of the targeted neighborhoods that are shown on Map 4.1, if implementing this action in the pilot neighborhood area is successful. Provide technical assistance to homeowners who wish to install these practices on their property through a proposed Community Watershed Services Support program. This program will provide to the community education on rain barrels, cisterns, rain gardens, tree planting, natural landscaping, and native plants as well as technical support by distributing educational materials on these topics and adding similar content to the county website. To increase the chance for success for this action, the Community Watershed Services Support program should address any concerns pilot area homeowners might have with their new rain barrel, rain garden, or cistern. The Community Watershed Services Support program will also support proposed actions A4.1, B1.2, and D3.1 and provide technical assistance and conduct educational outreach to neighborhood groups and organizations. The capital projects described in this action may be offered by the county to developers as suitable for implementation as proffers. The county may also contact and collaborate with local home improvement stores to provide materials or other support for these projects.

Watershed Benefit: By constructing rain gardens and installing rain barrels and cisterns in residential areas in the headwaters, the peak runoff flows will be reduced. This benefit was modeled using an assumed average neighborhood implementation rate of 10% for the rain barrels, cisterns, and rain gardens. The two-year peak flow reduction benefits for this action are included in the total peak flow reductions shown on Map 4.2.

Responsible Party: Fairfax County
Implementation Period: FY 2005 - FY 2029
Capital Cost: $170,000
Staff: 0.03 SYE and 0.03 SYE for the Community Watershed Services Support project = 0.06 SYE

The cost of this action is based upon the proposed targeted coverage areas shown on Map 4.1, with an average 10% implementation rate and four rain barrels or cisterns or one rain garden at each participating property.

Action A4.2: Implement a watershed-wide rain barrel sale project.

Strategy to Achieve Action: Distribute rain barrels to the public annually at a designated location such as the South County Government Center or Sherwood Regional Library. The time and place for the distribution should be broadly advertised throughout the watershed. This action could be promoted as a fundraiser to support the restoration of the watershed or to support community groups with similar interests in the watershed.

Watershed Benefit: Because rain barrels would be available to the public throughout the watershed, it is not possible to accurately quantify this action's benefit. However, if rain barrels were installed on a typical residence with a 2,000-square-foot roof, they would produce an approximate 83-cubic-foot reduction in runoff, assuming they detained the first half-inch of runoff.

Responsible Party: Fairfax County
Implementation Period: FY 2005 - FY 2029
Capital Cost: $10,000 per year for 25 years = $250,000
(LH9972 Community Watershed Support Services Project)
Staff: 0.03 SYE per year

Goal B: Preserve, maintain, and improve watershed habitats to support native flora and fauna.

The habitat quality is rated poor for the majority of the streams in the Little Hunting Creek watershed, with approximately 10 miles of degraded buffers and eroded stream banks. The creek and streams have manmade alterations such as paved and straightened channels and hardened shorelines that decrease the available habitat in the watershed. The increased quantity and poor quality of the stormwater runoff also impacts the habitat by eroding the stream bed and banks and polluting the water. The environment section of the county's Policy Plan states under Objective 2, "…Protect and restore the ecological integrity of streams in Fairfax County." The actions under this goal will strive to maintain the existing quality habitat areas in good condition and improve those habitat areas in poor condition.

Objective B1: Preserve, restore, and manage riparian buffers to benefit native flora and fauna.

Rationale: The condition of the existing riparian buffers is poor for 52% of the assessed bank length as found in the stream physical assessment. Riparian buffers are needed to support watershed habitats by filtering runoff from adjacent lands and providing a place for native plants and animals to live. The county's Chesapeake Bay Preservation ordinance requires that riparian buffers not be disturbed for perennial streams. The environment section of the county's Policy Plan, Objective 10 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.

Action B1.1: Plant buffers using native vegetation and trees adjacent to the stream for areas identified as good candidates for buffer restoration.

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. The removal of invasive species and the restoration of native species should be performed for all of buffer restoration projects. When removing invasive species, the use of herbicides should be limited and other methods, such as manual removal, employed where possible. Appropriate buffer material and species mix should be selected based on the restoration goal for each area. The following deficient buffer locations were found during the 2002 stream physical assessment and are potential locations for buffer restoration projects (locations are shown on Map 4.1):

North Little Hunting Creek

- Add buffer vegetation at the top of the bank along the paved channels at Audubon Estates Mobile Home Park near Janna Lee Avenue and north of Woodlawn Trail to help slow runoff. Line the bottom of the paved channels with grouted riprap (Map No. NLHC11). Implementation Period: FY 2010 - FY 2014, Capital Cost: $400,000

South Little Hunting Creek

- Establish additional buffer vegetation along the top of bank of the paved channel in the Wessynton subdivision. (Map No. SLHC6). Implementation Period: FY 2015 - FY 2019, Capital Cost: $20,000
- Restore the buffer adjacent to the paved channels located along the south branch of South Branch between Linton Lane and Vernon View Drive and acquire conservation easements for the land adjacent to the stream (Map No. SLHC7). Implementation Period: FY 2015 - FY 2019, Capital Cost: $40,000
- Mitigate the effects of the paved channels by removing them and installing bioengineered stream stabilization to slow flow velocities (Map No. SLHC8). Implementation Period: FY 2025 - FY 2029, Capital Cost: $150,000

Paul Spring Branch

- Restore the buffer vegetation at homes located adjacent to the stream near Schooley Drive, Memorial Street, and East Side Drive (Map No. PSB12), Implementation Period: FY 2025 - FY 2029, Capital Cost: $20,000
- Restore the buffer vegetation along the stream located south of Admiral Drive (Map No. PSB14). Implementation Period: FY 2015 - FY 2019, Capital Cost: $30,000

The projects listed under this action may be suitable for the county to offer to developers as items for implementation as proffers. The county has also initiated a partnership with the Virginia Department of Forestry to implement buffer restoration projects utilizing volunteers.

Watershed Benefit: The benefits of restoring riparian buffers in the watershed were not modeled. However, the 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. A typical 50-foot riparian buffer can reduce over 90% of suspended solids, 60% of phosphorous, and 70% of nitrogen from stormwater runoff that flows through the buffer area.

Responsible Party: Fairfax County and community groups
Implementation Period: See descriptions above
Capital Cost: See descriptions above
Staff: 0.03 SYE

Action B1.2: The county and community groups should provide educational and technical assistance to property owners with tidal shoreline and 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, limiting the use and correct application of fertilizers and herbicides, pet waste management, waste disposal, and proper disposal of leaves and grass clippings.

Strategy to Achieve Action: Coordinate with community groups to provide technical assistance and suitable educational materials for planting and maintaining healthy buffers. This effort should also be supported by the Community Watershed Services Support program, which should provide educational and technical assistance to property owners.

Watershed Benefit: The benefit of this action was not quantified; however, when implemented, this action will help in maintaining and perhaps restoring buffers that will provide stream bank and shoreline protection, provide habitat area, and filter pollutants from runoff. Typical quantified benefits for buffers are discussed in Action B1.1.

Responsible Party: Fairfax County and community groups
Implementation Period: FY 2005 - FY 2029
Capital Cost: $10,000 per year for 25 years = $250,000
(LH9972 Community Watershed Support Services Project)
Staff: 0.03 SYE

Action B1.3: Monitor the condition of restored and existing riparian buffer with annual stream walks to evaluate the condition and areas needing improvement.

Strategy to Achieve Action: The county may be able to use volunteers to perform annual stream walks to collect information about the condition of the buffer. The stream physical assessment update (to be performed by the county every five years as proposed in Action B2.2) will help to verify the information collected by the volunteers.

Watershed Benefit: This action will benefit the watershed by providing a way to monitor the success or failure of protecting existing and restored riparian buffers.

Responsible Party: Fairfax County
Implementation Period: FY 2007- FY 2029
Capital Cost: $15,000 per year for 23 years = $345,000
Staff: 0.03 SYE

Objective B2: Preserve, restore, and manage stream bank and in-stream habitat to benefit native flora and fauna.

Rationale: The existing stream habitat is considered poor for 58% and very poor for 15% of the assessed stream length in the watershed. Restoring the streams will improve the condition of the aquatic habitat and must be performed in conjunction with the previously stated objectives of reducing the amount of runoff from existing impervious areas to help prevent further erosion and channel widening. Restoring the streams to stabilize the banks will help protect properties located adjacent to the streams.

Action B2.1: The county and community groups should perform stream restoration projects in the areas identified as good candidates for these types of projects.

Strategy to Achieve Action: The 2002 county stream physical assessment located many streams in the watershed with poor habitats and 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 result 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.

This action identifies the stream sections that need restoration and the recommended stream restoration activity for 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, which are discussed in more detail in Appendix D of this plan. Activities associated with restoration of the riparian corridor and modifications to the stream channel are shown on Maps 4.6, 4.7, 4.8, and 4.9. More stream information will need to be collected in the future 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.

North Little Hunting Creek

- Restore the stream (LHLH003 and LHLH006) located north of Mount Vernon Plaza and replace the culvert at Fordson Road near Mount Vernon Plaza. The culvert replacement project is on county's drainage master plan project list (LH431). Proposed activities include removal/modification of culverts, channel reconfiguration, floodplain creation, riparian vegetation planting, and removal of invasive species (Map No. NLHC12). Implementation Period: FY 2015 - FY 2019, Capital Cost: $800,000
- Restore the stream located east of Huntley Meadows Park and south of the new subdivision (The Grove at Huntley Meadows) to mitigate the impact from increased runoff at the culvert crossing. Proposed activities include selected placement of in-stream habitat structure, channel reconfiguration, and riparian vegetation plantings (Map No. NLHC13). Implementation Period: FY 2025 - FY 2029, Capital Cost: $150,000
- Perform stream restoration of the channel (LHLH007) located south of Beech Craft Drive and west of Fordson Road. Proposed activities include channel reconfiguration, floodplain creation, bioengineering of stream banks, selective placement of in-stream habitat structures, and removal of unstable trees (Map No. NLHC14). Implementation Period: FY 2010 - FY 2014, Capital Cost: $350,000
- Perform stream restoration and add buffer vegetation to the channel (LHLH002 and part of LHLH001) from north of Audubon Estates Mobile Home Park near Audubon Avenue to 600 feet south of Richmond Highway. Install an animal passageway under Richmond Highway. Proposed activities include removal/modification of culverts, riparian vegetation planting, removal of invasive species, selected placement of in-stream habitat structures, channel reconfiguration, and trash/debris removal. Additional opportunities for restoration should be evaluated downstream to the confluence with the main stem of Little Hunting Creek during the preliminary evaluation and design phase of this project (Map No. NLHC15). Implementation Period: FY 2020 - FY 2024, Capital Cost: $820,000

South Little Hunting Creek

- Perform stream restoration for the tributary (LHLH011) located near Brady Street. Proposed activities include riparian vegetation planting, removal of invasive species, selected placement of in-stream habitat structures, and trash /debris removal (Map No. SLHC4). Implementation Period: FY 2025 - FY 2029, Capital Cost: $200,000
- Perform stream restoration for South Branch near Fort Hunt Park and Fort Hunt Elementary School. Acquire conservation easements for the private land located adjacent to the stream. Proposed activities include channel reconfiguration, selective placement of in-stream habitat structures, riparian vegetation planting, removal of invasive species, and trash/debris removal (Map No. SLHC5). Implementation Period: FY 2020 - FY 2024, Capital Cost: $560,000
- Restore the stream located south of George Washington Memorial Parkway on the west side of South Little Hunting Creek. Coordinate this work with the National Park Service. Proposed activities include selective placement of in-stream habitat structures, riparian vegetation planting, and removal of invasive species (Map No. SLHC9). Implementation Period: FY 2020 - FY 2024, Capital Cost: $230,000

Paul Spring Branch

- Perform stream restoration in conjunction with culvert replacements at Morningside Lane, Woodcliff Drive, Lyndale Drive, Admiral Road, and Fort Hunt Road. The actual size and type of culvert replacements will be verified during the development of the stream restoration projects. Proposed activities include removal/modification of culverts, channel reconfiguration, riparian vegetation planting, and removal of invasive species. The culvert replacement projects and stream restoration activities are included on the county's drainage master plan project list. This project incorporates former county projects LH244, LH245, and LH442 (Map No. PSB13). Implementation Period: FY 2025 - FY 2029, Capital Cost: $1,370,000

- Perform stream restoration and bank stabilization in phases in conjunction with culvert replacements at Mary Baldwin Drive and Paul Spring Road along Paul Spring Branch, and culvert improvements at Stafford Road from the headwaters to Mason Hill Drive. The county's drainage master plan project list includes improvement projects for Paul Spring Road (LH 451 and X00073) which will be superseded by this project. The actual size and type of the culvert replacements will be verified during the development of the stream restoration projects, as well as any other drainage improvements such as improving the surrounding conveyances. Proposed activities include riparian vegetative planting, removal of invasive species, removal of unstable trees, selective placement of in-stream habitat structures, bioengineering of stream banks, channel reconfiguration, floodplain creation, and trash/debris removal (Map No. PSB15). Implementation Period: FY 2010 - FY 2024, Capital Cost: $2,620,000
- Prior to commencing stream restoration activities along Paul Spring Branch near Paul Spring Road, a study should be performed to determine an adequate size drainage structure for the Paul Spring Road crossing, and the existing structure should be replaced (Map No. PSB15). Implementation Period: FY 2010 - FY 2011, Capital Cost: Included in PSB15 cost above.
- Perform bank stabilization to mitigate the impact from increased runoff at the two, four-foot diameter corrugated metal pipes crossing Mary Baldwin Drive. The runoff discharged from the pipes has caused severe erosion of the bed and banks on the downstream side with six-foot-high bank erosion. Proposed activities include channel reconfiguration and the selective placement of in-stream habitat structures, riparian vegetative planting, and removal of invasive species (Map No. PSB16). Implementation Period: FY 2025 - FY 2029, Capital Cost: $100,000
- Perform bank stabilization to mitigate four-foot-high bank erosion located adjacent to the four, 10-foot by six-foot concrete box culverts at Sherwood Hall Lane. Proposed activities include channel reconfiguration and the selective placement of in-stream habitat structures, riparian vegetative planting, and removal of invasive species (Map No. PSB17). Implementation Period: FY 2025 - FY 2029, Capital Cost: $40,000
- Perform bank stabilization to mitigate severe erosion from increased runoff at the pipe outfall at Wellington Road. Proposed activities include channel reconfiguration and the selective placement of in-stream habitat structures, riparian vegetative planting, and removal of invasive species (Map No. PSB18). Implementation Period: FY 2025 - FY 2029, Capital Cost: $100,000
- Perform bank stabilization to mitigate severe erosion from increased runoff at the pipe outfall at University Drive. Proposed activities include channel reconfiguration and the selective placement of in-stream habitat structures, riparian vegetative planting, and removal of invasive species (Map No. PSB19). Implementation Period: FY 2025 - FY 2029, Capital Cost: $100,000
- Perform bank stabilization to mitigate moderate erosion from increased runoff at the pipe outfall at Devonshire Road. Proposed activities include channel reconfiguration and the selective placement of in-stream habitat structures, riparian vegetative planting, and removal of invasive species (Map No. PSB20). Implementation Period: FY 2025 - FY 2029, Capital Cost: $100,000

North Branch

- Restore the stream for a distance of 1,500 feet upstream of Sherwood Hall Lane and for 1,000 feet downstream of Sherwood Hall Lane. This project incorporates former county projects LH441 and LH242. Proposed activities include riparian vegetation planting, removal of invasive species, removal of unstable trees, channel reconfiguration, selective placement of in-stream habitat structures, and trash/debris removal (Map No. NB7). Implementation Period: FY 2015 - FY 2019, Capital Cost: $390,000

- Restore the stream for 700 feet downstream of the Collingwood Road crossing located east of Shenandoah Road at the Williamsburg Manor Park. Proposed activities include riparian vegetation planting, removal of invasive species, selective placement of in-stream habitat structures, and trash/debris removal (Map No. NB8). Implementation Period: FY 2020 - FY 2024, Capital Cost: $110,000

The projects listed for this action may be offered by the county to developers as items suitable for implementation as proffers.

Watershed Benefit: The benefits of projects such as these are reduced stream erosion and improved aquatic habitat. Streams naturally cause some erosion and transport sediment; however, excessive velocities produce increased and detrimental erosion. By decreasing in-stream velocities to levels consistent with the stream's natural conditions, the volume of suspended solids may be reduced and the stream will no longer be impaired by this condition. This would result in the stream's sediment levels being more in line with those that occur naturally and achieve the goals of the Chesapeake Bay tributary strategy. The typical benefits of restoring riparian buffers are quantified in Action B1.1.

Responsible Party: Fairfax County
Implementation Period: See descriptions above
Capital Cost: See descriptions above
Staff: 0.03 SYE

Action B2.2: Monitor the condition of the streams by performing a stream physical assessment every five years in the future to track the improvement or degradation of streams from the baseline condition.

Strategy to Achieve Action: In the future, update the stream physical assessment data to provide information to evaluate the success of the Little Hunting Creek Watershed Management Plan strategies. Data such as habitat condition, buffer deficiencies, and erosion should be collected for some of the smaller streams not included in the 2002 stream physical assessment as shown by PR1 on Map 4.1.

Watershed Benefit: The benefit of this action cannot be directly quantified, but its implementation will allow for the quantitative evaluation of other proposed watershed management plan actions. This action is necessary to objectively evaluate the effectiveness of these actions and to continuously monitor the success of other implemented plan actions.

Responsible Party: Fairfax County
Implementation Period: FY 2007 - FY 2029
Total Capital Cost: $200,000
Staff: 0.03 SYE per year

Action B2.3: Facilitate the acquisition and donation of conservation easements by community groups for riparian buffer and stream protection and public/private open space for the environmental quality corridors described in the Fairfax County Comprehensive Plan.

Strategy to Achieve Action: In the county's comprehensive plan, the North Little Hunting Creek, Paul Spring Branch, and North Branch stream corridors are recommended to be public park/open space or private open space. Other tributaries in the watershed may need to be considered for future conservation easements. This plan recommends two locations for easement acquisition as shown on Map 4.1 and designated as NLHC22 and PSB21. The other portions of Paul Spring Branch and North Branch stream corridors are already designated as existing open space. Conservation easements should be obtained for the undeveloped parcels located next to the creek along Stockton Parkway. Other locations for conservation easements should be evaluated and considered by the county during the comprehensive planning process or as opportunities are presented. These opportunities could include when property owners with land adjacent to the creek would like to put their land in a conservation easement in perpetuity.

Watershed Benefit: Although the benefit of this action is not directly quantifiable, its implementation will directly benefit the watershed by protecting land adjacent to the stream from future development. The benefits of conserving land adjacent to the stream include protecting existing riparian buffers for wildlife habitat, reducing stream and property erosion, and filtering pollutants from runoff. Typical benefits of riparian buffers are quantified in Actions B1.1.

Responsible Party: Fairfax County and the Northern Virginia Conservation Trust
Implementation Period: FY 2007 - FY 2011
Capital Cost: $40,000 per year = $200,000
Staff: 0.03 SYE

Objective B3: Preserve, restore, and manage wetlands to benefit native flora and fauna.

Rationale: The amount of wetlands in the watershed is less than what existed in the past; however, it is not known how much wetlands have been destroyed from development in the watershed. The objective is to increase the amount of wetlands to provide additional habitat for fish, animal, and plant populations and have areas where the public can observe wildlife. Wetlands will provide a benefit to the water quality by filtering pollutants from stormwater runoff and acting as a detention area for stormwater runoff.

Action B3.1: Perform a wetlands function and value survey to identify the location, size, owner, type, and quality of existing wetlands in the watershed to determine the baseline information.

Strategy to Achieve Action: A contractor should be hired by the county to perform a wetlands function and value survey. This survey will provide a baseline condition and mapping of the wetlands in the watershed and help the county and the stakeholders in making decisions regarding priority wetland conservation and preservation areas. Areas should be identified which have the greatest potential for conservation, and restoration should be given the highest priority. The results of this survey, along with some background information on the importance and role of wetlands in the watershed, should be made available to the public through Action C2.5. 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: Since much of the information regarding wetlands is unknown throughout the watershed, this action will help identify important information related to wetlands, such as habitat, flood control, and nursery benefits, and establish a baseline condition from which future actions and priorities can be established. Wetlands typically remove over 70% of suspended solids, 40% of phosphorous, and 20% of nitrogen.

Responsible Party: Fairfax County
Implementation Period: FY 2007 - FY 2008
Capital Cost: $320,000
Staff: 0.03 SYE

Action B3.2: Construct and restore wetlands at suitable locations in the watershed as identified by the wetlands function and value survey in Action B3.1.

Strategy to Achieve Action: Potential wetland restoration areas may include the shoreline area at Martin Luther King Jr. Park (Map No. SLHC11), which is owned by the county, and areas along the George Washington Memorial Parkway near the Potomac River (Map No. PR2), which are owned by the National Park Service. The purpose of the wetland project (SLHC17) in the main stem portion of Little Hunting Creek will be to plant sub-aquatic vegetation and aquatic grasses in areas currently missing aquatic vegetation. The restoration of these wetlands should not block public access to this portion of the creek. A series of linear-constructed stormwater wetland BMPs may be placed along Paul Spring Branch (Map No. PSB9) to help detain the peak runoff and treat the stormwater runoff from developed areas. The primary function of this wetland project will be to provide extended detention of low flows of stormwater runoff, but inherently, it will provide wetland habitat. More detailed site information and public input will be obtained for all of the projects before starting the design process.

Other potential sites for constructed wetlands BMPs include the area northeast of the intersection of Paul Spring Road and Rippon Road (Map No. PSB10) and the portion of White Oak Park that borders Paul Spring Branch (Map No. PSB9). These projects could be constructed on existing county property or easements. The design process for these sites will include a thorough evaluation of the site to prevent unintended and potentially harmful effects on existing flora. The property owner should monitor and maintain any constructed or restored wetlands for at least five years. Coordination with the National Park Service will be required where appropriate, such as the areas located within the George Washington Memorial Parkway. Additional locations identified in the wetland function and value survey in Action B3.1 should be considered for constructing wetlands. The restoration and construction of wetlands will help to achieve Objectives A3 and C2 by reducing the impacts of increased stormwater runoff and removing pollutants from the runoff.

Watershed Benefit: The quantified benefit of this action should be established after action B3.1 has been completed and a plan for constructing and restoring wetlands has been established. Additionally, these constructed wetlands may possibly be banked to generate revenue for other BMPs in the watershed.

Responsible Party: Fairfax County and the National Park Service for the project located along the George Washington Memorial Parkway
Implementation Period: FY 2010 - FY 2024
Capital Cost: $1,250,000
Staff: 0.03 SYE

Action B3.3: Purchase private land, designate public land, or acquire easements for land conservation of critical wetland habitat areas as identified in the wetlands function and value survey in Action B3.1.

Strategy to Achieve Action: The future wetlands function and value assessment in Action B3.1 will describe the locations of sensitive wetland areas that should be preserved. The county should work with community groups to decide the priority wetland areas and the best way to preserve the wetlands for the future. One of the locations already identified by the community is at the former sewage treatment plant site near the intersection of Thomas J. Stockton Parkway and Londonderry Road as shown on Map 4.1 at SLHC10. This area could be targeted for tidal wetland restoration along the shoreline and riparian buffer restoration in conjunction with its redevelopment into a public nature park area with creek access for canoes and kayaks.

Watershed Benefit: The quantified benefit of this action should be established after action B3.1 has been completed and a plan for the preservation of existing wetlands has been established.

Responsible Party: Fairfax County and the Northern Virginia Conservation Trust
Implementation Period: FY 2007 - FY 2011
Capital Cost: Included in action B2.3
Staff: Included in action B2.3

Action B3.5: Create and distribute a brochure or other materials that inform the public about the value and benefit of wetlands.

Strategy to Achieve Action: Prepare a brochure or other material that will educate the public on the value and benefits of wetlands. The county could either develop this material itself, possibly using already available materials and tailoring them to the county's needs, or the county could hire a contractor to develop these materials. Materials should be distributed to the public through displays at county facilities and published on the county website.

Watershed Benefit: This information will provide the public with a better understanding of the importance of wetlands, including their function, benefit, and value to their environment. This should also prompt watershed residents to take a more active interest in preserving wetlands and replacing wetlands that have been destroyed.

Responsible Party: Fairfax County
Implementation Period: FY 2006 - FY 2029
Capital Cost: Included in Action C2.5
Staff: 0.03 SYE

Goal C: Preserve, maintain, and improve the water quality of the streams to benefit humans and aquatic life.

The existing water quality of the creek and streams is poor based on the information from the county's stream quality monitoring and Virginia DEQ's monitoring data regarding fecal coliform, nutrients such as nitrogen and phosphorous, chlordane, and PCBs. Sedimentation caused by stream bed and bank erosion and land disturbances in the watershed have caused silting of streams and the creek. There is a direct relationship between the upstream volume of runoff and velocities and the amount of sediment deposited downstream. To reduce the amount of degradation of the streams and sediments transported downstream, upstream runoff volumes and velocities must be reduced. This goal is consistent with the environment section of the county's Policy Plan as stated in Objective 2, "Prevent and reduce pollution of surface and groundwater resources."

Objective C1: Reduce and mitigate effects of sedimentation to the creek.

Rationale: The stream physical assessment observed areas of sedimentation in the non-tidal portions of the streams, and residents have observed sedimentation of the tidal portion of Little Hunting Creek. The primary source of sedimentation is from stream bank and bed erosion caused by excessive velocities from increased stormwater runoff. The actions under Goal A will help in reducing the amount of stormwater runoff and stream bank and bed erosion. This objective relates to mitigating the effects of past sedimentation.

Action C1.1: Perform a hydrographic survey in the future to determine the existing depths in South Little Hunting Creek and initiate a study to determine where dredging may be feasible to restore the navigation channel in the tidal portion of the creek and access from the shoreline.

Strategy to Achieve Action: Hire a contractor to perform a hydrographic survey of South Little Hunting Creek and evaluate, by means of a comprehensive study, the feasibility of dredging in the shallow areas of the creek. As part of this survey and study, a comprehensive environmental assessment should also be performed and include the impact of the placement of dredging spoil and the possibility of the re-suspension of contaminates. The U.S. Army Corps of Engineers should be involved in the dredging feasibility study because they will need to issue any future permits for dredging. The results of the environmental assessment and impacts of the dredging will need to be considered as a significant component of the dredging feasibility evaluation. This action is shown as SLHC1 on Map 4.1. It should be noted that private citizens or groups could undertake the dredging of South Little Hunting Creek; however, they would need to follow the same process and meet the same standards as the county, and this endeavor would be extremely expensive.

Watershed Benefit: This action will establish a baseline to evaluate and quantify the benefit or detriment from a dredging project. If dredging is performed in the future, it will help public recreation activities by improving boat access. Dredging the bottom will harm the existing aquatic habitat of the creek and may re-suspend existing contaminated sediments.

Responsible Party: Fairfax County and U.S. Army Corps of Engineers
Implementation Period: FY 2010 - FY 2014
Capital Cost: $510,000
Staff: 0.03 SYE

Action C1.2: The county, community groups, and commercial property owners should sweep up sand used for traction control on Richmond Highway and other major streets and parking areas in the watershed during the winter to prevent it from reaching the creek. Limit the use of certain de-icing materials, especially those that greatly impair water quality.

Strategy to Achieve Action: Coordinate with VDOT to limit the use of certain de-icing materials and minimize the amount of sand used for traction control in the winter. The county, community groups, and commercial property owners could pay a contractor to sweep the streets and parking lots. VDOT has a program to accept the swept sand for future reuse or disposal. Evaluate the benefit of sweeping of sand from private and public parking lots and improvement of water quality by limiting the use of de-icing materials.

Watershed Benefit: Because of the varied implementation of this action, it is difficult to quantify its benefit. The general benefit of this action to the watershed would be the reduction of pollutants, mostly TSS, in the areas where this action is implemented.

Responsible Party: Fairfax County and community groups
Implementation Period: FY 2007 - FY 2029
Capital Cost: $20,000 per year = $460,000
Staff: 0.03 SYE

Objective C2: Reduce the amount of pollutants such as fecal coliform bacteria, phosphorous, and nitrogen in stormwater runoff.

Rationale: The majority of the pollution in the stormwater runoff comes from the existing land uses in the watershed. The fecal coliform bacteria concentrations in the watershed exceed the state water quality standards. The concentration of nitrogen and phosphorous in the water has caused algal blooms which cause the creek to be listed by the Virginia DEQ as nutrient impaired. The purpose of this objective is to mitigate the sources of manmade pollution to Little Hunting Creek to the maximum extent practical.

Action C2.1: Expand existing county monitoring programs to identify the sources of fecal coliform in the watershed that may be from humans, domesticated animals, or wildlife, and prepare an action plan to address the reduction of fecal coliform bacteria contamination.

Strategy to Achieve Action: Perform a future study of the sources of fecal coliform bacteria to Little Hunting Creek and prepare an action plan that will be a separate document from this watershed management plan.

Watershed Benefit: This action would allow for the evaluation and quantification of fecal coliform bacteria impacts to the watershed. This would then allow a baseline to be established to implement an action plan for the reduction of fecal coliform bacteria.

Responsible Party: Fairfax County
Implementation Period: FY 2007 - FY 2009
Capital Cost: $320,000
Staff: 0.03 SYE

Action C2.2: Install BMPs or enhance the performance of existing BMPs at selected locations to reduce the nitrogen and phosphorous pollutant loading from existing developments that currently have no water quality treatment. This action should be performed in conjunction with actions identified under Objectives A3 and A4.

Strategy to Achieve Action: The structural BMP options for this action are described under Actions A3.6, A3.7, A3.8, and A4.1. Retrofitting existing stormwater management facilities and BMPs in the watershed to provide a greater pollutant removal benefit may be accomplished by creating wetlands in the bottom of existing dry detention facilities or detaining water for a longer time in the detention facilities. The county will not have to obtain an easement for retrofitting existing public stormwater management facilities unless additional areas around facilities are needed. The cost is minimal to create a wetland in the bottom of an existing dry detention facility and/or reconfigure the outlet structure. A new wetland constructed in the bottom or fringe of an existing facility may increase the pollutant removal efficiency by 10% to 15%. The outfall structure of an existing facility could be modified to store water longer in the BMP, or perhaps more drainage area could be directed to the existing BMP. Since most residential areas in the watershed do not have existing BMPs, the new BMP facilities described in Action A3.7 will provide treatment of the stormwater runoff.

Watershed Benefit: The pollutant reduction from the proposed BMP retrofits and new BMPs was quantified in the watershed model. The pollutant removal percentages for all of the proposed actions are shown for total suspended solids (TSS), total phosphorous (TP), and total nitrogen (TN) in Table 4.5.

Responsible Party: Fairfax County
Implementation Period: See the descriptions for Actions A3.6, A3.7, A3.8, and A4.1.
Capital Costs: See the descriptions for Actions A3.6, A3.7, A3.8, and A4.1.
Staff: Included in Actions A3.6, A3.7, A3.8, and A4.1.

Action C2.3: Perform additional water quality monitoring and conduct a macroinvertebrate and aquatic plant survey of South Little Hunting Creek, such as where it discharges into the Potomac and other locations in the main stem of Little Hunting Creek, in the future to get more information concerning the water quality in the tidal portion of the creek.

Strategy to Achieve Action: Work with the Virginia DEQ to perform additional water quality monitoring of South Little Hunting Creek (Map No. SLHC13), including the inflow points of the major tributaries of North Little Hunting Creek and North Branch. Monitoring data should be collected on a frequent and regular basis to evaluate the levels of fecal coliform bacteria, nutrients such as nitrogen and phosphorous, dissolved oxygen, and sediment. A macroinvertebrate and aquatic plant study will help to determine the quality of the aquatic habitat in the tidal portion of the creek. Volunteer stream monitors who are properly trained in the correct protocols may also help collect data in the tidal portion of the creek. Potential partners or sources of grant funding for the macroinvertebrate study may include the U.S. Environmental Protection Agency, Chesapeake Bay Foundation, U.S. Army Corps of Engineers, Virginia Department of Game and Inland Fisheries, and Virginia Marine Resources Commission.

Watershed Benefit: This action would allow for the evaluation and quantification of the quality of water and aquatic habitat in the watershed. This would then allow a baseline to be established to implement an action plan for the improvement of water quality and aquatic habitat. After the baseline has been established, the additional monitoring data can be used to help evaluate the health of the streams and track the progress being made by other proposed actions in the plan.

Responsible Party: Fairfax County and the Virginia Department of Environmental Quality
Implementation Period: FY 2007 - FY 2029
Capital Cost: Included in Action B2.2
Staff: 0.03 SYE

Action C2.4: Identify and investigate locations of possible illicit discharges from commercial and residential activities such as car repair and painting. Take enforcement actions to stop the identified illicit discharges.

Strategy to Achieve Action: As part of the VPDES MS-4 permit compliance activities, investigate the locations of possible illicit discharges to the streams. These locations include the area where Paul Spring Branch crosses Memorial Street (Map No. PSB22) and the potential illegal dumpsite adjacent to the Martin Luther King, Jr. Park (Map No. SLHC15). The county's Stormwater Planning Division is considered the permittee and follows up on any illicit discharges as part of its ongoing efforts to detect the presence of illicit connections and improper discharges to the storm drain system.

Watershed Benefit: This action's benefit will help reduce the current amount of pollutants resulting from illicit discharges. Stopping illicit discharges will have a direct benefit to the watershed by eliminating hazardous pollutants reaching the streams.

Responsible Party: Fairfax County
Implementation Period: Start date is unknown
Capital Cost: $1,920,000 (LH9976 Enforcement Enhancement Project includes Action D1.3)
Staff: 0.1 SYE

Action C2.5: The county and community groups should educate the public on ways to reduce the amount of pollutants in stormwater runoff.

Strategy to Achieve Action: The county and community groups should partner with state and federal agencies such as the Virginia Department of Conservation and Recreation and U.S. Environmental Protection Agency to provide educational and technical assistance to residential and commercial property owners and landscape services regarding ways to reduce pollutants in stormwater runoff. Relevant information should be posted on the county website, with references to appropriate printed material. One area that could be focused on is the application of fertilizers with information for homeowners that could be made available through local retailers. Property owners with large areas of grass should be targeted with information concerning reducing the use of herbicides, pesticides, and fertilizer.

Watershed Benefit: The potential resulting benefit would be improved water quality as a result of the community reducing pollutants in stormwater runoff.

Responsible Party: Fairfax County and community groups
Implementation Period: FY 2006 - FY 2029
Capital Cost: $60,000 per year = $1,440,000
Staff: 0.03 SYE

Objective C3: Mitigate the effects of past pollution in the watershed from pollutants such as chlordane and PCBs.

Rationale: Past pollution of the tidal portion of Little Hunting Creek with chlordane and PCBs is still apparent today. The source of this pollution is not known; however, it is not new. Little Hunting Creek is considered an impaired waterbody by Virginia DEQ due to PCBs in fish exceeding the water quality limit. Sediment samples taken in the tidal portion of the creek have had chlordane concentrations exceeding the criteria for aquatic life.

Action C3.1: The county and community should engage the U.S. Army Corps of Engineers, Virginia Marine Resources Commission, and Virginia DEQ to investigate the extent and concentrations of chlordane and PCB contamination and to aid in the restoration of water quality for the tidal portions of Little Hunting Creek (Map No. SLHC14). The feasibility of remediation will be evaluated, and at a minimum, activities that may suspend the contaminants will be restricted.

Strategy to Achieve Action: The county and community should establish partnerships with U.S. Army Corps of Engineers, Virginia Marine Resources Commission, and Virginia DEQ to perform a future evaluation of the extent of the chlordane and PCB contamination in the tidal portions of Little Hunting Creek. The potential human health risks from the existing contamination and feasibility of remediation should be evaluated. This action should be coordinated with the dredging feasibility study in Action C1.1. Post signs in prominent locations advising the public of the Virginia DEQ's health advisory for fish consumption.

Watershed Benefit: This action is required to determine the amount, extent, and impact of chlordane and PCB contamination. Establishing the amount and impact of contamination will help to determine if remediation is necessary, and if remediation is necessary, what actions would be appropriate.

Responsible Party: Fairfax County
Implementation Period: FY 2007 - FY 2008
Capital Cost: $30,000
Staff: 0.03 SYE

Goal D: Provide a means for increasing community involvement for long-term watershed stewardship.

Education and involvement in watershed issues will help drive the actions for all of the goals of this plan. The community has been involved in the process to develop the Little Hunting Creek Watershed Management Plan, and continued involvement will help improve the state of the watershed. The county will also facilitate this goal through its Community Watershed Services Support project. This program will support strategies to achieve actions A4.1, B1.2, and D3.1 by distributing educational materials to the public, providing technical assistance to the community, and assisting in conducting outreach to neighborhood groups and associations. 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.

Objective D1: Reduce the amount of trash and dumpsites in the watershed to help protect and improve the streams.

Rationale: Trash and dumpsites located in the watershed are highly visible indicators of the lack of watershed stewardship. Creating an educational campaign on the problems of trash and dumping and establishing regular volunteer cleanups will help promote a feeling of ownership of the streams.

Action D1.1: The county and community groups should partner to clean up trash, woody debris that impairs stream flow, and dumpsites at several locations in the watershed.

Strategy to Achieve Action: Partner with community groups, such as home owner associations, to clean up trash, woody debris, fallen trees, and dumpsites at several locations in the watershed. The county may need to provide assistance to volunteer groups for the removal of bulk trash items. Cleanup locations are shown on Map 4.1 at NLHC18, PSB11, and NB6.

Watershed Benefit: The benefit to the watershed for this action will be the removal of trash and debris that pollute streams; clean streams will help foster a feeling of stewardship in the watershed. This action will also provide a good opportunity for public education and outreach.

Responsible Party: Fairfax County and community groups
Implementation Period: FY 2005 - FY 2009
Capital Cost: $40,000 per year = $200,000
Staff: 0.03 SYE

Action D1.2: Conduct a vigorous public information campaign including installing signs throughout the watershed and coordinating with community groups to deter littering and trash dumping. Signs could indicate stream names, watershed boundaries, public access areas to creeks, and areas where dumping is prohibited. They should also encourage and support recycling and storm drain stenciling. The information campaign should also inform the public on the proper disposal of litter and trash and consequences of violating county ordinances.

Strategy to Achieve Action: Enhance existing public education programs on the prevention of littering and trash dumping. Information about the county's current procedures for reporting illegal dumping can be found at www.fairfax.va.us/gov/dpwes/publications/urbanfor.htm.

Install signs throughout the watershed to convey desired information, such as locations of major stream crossings. Encourage community groups to undertake storm drain stenciling projects by supplying appropriate stencils to increase the awareness of where stormwater discharges. Due to the ethnic and cultural diversity of the watershed citizens, provide public education materials and no dumping signs in languages other than English.

Watershed Benefit: This action will raise public awareness regarding the watershed and help promote a sense of responsibility and good stewardship. The benefit to the watershed will be decreased amounts of trash and debris throughout the watershed.

Responsible Party: Fairfax County
Implementation Period: FY 2006 - FY 2029
Capital Cost: Included in Action C2.5
Staff: Included in Action C2.5

Objective D2: Coordinate and enhance the efforts of state, local, and neighborhood organizations in watershed education and volunteer activities.

Rationale: Existing state, local, and neighborhood organizations participate in a variety of existing volunteer activities such as stream monitoring, stream cleanup, and education. Coordinating activities among existing organizations may help in combining resources or creating new opportunities for watershed activities.

Action D2.1: Create and administer a new small grant program to sponsor volunteer community groups in watershed stewardship and restoration activities.

Strategy to Achieve Action: Evaluate the types of groups and watershed activities that will be eligible for the small grant program and write the guidelines and evaluation criteria for the grants. Grant amounts may be in the range of $5,000 or less for volunteer watershed activities such as educational activities, buffer planting, stream cleanup, or wetland restoration. A grant coordinator should be designated within the county.

Watershed Benefit: This action will help promote positive community activities that will directly benefit the watershed.

Responsible Party: Fairfax County
Implementation Period: FY 2007 - FY 2029
Capital Cost: $20,000 per year = $460,000
Staff: 0.03 SYE per year

Action D2.2: Create and distribute brochures to describe the Little Hunting Creek Watershed Management Plan and explain what homeowners and businesses in the watershed can do to improve the streams in the watershed.

Strategy to Achieve Action: Write brochures with input from the stakeholders in the watershed and distribute them throughout the watershed. Brochures targeting residents should be prepared in other languages in addition to English to reach all residents in the watershed. One brochure should clearly describe what each individual resident can do to improve the streams in the watershed. Other brochures should be developed for homeowners to serve as informational guides and help disseminate information. An example of this type of brochure would be to discuss the benefits of geogrid and other porous pavements. An additional brochure should be developed for commercial property owners and developers. This brochure would explain the benefits of how several property owners could work together for the benefit of the watershed, such as collectively managing runoff from their properties.

Watershed Benefit: This action will help educate the stakeholders and promote activities that will directly benefit the watershed.

Responsible Party: Community groups
Implementation Period: FY 2006 - FY 2029
Capital Cost: Included in Action C2.5
Staff: Included in Action C2.5

Action D2.3: Establish a county liaison to help coordinate watershed education in schools and encourage school participation in developing and caring for county restoration projects.

Strategy to Achieve Action: A member of the county education administration should be designated as a watershed education liaison to help coordinate watershed education efforts. This individual could be a resource for teachers developing lesson plans, student conservation projects, and school participation in county-supported restoration activities. This liaison could be further supported and assisted by the Community Watershed Services Support Project.

Watershed Benefit: This action will help promote grass roots education and involvement in watershed stewardship and positive community activities that will directly benefit the watershed.

Responsible Party: Fairfax County
Implementation Period: FY 2006 - FY 2029
Capital Cost: Included in Action C2.5
Staff: Included in Action C2.5

Objective D3: Support the formation of a volunteer community organization to aid in the stewardship of the Little Hunting Creek Watershed.

Rationale: A volunteer community organization can lead the way in supporting the implementation of the Little Hunting Creek Watershed Management Plan by generating and maintaining social and political momentum for restoring Little Hunting Creek.

Action D3.1: The Little Hunting Creek Steering Committee should help in forming a community organization for the Little Hunting Creek Watershed.

Strategy to Achieve Action: The Little Hunting Creek Steering Committee should seek grants and community sponsors, such as home owner associations, to help in the formation of a volunteer community organization. The county's Community Watershed Services Support Program should also help form the community organization and could later provide support to the new organization to ensure its success. The community organization will promote stewardship of the watershed by organizing watershed activities, overseeing implementation of the watershed management plan, helping monitor the success of the plan, and creating partnerships with businesses and other organizations in the watershed, such as local schools and churches. The organization should seek to work with other existing community groups and associations and help establish representatives in areas where there are none. A funding committee within the watershed organization should also be established to coordinate grant opportunities and seek other funding sources. One of the key steps will be to hire a part-time watershed coordinator to organize the volunteer effort.

Watershed Benefit: This action is essential to the success of the watershed management plan. The community organization will be responsible for keeping the momentum of previous efforts going and ensuring that the intent of this plan is carried out.

Responsible Party: Little Hunting Creek Steering Committee
Implementation Period: FY 2005 - FY 2029
Capital Cost: $20,000 per year for 25 years = $500,000
(LH9972 Community Watershed Support Services Project)
Staff: 0.03 SYE

4.3 Benefits of Plan Actions

Hydrologic, hydraulic, and water quality models were created for the Little Hunting Creek Watershed to quantify the benefit of the plan's proposed alternatives. As a separate indicator, the U.S. Army Corps of Engineers stream attributes rating method was also used to compare existing stream conditions with anticipated improvements to the watershed as a result of plan implementation. The models and stream rating system helped to identify the following benefits to the Little Hunting Creek Watershed:

1. Reductions in peak stormwater discharges resulting in
   - Reductions in road, house, and yard flooding
   - Reductions in stream velocities and bank erosion
2. Reductions in pollutant loads resulting in improved stream water quality
3. Improved stream habitat

Future ultimate development conditions without any proposed BMP alternatives (future), and future ultimate development conditions with the proposed BMP alternatives (future proposed), were modeled to evaluate the effect of the proposed alternatives in the watershed and to allow formalization of cause and effect relationships. The future and future proposed conditions take into consideration the development of vacant parcels, redevelopment of underutilized parcels, and an approximate 19% impervious cover associated with residential parcel improvements (greater than the 18% allowed by the county for new home construction on non-bonded lots normally associated with residential infill development). These models were developed using the same foundation data and modeling guidelines and techniques outlined in Chapter 3 of this plan. Additional work to develop the models and analyze the results included the following steps:

- Delineate coverage areas for all structural BMP alternatives, including retrofitting BMPs, new BMPs, and LID practices
- Delineate coverage areas for all non-structural BMP alternatives for which quantifiable benefits could reasonably be estimated (e.g., Richmond Highway redevelopment)
- Assess water quantity and quality impacts from the proposed actions

Peak discharges for each subbasin were compared between future and future proposed conditions to evaluate the change in stormwater runoff as a result of implementing the proposed plan actions. The results are shown on Map 4.2, titled "Peak Flow Model Results – Future vs. Future Proposed." The cumulative effects of the runoff flow reduction on the downstream portions of the watershed are shown on Map 4.16. The proposed plan strategies focus on peak flow reduction for the more frequent two-year storm event by targeting strategies at headwaters to detain runoff and promote infiltration.

The result of implementing these strategies across the watershed yields a significant average peak flow percent reduction. The average peak discharge was calculated by dividing the resulting peak flow reduction from the plan strategies by the number of subbasins with proposed projects. The resulting flow reduction is approximately 14% and 13% for the two-year and 10-year peak discharges, respectively; however, this corresponds to a relatively minor reduction with respect to the overall peak discharge rate. For example, in the North Little Hunting Creek sub-basin LH-LH-0004, the future peak flow rate for a two-year rain event is 221 cfs. With a 16% reduction due to the proposed draft plan strategies, the future proposed peak flow rate for a two-year rain event is 186 cfs. The plan strategies provide a peak flow reduction benefit to their immediate area, but because the watershed is so urbanized, the reduced peak discharge rate does not have a significant impact on the watershed as a whole. For a summary of individual project peak flow reductions and the quantified benefits resulting in each watershed, as well as the total improvement to the entire watershed, please see Tables 4.1, 4.2, and 4.3. The following table summarizes the cumulative peak flow reduction benefit for the plan actions for each subwatershed. The flows presented in this table were generated from the hydraulic model since the individual peak flow reductions for each subbasin are not additive.

Table 4.4 Subwatershed Peak Flow Reduction Summary

Subwatershed	Two-Year Future Peak Flow (cfs)	Two-Year Future Proposed Peak Flow (cfs)	Two-Year Reduction in Peak Flow (%)	10-Year Future Peak Flow (cfs)	10-Year Future Proposed Peak Flow (cfs)	10-Year Reduction in Peak Flow (%)
North Little Hunting Creek	578.8	474.9	-18.0	1161.5	1000.6	-13.8
South Little Hunting Creek	72.2	69.9	-3.2	140.7	137.5	-2.3
Paul Spring	562.5	432.3	-23.1	1505.1	1011.6	-33.2
North Branch	972.0	834.5	-14.1	2115.8	1786.6	-15.6
Potomac River	N/A	N/A	N/A	N/A	N/A	N/A

The hydraulic model results were reviewed with respect to future and future proposed flow velocities in the streams, and the velocities for the two-year rainfall event for the future and future proposed conditions are shown on Map 4.3. The percent reductions in stream velocities from future to future proposed conditions are shown on Map 4.4. The changes in watershed hydraulics due to the plan strategies have reduced the stream velocities but were not intended to reduce 100-year flood limits The velocities have been reduced such that some areas would no longer experience erosion or the extent of erosion would be somewhat reduced with the proposed plan actions. The model results for the flooding limits for the two- and 10-year peak rainfall events were also evaluated, and the results for the future development conditions are shown on Map 4.5. The difference in the flooding limits for the future and future proposed conditions was very minor. The water surface elevations which determine the floodplain limits changed very little due to the proposed strategies since the existing stream geometry, according to the digital terrain model, has steep side slopes.

The target pollutant for the Chesapeake Bay protection strategy is phosphorus. For modeling purposes, the removal rate for new and retrofit BMPs was set to 40% for this constituent. However, since the entire watershed area cannot be directly treated by a BMP facility, the resulting removal rate is less than 40%. In addition to phosphorus, the most significant pollutants of concern to the Chesapeake Bay are suspended solids and nitrogen. The following table summarizes the loading rate reduction for these pollutants for each subwatershed in Little Hunting Creek, as well as the total reduction for the entire watershed.

Table 4.5 Pollutant Loading Rate Reduction

Subwatershed	Future TSS Loading Rate, lb/ac/yr	Future Proposed TSS Loading Rate, lb/ac/yr	Reduction in TSS Loading Rate, lb/ac/yr	% Decrease TSS Loading Rate	Future TP Loading Rate, lb/ac/yr	Future Proposed TP Loading Rate, lb/ac/yr	Reduction in TP Loading Rate, lb/ac/yr	% Decrease TP Loading Rate	Future TN Loading Rate, lb/ac/yr	Future Proposed TN Loading Rate, lb/ac/yr	Reduction in TN Loading Rate, lb/ac/yr	% Decrease TN Loading Rate
North Little Hunting Creek	430	368	62	14	0.518	0.448	0.070	14	4.83	4.33	0.50	10
South Little Hunting Creek	274	270	4	1	0.314	0.310	0.004	1	2.96	2.92	0.04	1
Paul Spring	327	262	65	20	0.339	0.288	0.051	15	3.69	3.37	0.32	9
North Branch	361	311	50	14	0.408	0.362	0.046	11	3.96	3.70	0.26	7
Potomac River	216	215	1	0	0.279	0.278	0.001	0	2.19	2.18	0.01	0
Little Hunting Creek Total	1608	1426	182	11	1.858	1.686	0.172	9	17.63	16.50	1.13	6

The overall watershed benefit of the proposed projects in the plan, with respect to the Chesapeake Bay Preservation Ordinance, is a reduction in total phosphorus of 9%. This has nearly the same effect as treating the entire watershed as a redevelopment project, which would generally require a reduction in phosphorus of approximately 10%. This reduction would be in addition to the benefits provided by water quality controls constructed with any actual redevelopment or new development in the watershed. Although the total future proposed pollutant loading rates for suspended solids, phosphorus, and nitrogen will still be considered poor according to the ranges discussed in Table 2.12, this is still a significant improvement over future conditions without implementation of the proposed projects in the plan.

The model result summaries for each subwatershed are provided in the following sections. To help monitor the success of the Little Hunting Creek Watershed Management Plan strategy, the hydrologic, hydraulic, and water quality models should be updated as the plan strategies are implemented.

North Little Hunting Creek Subwatershed

This subwatershed has the most significant increase in future stormwater discharge due to the potential development of vacant parcels and the increase in medium-density residential land use, especially in the area located east of Huntley Meadows Park. For this reason, multiple proposed BMPs, both structural and non-structural, are recommended for implementation as depicted on Map 4.1. The majority of these actions are proposed in the upper reaches of North Little Hunting Creek to reduce the runoff from the Richmond Highway corridor, which produces the greatest volume of runoff in the subwatershed. The result of implementing these recommendations is a significant average reduction in the subwatershed's peak discharges of 17% for the two- and 10-year storm events. The most significant reduction in peak discharge is for subbasin LH-LH-0005, which has an almost 50% decrease for the two-year storm and a 42% decrease for the 10-year storm. Changes in peak discharges between future and future proposed two-and 10-year storm events for each subbasin are shown on Map 4.2.

Velocities in North Little Hunting Creek are relatively unchanged from the future to future proposed conditions; however, several sections of high velocity have been reduced. These high flow velocities could be attributed to the high flow volumes under future proposed conditions (even though they have been reduced significantly) and the geometry of the stream. The velocity results from the modeling of the future and future proposed conditions can be seen on Map 4.3 and Map 4.4.

The two- and 10-year peak discharges for the future and future proposed conditions are almost unchanged from the existing conditions described in Chapter 3, section 3.1.6. This is due to continued high peak discharges, even though they have been significantly reduced by the future proposed plan actions and no modeled alteration of the stream geometry. The future proposed model shows some minor flooding of the Harmony Trailer Park. Improvement of the floodplain and flood reduction for the Harmony Trailer Park along North Little Hunting Creek is addressed in the proposed stream restoration activities (Map No. NLHC12 and Map No. NLHC15). There are no roadway overtopping locations for the two- or 10-year storm event for future or future proposed conditions along North Little Hunting Creek. The future proposed flooding limits for North Little Hunting Creek are shown on Map 4.5.

The future proposed water quality modeling results for the North Little Hunting Creek Subwatershed showed a 15% decrease in the pollutant loads for TSS, a 14% decrease in pollutant loads for TP, and a 13% decrease in the pollutant loads for TN. The decrease in modeled pollutant loads is due to the proposed plan actions for new BMPs, commercial and residential LID projects, redevelopment peak flow reduction, and BMP retrofits. The greatest pollutant reductions are from the LID and new BMP projects located in the commercial areas along the Route 1 corridor.

With implementation of the LID practices, new BMPs, and BMP retrofits, four of the subbasins in the North Little Hunting Creek Subwatershed along Route 1 went from poor condition to fair condition for sediment loading rates. The greatest reduction in TSS was in LH-LH-0005, which was reduced by 37%. The subbasins in the lower reaches, LH-LH-0001 and LH-LH-0002, showed little improvement in water quality since the proposed stormwater controls do not specifically target water quality improvements in those subbasins.

There was an average reduction of 9% TP in the upper reaches of the North Little Hunting Creek Subwatershed, which included the subbasins LH-LH-0007, LH-LH-0008, and LH-LH-0009. However, the implementation of the proposed BMPs did not change the condition of the area from the poor category. A large reduction in TP was seen in the Route 1 commercial area around the Mount Vernon Plaza and Hybla Valley Plaza areas, which moved the areas to either the fair or good condition.

For total nitrogen, the greatest reduction in the subwatershed occurred in subbasins LH-LH-0004 and LH-LH-0005. Combined, the proposed improvements in the two subbasins achieved a 40% removal rate for TN. Since there is only a small area covered by proposed or new detention basins, the reduction can be attributed to the reduction in flow from the commercial and high-density residential areas, which tend to have higher loading values for TN. The pollutant loading rate reductions for this subwatershed can be found in Table 4.5. The water quality results can be found in Maps 4.10, 4.11, 4.12, 4.13, 4.14, and 4.15.

South Little Hunting Creek Subwatershed

The hydraulic model for this subwatershed consists of only South Branch and not the tidal portion of Little Hunting Creek. The hydrologic model consists of the entire subwatershed area.

The peak runoff discharges for this watershed are relatively high with respect to its overall size. For this reason, only two strategies were proposed and modeled for this subwatershed. The strategies modeled were the installation of rain gardens at Fort Hunt Elementary School (Map No. SLHC3) and the retrofitting of the publicly owned dry detention BMP located opposite of 3301 Woodland Lane (Map No. SLHC6). These strategies produced minor reductions in the two-year and 10-year peak discharges of 0.1% and 0.1%, respectively. A comparison of the reduction in peak discharges between future and future proposed two-and 10-year storm events for each subbasin is shown on Map 4.2.

The velocities produced by the two-year rainfall event in South Branch are generally slow to moderate in future and future proposed conditions. The future velocities are almost unchanged for the future proposed condition, since this subwatershed was not heavily targeted for implementation of water quantity reducing actions. No significant change in stream conditions is anticipated for either future or future proposed conditions as a result of changes in stream velocities. The velocity results from the hydraulic modeling of the future and future proposed conditions can be seen on Map 4.3 and Map 4.4.

The future and future proposed floodplains for the two- and 10-year peak discharges are almost the same, and they are contained within the extended channel banks for both reaches of South Branch. Map 4.5 shows the extent of the future proposed flooding limits for South Branch.

The future proposed water quality modeling results for the South Little Hunting Creek Subwatershed showed a 1% decrease in the pollutant loads for TSS, TP, and TN. The decrease in modeled pollutant loads is minimal because there is one LID project and one BMP retrofit proposed in the plan and modeled for this subwatershed.

Paul Spring Branch Subwatershed

The upper reaches of this subwatershed are highly urbanized and the entire subwatershed has over 25% imperviousness. These characteristics translate into relatively high runoff volumes with respect to the size of the watershed. As discussed in Section 3.3.6, the future conditions in this subwatershed will result in a slight increase in impervious surfaces, which will result in minor increases in the already high stormwater peak discharges. The headwaters of Paul Spring Branch, including the Richmond Highway corridor, were targeted extensively to reduce runoff volumes. The proposed structural and non-structural BMPs for the upper portion of this subwatershed reduce the average peak discharges for LH-PSB-005, LH-PSB-006. and LH-PSB-007 for the two-year storm event by over 30% and by almost 40% for the 10-year storm event. Generally, the proposed future peak discharges for this subwatershed show significant reductions when compared to future conditions. Subwatershed-wide, there is an average 30% and 27% decrease in two- and 10-year storm event runoffs, respectively. Changes in peak discharges between future and future proposed two-and 10-year storm events for each subbasin are shown on Map 4.2.

The future proposed velocity conditions in Paul Spring Branch were very similar to the future velocity conditions with some notable improvements. Overall, the velocities were generally moderate, with some areas of high velocity, for both future and future proposed conditions. The extent of the high velocities for the future proposed condition was either eliminated or reduced significantly, and the velocities were reduced in the areas evaluated in the stream physical assessment as being highly eroded. The exception to this condition is the outlet velocity for the culvert at Mary Baldwin Drive, which is still high under future proposed conditions. Areas still experiencing high flow velocities in the future proposed model could be attributed to the high flow volumes under future proposed conditions (even though they have been reduced significantly) and the geometry of the stream. Areas of high velocity and erosion are addressed in more detail in the proposed stream restoration activities (Map No. PSB15). Map 4.3 and Map 4.4 show the velocity results from the hydraulic modeling of the future and future proposed conditions.

The changes in the existing floodplain under future and future proposed conditions are minimal. There is a slight decrease in water surface elevation for the two- and 10-year storm events and a corresponding negligible decrease in the extent of the associated floodplains. The small extent of changes in water surface elevation and floodplain extent can be attributed to steep slopes of the stream geometry. Under future and future proposed conditions, Paul Spring Road is overtopped for the two- and 10-year storm events. Mary Baldwin Drive is overtopped for the 10-year future storm event and for the future proposed condition. The replacement of these culverts is addressed in the stream restoration activities for Paul Spring Branch (Map No. PSB15). Map 4.5 shows the extent of the future proposed flooding limit for Paul Spring Branch.

The future proposed water quality modeling results for the Paul Spring Branch Subwatershed showed a 24% decrease in the pollutant loads for TSS, a 17% decrease in pollutant loads for TP, and an 11% decrease in the pollutant loads for TN. The decrease in modeled pollutant loads is due to the proposed plan actions for new BMPs; commercial, residential and institutional LID projects; and BMP retrofits. The greatest pollutant reductions are from the LID and new BMP projects.

With the large number of projects in the headwaters of the Paul Spring Subwatershed, the area has one of the greatest improvements in water quality in Little Hunting Creek. For proposed conditions, all subbasins were either in the fair or good category for TSS. One subbasin, LH-LH-0007, moved from the poor category for future conditions to fair condition due to the proposed new BMPs and LID. The largest reduction in the sediment loading rate was also found in LH-PS-0007, which achieved a 40% TSS reduction. The two subbasins LH-PS-0003 and LH-PS-0004 achieved a 21% and 34% reduction and moved to the good category for TSS due to the proposed new and retrofit BMPs.

For TP, two areas, LH-LH-0006 and LH-LH-0007, were moved from the poor category to the fair category with a reduction of 23% and 31%. With the exception of one subbasin, LH-LH-0007, the subwatershed was shown for future conditions as being in the good category for TN. By reducing the TN in LH-LH-0007 by 22%, the proposed improvements in the headwaters changed the subbasin from the fair category for future conditions to the good category.

There were minimal improvements in water quality for the two subbasins in the downstream end of Paul Spring since there were few proposed stormwater controls. The pollutant loading rate reductions for this subwatershed can be found in Table 4.5. The water quality results can be found on Maps 4.10, 4.11, 4.12, 4.13, 4.14, and 4.15.

North Branch Subwatershed
The potential future development in this watershed will result in a slight overall increase in impervious surfaces, as future land uses are almost exclusively medium-density residential and low-intensity commercial. This potential future development will produce peak discharges for the two- and 10-year rainfall events that are slightly higher than they are for existing conditions. The majority of the entire northern portion of this subwatershed was targeted for structural BMP improvements, which corresponds directly to areas of higher existing and future development density. When compared to future conditions, the average future proposed peak flow rates for the two- and 10-year rainfall events were reduced by 13% and 11%, respectively. The most significant decrease in peak discharges was LH-NB-0011, which realized a 40% reduction with implementation of all the proposed BMP alternatives. The reduction in peak discharges between future and future proposed two-and 10-year storm events for each subbasin are shown on Map 4.2.

The velocities produced by the two-year rainfall event in North Branch are virtually unchanged between the future and future proposed conditions. No erosion or head cuts were observed in North Branch during the stream physical assessment, but the hydraulic modeling shows high velocity conditions for the culvert crossing at Sherwood Hall Lane. These high velocities will be addressed as part of the proposed stream restoration activities for North Branch (Map No. NB7). Future and future proposed velocity conditions as calculated in the hydraulic model are shown on Maps 4.3 and 4.4.

The changes in the existing floodplain for North Branch under future and future proposed conditions are very small. There is generally a slight decrease in water surface elevation for the two- and 10-year storm events and a corresponding negligible decrease in the extent of the associated floodplain. The small extent of changes in water surface elevation and floodplain extent can be attributed to steep slopes of the stream geometry. There are no roadway overtopping locations for the two- or 10-year storm event for future or future proposed conditions along any reach of North Branch. The future proposed flooding limits for North Branch are shown on Map 4.5.

The future proposed water quality modeling results for the North Branch Subwatershed showed a 14% decrease in the pollutant loads for TSS, a 9% decrease in pollutant loads for TP, and a 7% decrease in the pollutant loads for TN. The decrease in modeled pollutant loads is due to the proposed plan actions for new BMPs, residential and institutional LID projects, and BMP retrofits. The greatest pollutant reductions are from the LID and new BMP projects.

For TSS, all subbasins, with the exception of one, were identified as being in the fair category for future proposed conditions. Subbasin LH-NB-0011, which includes the Hollin Hills area, contained the largest number of proposed improvements and correspondingly showed a large decrease in sediment loading. Subbasins LH-NB-0003 and LH-NB-0005, which are in the area around Mount Vernon Hospital, each contain a large number of proposed new or retrofit BMP projects and each has a 15% reduction in TSS. Subbasins LH-NB-0003 and LH-NB-0004 improved to the fair category due to the proposed LID demonstration projects at Carl Sandburg and Walt Whitman Middle Schools and the retrofit BMPs at Mount Vernon Hospital and in the neighborhood off Lakeshire Drive.

For TP, three subbasins changed from poor to good. The only subbasin that did not improve was LH-NB-0007, in the Hollin Hall and Wellington neighborhoods, which has a high residential development area, a commercial area, and few proposed stormwater controls.

The pollutant loading rate reductions for this subwatershed can be found in Table 4.4. The water quality results can be found in Maps 4.10, 4.11, 4.12, 4.13, 4.14, and 4.15.

Potomac River Subwatershed

No hydraulic modeling was performed for the small streams located in the Potomac River Subwatershed. However, watershed hydrology was evaluated and peak discharges were estimated.

The existing hydrology developed for this subwatershed produced stormwater runoff that is moderate with respect to the size of the watershed, and the future land use is planned to be medium-density residential, which will produce minor increases in peak discharges. For this reason, only one strategy was proposed and modeled for this subwatershed—to construct a LID demonstration project at Waynewood Elementary School (Map No. PR3). These strategies produced minor reductions of 0.4 for both the two- and 10-year peak discharges. Changes in peak discharges between future and future proposed two- and 10-year storm events for each subbasin are shown on Map 4.2.

The future proposed water quality modeling results for the Potomac River Subwatershed showed a 0.4% decrease in the pollutant loads for TSS and for TN and a 0.3% decrease in pollutant loads for TP. The decrease in modeled pollutant loads due to the plan actions is minimal because there is only one LID project, PR3, proposed in this subwatershed at Waynewood Elementary School.

Stream Habitat Improvements

The U.S. Army Corps of Engineers stream attributes rating method[1] was used to compare existing stream conditions with anticipated improvements to the watershed as a result of plan implementation. The following parameters are considered in this rating system:

1. Channel Incision: The degree to which the channel has downcut or is incised in its floodplain
2. Riparian Condition: Riparian corridor width
3. Bank Erosion: The amount of bank erosion
4. Channelization: Whether or not the stream has been channelized
5. In-stream Habitat: The amount and condition of in-stream habitat

The index values range from 1 (lowest score) to 5 (highest score). By applying the 2003 Stream Physical Assessment habitat-related data to the methodology, the overall existing stream condition index for Little Hunting Creek is 2.86. For comparison, the countywide reach-length weighted stream index is 3.49. Based on complete implementation of the stream and tree buffer restoration projects proposed in the watershed plan, the overall Little Hunting Creek stream index is projected to be 3.51. It is anticipated that the corresponding measurable improvement for Little Hunting Creek would be for the stream physical assessment total habitat rating to shift from the "poor" category to the high range of the "fair" category. It must be emphasized that this rating system only applies to stream habitat conditions. Direct water quality and quantity improvements realized as a result of implementation of other watershed plan recommendations (i.e. excluding the stream and tree buffer restoration projects) are not reflected in this stream habitat rating.

4.4 Implementation of Plan Actions

The recommended plan actions described in Section 4.2 will be implemented over the 25-year life of the Little Hunting Creek Watershed Management Plan. This plan should serve as guidance for all county agencies and officials to steer and determine the development and redevelopment within the watershed. The plan should also be implemented as an active document. That is to say that as projects are implemented or over a periodic cycle of five years, the implementation schedule should be updated to reflect plan changes. The initial implementation schedule was developed as described below.

The first step in developing a logical and feasible implementation schedule was to provide a prioritization of the actions to evaluate how well they met the plan goals. The objective of the prioritization was to determine which actions best meet the goals of the plan, and the Little Hunting Creek Steering Committee used this information to help prepare the implementation schedule. The following prioritization criteria were used:

1. Peak flow reduction: This criterion describes how much runoff is reduced by the action.
2. Habitat benefit: This criterion describes the amount and type of habitat that is improved or created by the action.
3. Water quality improvement: This criterion describes the amount of water quality improvement.
4. Promotion of watershed stewardship: This criterion describes the amount of community involvement and increase in stakeholder watershed ownership.
5. Cost: This criterion describes the cost or cost versus benefit of the action.

The actions in the plan were scored from 1 to 5 for each of the prioritization criteria, with 5 as the best score and 1 as the worst score. The information that was used to score the actions according to the criteria included quantitative and qualitative information. The quantitative data that was used in the prioritization scoring included the amount of peak flow reduction, size of the existing or proposed drainage area, size of the project such as linear feet of proposed stream restoration, reach habitat score, estimated cost, or estimated benefit versus the cost. As an example of how this data was used, a stream restoration project that restored 1,000 feet of stream with a poor habitat score would be scored higher than a stream restoration project that restored 1,000 feet of stream with a fair habitat score. For those actions with no quantitative data, a qualitative assessment of how well an action would meet the criteria was performed. For example, how well a public education program would motivate stakeholders to perform an action to benefit the watershed.

The reduction of peak flows throughout the watershed is one of the primary goals of the plan and peak flow reduction criteria was weighted at 40% to reflect a greater need to have actions that mitigate the effects of the increased runoff from existing and proposed imperviousness. With this focus in mind, projects that targeted the headwaters of the subwatersheds were given higher scores, since they would provide a more significant peak flow reduction benefit. All the other criteria were weighted at 15% and a total score was given for each action.

The highest score overall score that could be achieved is 5 and the lowest score that could be achieved is 1. The actions were ranked according to their total score. Some of the actions described in Section 4.2 were evaluated as stand-alone capital improvement plan projects such as BMP retrofits, new BMPs, and stream restoration. Other actions that are similar in nature were grouped together as shown in Table 4.6. The policy actions were ranked separately from the capital improvement program actions and are included in Chapter 5.

Table 4.6 Prioritization of Proposed Actions

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Cost or Cost/ Benefit	Total Score
Weighting Factor	40%	15%	15%	15%	15%	
Capital Improvement Program Projects						
New BMP PSB27	5	3	5	4	5	4.55
New BMP PSB29	5	3	5	4	5	4.55
New BMP NB11	5	3	5	4	5	4.55

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Cost or Cost/ Benefit	Total Score
Weighting Factor	40%	15%	15%	15%	15%	
New Commercial LID NLHC9	5	3	5	3	5	4.4
New BMP PSB32	5	3	5	4	4	4.4
New BMP NLHC20	5	3	5	3	5	4.4
Retrofit BMP PSB7	5	3	4	3	5	4.25
New BMP NLHC1	5	3	4	5	3	4.25
New BMP NLHC19	5	3	5	3	4	4.25
New School LID NB1	5	3	5	4	3	4.25
New BMP PSB30	5	3	4	3	4	4.1
New BMP PSB24	5	3	4	3	3	3.95
New BMP NB14	5	2	4	2	5	3.95
New BMP PSB25	4	3	4	3	4	3.7
New BMP NB12	4	3	4	3	3	3.55
Community Watershed Support Services Project: A4.2, B1.2, D3.1	3	3	2	5	5	3.45
Retrofit BMP PSB4	4	2	3	3	4	3.4
New BMP PSB31	4	3	4	2	3	3.4
New BMP PSB26	4	2	4	2	4	3.4
Wetland Restoration PR2	3	5	4	2	3	3.3
New Comm./Instit. LID PSB2	4	2	3	4	2	3.25
New BMP NLHC24	4	3	4	2	2	3.25
New BMP PSB28	4	2	3	2	4	3.25
Buffer Restoration NLHC11	1	5	4	5	5	3.25
New Commercial LID PSB1	4	3	4	3	1	3.25
New School LID NLHC21	3	3	5	4	1	3.15
New BMP NB13	4	2	2	3	3	3.1
New School LID SLHC3	4	2	3	3	2	3.1
Retrofit BMP NLHC4	4	2	1	1	5	2.95
Public Education Project: B3.5, C2.5, D1.2, D2.2, D2.3	2	2	2	5	5	2.9
North Little Hunting Creek Residential Rain Barrel and Rain Garden: A4.1	3	1	2	5	3	2.85
Paul Spring Branch Residential Rain Barrel and Rain Garden: A4.1	3	1	2	5	3	2.85

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Cost or Cost/ Benefit	Total Score
Weighting Factor	40%	15%	15%	15%	15%	
North Branch Rain Barrel and Rain Garden: A4.1	3	1	2	5	3	2.85
Retrofit BMP NB2	3	3	5	2	1	2.85
Buffer Restoration SLHC7	1	4	3	4	5	2.8
Conservation Acquisition Project: B2.3, B3.3	1	4	3	4	5	2.8
Wetland Restoration SLHC11	2	4	4	2	3	2.75
Wetland Restoration PSB9	2	4	4	2	3	2.75
New School LID PR3	3	1	2	3	4	2.7
New BMP NLHC23	3	3	3	2	2	2.7
Inspection Enhancement Project: A3.1	3	2	3	2	3	2.7
Enforcement Enhancement Project: C2.4, D1.3	1	3	5	4	3	2.65
Buffer Restoration SLHC6	1	3	3	4	5	2.65
Buffer Restoration PSB14	1	3	3	4	5	2.65
Dumpsite Removal Project: D1.1	1	3	3	5	4	2.65
Retrofit BMP NLHC6	3	2	2	3	2	2.55
Retrofit BMP PSB23	3	1	2	1	5	2.55
New BMP NLHC16	3	2	2	2	3	2.55
Stream Restoration NLHC14	1	4	3	4	3	2.5
Buffer Monitoring Project: B1.3	1	4	3	3	4	2.5
Sediment Monitoring/ Stream Physical Assessment/Monitoring Project: B2.2, C2.3	1	4	3	3	4	2.5
Wetlands Survey Project: B3.1	1	4	3	2	5	2.5
Stream Restoration NLHC12	1	5	3	4	2	2.5
Stream/Buffer Restoration NLHC15	1	5	3	4	2	2.5
Stream Restoration SLHC5	1	5	3	4	2	2.5
Retrofit BMP NLHC5	3	1	3	2	2	2.4
Retrofit BMP NB9	3	2	3	1	2	2.4

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Cost or Cost/ Benefit	Total Score
Weighting Factor	40%	15%	15%	15%	15%	
Small Watershed Grant Program: D2.1	1	2	2	5	4	2.35
Stream Restoration SLHC9	1	4	3	4	2	2.35
Stream Restoration PSB15	1	5	3	4	1	2.35
Stream Restoration NB7	1	4	3	4	2	2.35
Retrofit BMP PSB3	2	2	1	3	4	2.3
Retrofit BMP NB3	2	2	2	3	3	2.3
New BMP NLHC17	3	1	2	2	2	2.25
Wetland Restoration PSB10	1	3	4	2	3	2.2
Wetland Restoration SLHC17	1	3	4	3	2	2.2
Street Sweeping Program: C1.2	1	2	5	2	3	2.2
Fecal Coliform Source Study Project: C2.1	1	2	5	2	3	2.2
PCB Contamination Study Project: C3.1	1	3	4	2	3	2.2
Stream Restoration PSB13	1	4	3	4	1	2.2
Stormwater Infrastructure Condition Assessment	2	2	2	2	3	2.15
Retrofit BMP PSB8	3	1	1	1	3	2.1
Buffer Restoration PSB12	1	2	1	3	5	2.05
Stream Restoration SLHC4	1	3	3	4	1	2.05
Stream Restoration NLHC13	1	3	1	3	3	1.9
Stream Restoration PSB16	1	2	1	3	4	1.9
Stream Restoration PSB19	1	2	1	3	4	1.9
Stream Restoration PSB20	1	2	1	3	4	1.9
Retrofit BMP PSB5	2	1	1	1	4	1.85
Retrofit BMP PSB6	2	2	1	1	3	1.85
Retrofit BMP NB5	2	2	3	1	1	1.85
Buffer Restoration SLHC8	1	1	1	3	4	1.75
Stream Restoration NB8	1	2	1	3	3	1.75
Retrofit BMP NLHC2	2	1	2	1	2	1.7
Retrofit BMP SLHC16	2	1	1	3	1	1.7
Stream Restoration PSB18	1	1	1	3	3	1.6
Retrofit BMP NB4	2	2	1	1	1	1.55
Flood-Proof Dwellings: A3.12	2	1	1	1	2	1.55

Stream Restoration PSB17	1	1	1	3	2	1.45
Retrofit BMP NLHC3	2	1	1	1	1	1.4
Retrofit BMP NB10	2	1	1	1	1	1.4
Enforcement Enhancement: C2.4, D1.3	1	2	2	2	1	1.45
Dredging Feasibility Study Project: C1.1	1	1	1	2	2	1.3

Some of the actions in the implementation plan were scheduled by the Steering Committee according to the following important factors in addition to the prioritization rating:

- Logical progression of actions such as starting upstream headwater flow reduction actions before downstream stream restoration actions
- High visibility and chance for early success of an action, such as implementing LID at Beacon Mall
- Community support for an action such as the dredging feasibility study
- Spreading of actions throughout the watershed during the plan period and not concentrating early actions only in one area

The capital improvement program projects implementation plan is shown in Table 4.7. The timeline for implementation is shown on Figure 4.1. The dates for implementation shown in the plan are target dates subject to county funding approval and ongoing updates to the plan. Map 4.17 shows the implementation periods for the CIP projects that have specific locations. The projects that are watershed-wide are not shown on Map 4.17.

Table 4.7 Capital Improvement Program Projects Implementation[2]

Plan Map No.	County CIP Project No.	Project Description	Fiscal Year Start	Fiscal Year End	Estimated Cost
NB11	LH9143	New BMP	2005	2006	$240,000
PSB25	LH9154	New BMP	2005	2006	$240,000
PSB1	LH9855	New Commercial LID	2005	2007	$610,000
PSB8	LH1945	Retrofit BMP	2005	2007	$60,000
N/A	LH9972	Community Watershed Support Services Project: A4.2, B1.2, D3.1	2005	2029	$1,000,000
N/A	LH9977	Dumpsite Removal Project: D1.1	2005	2009	$200,000
N/A	LH9982	North Little Hunting Creek Residential Rain Barrel and Rain Garden: A4.1	2005	2029	$40,000
N/A	LH9983	Paul Spring Branch Residential Rain Barrel and Rain Garden: A4.1	2005	2029	$60,000
N/A	LH9984	North Branch Rain Barrel and Rain Garden: A4.1	2005	2029	$70,000
PSB32	LH9156	New BMP	2006	2007	$600,000
NLHC1	LH9139	New BMP	2006	2007	$430,000
NLHC20	LH9144	New BMP	2006	2007	$260,000
PSB24	LH9153	New BMP	2006	2007	$240,000
NLHC23	LH9140	New BMP	2006	2008	$110,000

Plan Map No.	County CIP Project No.	Project Description	Fiscal Year Start	Fiscal Year End	Estimated Cost
PSB31	LH9168	New BMP	2006	2008	$140,000
NLHC16	LH9138	New BMP	2006	2008	$130,000
NLHC21	LH9871	New School LID	2006	2008	$250,000
NLHC17	LH9137	New BMP	2006	2008	$110,000
PSB2	LH9828	New Comm./Instit. LID	2006	2009	$520,000
N/A	LH9973	Public Education Project: B3.5, C2.5, D1.2, D2.2 , D2.3	2006	2029	$1,440,000
N/A	LH9985	Wetlands Survey Project: B3.1	2007	2008	$320,000
N/A	LH9987	PCB Contamination Study Project: C3.1	2007	2008	$30,000
NB1	LH9111	New School LID	2007	2008	$580,000
NB14	LH9116	New BMP	2007	2008	$160,000
NLHC9	LH9819	New Commercial LID	2007	2009	$590,000
N/A	LH9986	Fecal Coliform Source Study Project: C2.1	2007	2009	$320,000
PSB29	LH9147	New BMP	2007	2009	$260,000
N/A	LH9974	Conservation Acquisition Project: B2.3, B3.3	2007	2011	$200,000
N/A	LH9979	Sediment Monitoring/Stream Physical Assessment/Monitoring Project: B2.2,	2007	2029	$200,000
N/A	LH9980	Small Watershed Grant Program: D2.1	2007	2029	$460,000
N/A	LH9978	Buffer Monitoring Project: B1.3	2007	2029	$345,000
N/A	LH9981	Street Sweeping Program: C1.2	2007	2029	$460,000
NB12	LH9142	New BMP	2008	2009	$200,000
PSB26	LH9165	New BMP	2008	2009	$150,000
PSB4	LH9132	Retrofit BMP	2008	2009	$110,000
PSB30	LH9150	New BMP	2008	2010	$210,000
NLHC24	LH9141	New BMP	2009	2010	$170,000
PSB7	LH9152	Retrofit BMP	2009	2010	$110,000
PSB15	LH9264	Stream Restoration	2010	2024	$2,620,000
N/A	LH9988	Dredging Feasibility Study Project: C1.1	2010	2014	$510,000
NB13	LH9126	New BMP	2010	2014	$150,000
NB2	LH9125	Retrofit BMP	2010	2014	$250,000
NLHC11	LH9320	Buffer Restoration	2010	2014	$400,000
NLHC14	LH9234	Stream Restoration	2010	2014	$350,000
NLHC19	LH9136	New BMP	2010	2014	$210,000
NLHC4	LH9122	Retrofit BMP	2010	2014	$30,000
NLHC6	LH9117	Retrofit BMP	2010	2014	$70,000
PR2	LH9706	Wetland Restoration	2010	2014	$200,000
PR3	LH9812	New School LID	2015	2019	$80,000

Plan Map No.	County CIP Project No.	Project Description	Fiscal Year Start	Fiscal Year End	Estimated Cost
NLHC6	LH9117	Retrofit BMP	2010	2014	$70,000
PR2	LH9706	Wetland Restoration	2010	2014	$200,000
PR3	LH9812	New School LID	2015	2019	$80,000
PSB14	LH9331	Buffer Restoration	2015	2019	$30,000
PSB27	LH9166	New BMP	2015	2019	$100,000
PSB28	LH9167	New BMP	2015	2019	$70,000
PSB9	LH9748	New Wetland BMP	2015	2019	$230,000
SLHC11	LH9708	Wetland Restoration	2015	2019	$390,000
SLHC17	LH9790	Wetland Restoration	2015	2019	$230,000
SLHC3	LH9804	New School LID	2015	2019	$270,000
SLHC6	LH9301	Buffer Restoration	2015	2019	$20,000
SLHC7	LH9305	Buffer Restoration	2015	2019	$40,000
NB3	LH9114	Retrofit BMP	2015	2019	$60,000
NB7	LH9227	Stream Restoration	2015	2019	$390,000
NB9	LH9115	Retrofit BMP	2015	2019	$90,000
NLHC12	LH9235	Stream Restoration	2015	2019	$800,000
NLHC15	LH9218	Stream/Buffer Restoration	2020	2024	$820,000
NLHC2	LH9121	Retrofit BMP	2020	2024	$90,000
NLHC5	LH9124	Retrofit BMP	2020	2024	$110,000
PSB10	LH9751	New Wetland BMP	2020	2024	$200,000
PSB3	LH9159	Retrofit BMP	2020	2024	$50,000
PSB5	LH9157	Retrofit BMP	2020	2024	$60,000
PSB6	LH9158	Retrofit BMP	2020	2024	$70,000
SLHC5	LH9204	Stream Restoration	2020	2024	$560,000
SLHC9	LH9203	Stream Restoration	2020	2024	$230,000
NB10	LH9113	Retrofit BMP	2020	2024	$30,000
NB4	LH9109	Retrofit BMP	2020	2024	$80,000
NB5	LH9110	Retrofit BMP	2020	2024	$90,000
NB8	LH9270	Stream Restoration	2020	2024	$110,000
NLHC13	LH9233	Stream Restoration	2025	2029	$150,000
NLHC3	LH9123	Retrofit BMP	2025	2029	$60,000
PSB12	LH9360	Buffer Restoration	2025	2029	$20,000
PSB13	LH9230	Stream Restoration	2025	2029	$1,370,000
PSB16	LH9263	Stream Restoration	2025	2029	$100,000
PSB17	LH9249	Stream Restoration	2025	2029	$40,000
PSB18	LH9229	Stream Restoration	2025	2029	$100,000
PSB19	LH9262	Stream Restoration	2025	2029	$100,000
PSB20	LH9269	Stream Restoration	2025	2029	$100,000
PSB23	LH9146	Retrofit BMP	2025	2029	$80,000

Plan Map No.	County CIP Project No	Project Description	Fiscal Year Start	Fiscal Year End	Estimated Cost
SLHC16	LH9100	Retrofit BMP	2025	2029	$60,000
SLHC4	LH9207	Stream Restoration	2025	2029	$200,000
SLHC8	LH9302	Buffer Restoration	2025	2029	$150,000
N/A	LH9975	Inspection Enhancement Project: A3.1[3]	—	2029	$200,000
N/A	LH9976	Enforcement Enhancement Project: C2.4, D1.3[4]	—	2029	$1,920,000
N/A	LH9989	Stormwater Infrastructure Condition Assessment A3.11[3]	—	2029	$216,000

The 25-year estimated funding requirements for all the structural and non-structural recommended actions is $26.6 million, and the breakdown of funding requirements for each five-year period of the plan is shown in Table 4.7. The cost estimates and location maps for the recommended CIP projects are provided in the project fact sheets in Appendix C.

Table 4.8 Funding Requirements

Fiscal Year Period	Estimated Funding Requirements
FY2005 - FY2009	$8,525,000
FY2010 - FY2014	$4,308,000
FY2015 - FY2019	$5,085,000
FY2020 - FY2024	$4,785,000
FY2025 – FY2029	$3,879,000
Total Structural and Non-Structural Action Cost	**$26,582,000**

4.5 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 because of a low success rate or as watershed conditions change.

Action A3.6: Retrofit suitable existing stormwater management facilities and BMPs to make them more effective. Retrofitting these facilities is intended to meet the goals and objectives of this plan which will exceed the performance criteria or standards that were used to design the facility.

MONITOR: Number of retrofit projects implemented and reductions in peak flows from existing facilities

TARGET: Construct the following number of retrofit projects for each five-year period.

- Three retrofit projects for FY 2005 to FY 2009
- Three retrofit projects for FY 2010 to FY 2014
- Two retrofit projects for FY 2015 to FY 2019

Action A3.7: Construct new public BMPs, including LID practices, to detain the runoff from existing surrounding development without current stormwater management controls.

MONITOR: Number of new public BMPs with LID practices installed in headwaters on sites without BMPs

TARGET: Construct the following number of new public BMP projects for each five-year period.

- 16 new BMPs for FY 2005 to FY 2009
- Two new BMPs for FY 2010 to FY 2014
- Two new BMPs for FY 2015 to 2019

Achieve projected peak flow reductions for the two-year storm (see Table 4.2).

Action A3.8: Construct LID demonstration projects at publicly owned locations such as schools, parks, and other county properties.

MONITOR: Number of public demonstrations of LID projects installed

TARGET: Install a LID project at 10% of the public facility locations each year for 100% participation within 10 years, and achieve two-year storm projected peak flow reduction (see Table 4.3).

Action A4.1: Facilitate and provide technical assistance for the construction of LID practices such as rain gardens, cisterns, and rain barrels throughout the watershed, initially targeting areas near the headwaters of streams to detain the runoff from residential developments without existing stormwater management controls.

MONITOR: Percentage of households within the targeted watershed participating in rain barrels and/or rain garden installation, percentage of rain barrels and rain gardens functioning and maintained after five years

TARGET: An average 10% implementation rate with four rain barrels or one rain garden at each participating property. See Map 4.1 for the targeted neighborhoods.

Action A4.2: Implement a watershed-wide rain barrel sale project.

MONITOR: Number of residents purchasing and installing rain barrels, percentage of rain barrels functioning and maintained after five years

TARGET: One-hundred rain barrels sold/distributed each year.

Action B1.1: Plant buffers using native vegetation and trees adjacent to the stream for areas identified as good candidates for buffer restoration.

MONITOR: Amount of new or restored buffer created in the watershed

TARGET: Construction of the following buffer restoration projects in the watershed:

- One project with 16,000 linear feet of buffer restoration in the North Little Hunting Creek Subwatershed
- Three projects with a total of 3,200 linear feet of buffer restoration in the South Little Hunting Creek Subwatershed
- Two projects with a total of 1,900 linear feet of buffer restoration in the Paul Spring Branch Subwatershed.

50% decrease in assessed buffers with a poor rating (baseline amount is 52%) by FY 2024, and 100% of buffers restored in 25 years.

Action B1.2: The county and community groups should provide educational and technical assistance to property owners with tidal shoreline and 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, limiting the use and correct application of fertilizers and herbicides, pet waste management, waste disposal, and proper disposal of leaves and grass clippings.

MONITOR: Number of residents requesting technical assistance and development and distribution of educational materials, number of miles of undeveloped buffers lost to development

TARGET: 5% of property owners requesting or receiving technical assistance to manage buffers each year.

Action B1.3: Monitor the condition of restored and existing riparian buffers with annual stream walks to evaluate the condition and areas needing improvement.

MONITOR: Length of stream buffer assessed

TARGET: 20% of the total length of stream buffers evaluated by citizen volunteers or the county every five years.

Action B2.1: The county and community groups should perform stream restoration projects in the areas identified as good candidates for these types of projects.

MONITOR: Percentage of stream corridors where condition of stream habitat is very poor or poor (baseline is 58% poor and 15% very poor), amount of stream restoration, for in-stream projects, monitor benthic invertebrates to assess habitat quality using county staff and volunteer stream monitors

TARGET: Construction of the following stream restoration projects:

- Four stream restoration projects with a total of 8,200 linear feet in the North Little Hunting Creek Subwatershed
- Three stream restoration projects with a total of 5,100 linear feet in the South Little Hunting Creek Subwatershed

- Seven stream restoration or bank stabilization projects with a total of 12,100 linear feet in the Paul Spring Branch Subwatershed
- Two stream restoration projects with a total of 3,200 linear feet in the North Branch Subwatershed

30% reduction in amount of stream habitat rated very poor by FY 2019, and 50% of streams achieving higher water quality rating from baseline by FY 2019.

Action B2.2: Monitor the condition of the streams by performing a stream physical assessment every five years in the future to track the improvement or degradation of streams from the baseline condition.

MONITOR: Length of streams assessed

TARGET: Implement stream monitoring and assessment program to include smaller streams (as shown by PR1 on Map 4.1) by FY 2007.

Assess 20% of the stream length every year and repeat the stream assessment cycle for the life of the plan and beyond.

Action B2.3: Facilitate the acquisition and donation of conservation easements by community groups for riparian buffers, stream protection, and public/private open space for the environmental quality corridors described in the Fairfax County Comprehensive Plan.

MONITOR: Number and acreage of new riparian conservation easements recommended on Map 4.1 and along Stockton Parkway, condition of easements over time

TARGET: Acquire conservation easements for all stream corridors and creek buffer areas not covered by existing easements by FY 2024.

Action B3.1: Perform a wetlands function and value survey to identify the location, size, owner, type, and quality of existing wetlands in the watershed to determine the baseline information.

MONITOR: Performance of wetlands function and value survey

TARGET: Identify the location, size, owner, type, and quality of existing wetlands of wetlands in the watershed by FY 2008, and catalog the wetlands with the greatest potential for restoration by FY 2008.

Action B3.2: Construct and restore wetlands at suitable locations in the watershed as identified by the wetlands function and value survey in Action B3.1.

MONITOR: Number and acreage of new and restored wetlands and restored functions and values for locations identified in the watershed plan, number of wetland acreage lost through dredging/filling, and condition and percentage change of wetland acreage over time.

TARGET: Construct the wetland projects described in the plan, and double the amount of new or restored acres of wetlands by FY 2020.

Action B3.3: Purchase private land, designate public land, or acquire easements for land conservation of critical wetland habitat areas as identified in the wetlands function and value survey in Action B3.1.

MONITOR: Number and acreage of critical wetland habitat area protected, and condition of wetland habitat over time

TARGET: 10% of new total wetland acreage protected every five years.

Action B3.5: Create and distribute a brochure or other materials that inform the public about the value and benefit of wetlands.

MONITOR: Development of a county wetlands brochure and distribution of information about wetlands to the public

TARGET: Create county wetlands brochure by FY 2008, and 5% of property owners receiving information about wetlands each year.

Action C1.1: Perform a hydrographic survey in the future to determine the existing depths in South Little Hunting Creek and initiate a study to determine where dredging to restore the navigation channel in the tidal portion of the creek and access from the shoreline may be feasible.

MONITOR: Implementation of hydrographic study

TARGET: Study to take place between FY 2010 and FY 2014.

Action C1.2: The county, community groups, and commercial property owners should sweep up sand used for traction control on Richmond Highway and other major streets and parking areas in the watershed during the winter to prevent it from reaching the creek. Limit the use of certain de-icing materials, especially those that greatly impair water quality.

MONITOR: Implementation of street sweeping program in neighborhoods and reduction in total suspended solids in streams

TARGET: One new neighborhood street sweeping program every two years and ongoing implementation of past projects, and a 10% reduction in total suspended solids.

Action C2.1: Initiate a future project to identify the sources of fecal coliform in the watershed that may be from humans, domesticated animals, or wildlife, and prepare an action plan to address the reduction of fecal coliform.

MONITOR: Monitor sources of fecal coliform to establish baseline, and track development and implementation of TMDL remediation plan to reduce or eliminate fecal coliform

TARGET: Meet state water quality standards for fecal coliform by TMDL plan date.

Action C2.2: Install BMPs or enhance the performance of existing BMPs at selected locations to reduce the nitrogen and phosphorous pollutant loading from existing developments that currently have no water quality treatment. This action should be performed in conjunction with actions identified under Objectives A3 and A4.

MONITOR: Track development and implementation of new BMPs or retrofit BMPs under actions A3.6, A3.7, A3.8m and A4.1

TARGET: The pollutant reduction from the BMP retrofits and new BMPs was quantified in the watershed model. See Table 4.4 for the pollutant removal percentages for all of the proposed actions for TSS, TP, and TN.

Action C2.3: Perform additional water quality monitoring and conduct a macroinvertebrate and aquatic plant survey of South Little Hunting Creek, such as where it discharges into the Potomac and other locations in the main stem of Little Hunting Creek, in the future to get more information concerning the water quality in the tidal portion of the creek.

MONITOR: Benthic invertebrates to indicate habitat quality and hydric and submerged vegetation for types and percentages indigenous species

TARGET: Significant improvement (or rating change) from baseline condition (e.g. fair to good).

Action C2.4: Investigate and identify locations of possible illicit discharges from commercial and residential activities such as car repair and painting. Take enforcement action to stop the identified illicit discharges.

MONITOR: Number and locations of illicit discharges (beginning with those identified in the watershed plan) and number and type of enforcement actions

TARGET: 100% of illicit discharges stopped.

Action C2.5: The county and community groups should educate the public on ways to reduce the amount of pollutants in stormwater runoff.

MONITOR: Number of residents requesting technical assistance and development and distribution of educational materials

TARGET: 10% of property owners requesting or receiving technical assistance to manage yards/properties.

Action C3.1: The county and community should engage the U.S. Army Corps of Engineers, Virginia Marine Resources Commission, and Virginia DEQ to investigate the extent and concentrations of chlordane and PCB contamination and to aid in the restoration of water quality for the tidal portions of Little Hunting Creek (Map No. SLHC14). The feasibility of remediation will be evaluated, and at a minimum, activities that may suspend the contaminants will be restricted.

MONITOR: Extent and concentrations of PCBs and chlordane in sediments and fish

TARGET: Complete the study by FY 2008 and mitigate the PCBs and chlordane by FY 2029.

Action D1.1: The county and community groups should partner to clean up trash, woody debris that impairs stream flow, and dumpsites at several locations in the watershed.

MONITOR: Number of linear feet of streams cleaned (cleanup locations are shown on Map 4.1 at NLHC18, PSB11, and NB6) and/or tons of trash removed each year and percentage change from year to year, and number of people participating in cleanup activities each year

TARGET: Cleanup of trash and dumpsites by FY 2009 and reduction in pounds of trash picked up per year by 70%.

Action D1.2: Conduct a vigorous public information campaign, including installing signs throughout the watershed, and coordinate with community groups to deter littering and the dumping of trash. Posted signs could indicate information such as stream names, watershed boundaries, public access areas to creeks, and areas where dumping is prohibited. They should also encourage and support recycling and storm drain stenciling. The information campaign should also inform the public on the proper disposal of litter and trash and consequences of violation of county ordinances.

MONITOR: Number and locations of educational signs and stencils and number of illegal dumping reports received by the county

TARGET: Install educational signs and stencils by FY 2008, and reduce the number of illegal dumping reports received by 50%.

Action D2.1: Create and administer a new small grant program to sponsor volunteer community groups in watershed stewardship and restoration activities.

MONITOR: Number of residents requesting grants for watershed stewardship activities and types of projects implemented

TARGET: Five watershed stewardship projects initiated each year.

Action D2.2: Create a brochure to describe the Little Hunting Creek Watershed Management Plan and explain what homeowners and businesses in the watershed can do to improve the streams in the watershed. Create brochures for homeowners and businesses to provide information on how they can specifically help reduce peak flows in the Little Hunting Creek Watershed.

MONITOR: Number of watershed brochures distributed

TARGET: 500 watershed brochures distributed each year with success indirectly measured by increased participation in watershed plan activities.

Action D2.3: Establish a county liaison to help coordinate watershed education in schools and encourage school participation in developing and caring for county restoration projects.

MONITOR: Designation of county liaison and number of schools participating in school restoration projects

TARGET: County liaison established by FY2007, and at least two schools in the watershed participating in restoration projects each year.

Action D3.1: The Little Hunting Creek Steering Committee should help form a community organization for the Little Hunting Creek Watershed.

MONITOR: Formation of community watershed organization

TARGET: Residents/businesses from each subwatershed participating in the organization and related watershed activities. An indirect measure is successful tracking and implementation of the watershed plan.

(Footnotes)

[1] Stream Attributes Crediting Methodology: Impact and Compensation Reaches. Norfolk District Corps of Engineers Regulatory Branch.

[2] The implementation dates are target time frames subject to county funding approval and updates to the watershed plan.

[3] Actions A3.1and A3.11, described in Chapter 5 as "policy" recommendations, would be implemented as capital projects. Since the projects are subject to the policy review process, no fixed start date can be proposed at this time.

[4] Action D1.3, described in Chapter 5 as a "policy" recommendation, would be implemented as a capital project. Since the project is subject to the policy review process, no fixed start date can be proposed at this time.

Figure 4.1 Implementation Timeline

ID	Map No.	CIP No.	Project Description	Cost
1	N/A	LH9972	Community Watershed Support Services Project: A4.2, B1.2, D3.1	$1,000,000.00
2	N/A	LH9982	North Little Hunting Creek Residential Rain Barrel and Rain Garden: A4.1	$40,000.00
3	N/A	LH9983	Paul Spring Branch Residential Rain Barrel and Rain Garden: A4.1	$60,000.00
4	N/A	LH9984	North Branch Rain Barrel and Rain Garden: A4.1	$70,000.00
5	N/A	LH9977	Dumpsite Removal Project: D1.1	$200,000.00
6	PSB1	LH9855	New Commercial LID at 6700 Richmond Highway	$610,000.00
7	PSB8	LH1945	Retrofit BMP at 1909 Windmill Lane	$60,000.00
8	NB11	LH9143	New BMP at 7603 Elba Road	$240,000.00
9	PSB25	LH9154	New BMP at 3223 Groveton Street	$240,000.00
10	N/A	LH9973	Public Education Project: B3.5, C2.5, D1.2, D2.2 , D2.3	$1,440,000.00
11	PSB2	LH9828	New Comm./Instit. LID at Various Churches and the Bucknell Elementary School	$520,000.00
12	NLHC23	LH9140	New BMP at Mount Vernon Square Townhomes	$110,000.00
13	PSB31	LH9168	New BMP at 2223 Beacon Hill Road	$140,000.00
14	NLHC16	LH9138	New BMP at 2313 Darius Lane	$130,000.00
15	NLHC21	LH9871	New School LID at the Hybla Valley Elementary School and the Bryant High School	$250,000.00
16	NLHC17	LH9137	New BMP at 3431 Lockheed Boulevard	$110,000.00
17	PSB32	LH9156	New BMP at 6950 Richmond Highway	$600,000.00
18	NLHC1	LH9139	New BMP at 7201 Richmond Highway	$430,000.00
19	NLHC20	LH9144	New BMP at 2709 Popkins Lane	$260,000.00
20	PSB24	LH9153	New BMP at 6625 Lenclair Street	$240,000.00
21	N/A	LH9979	Sediment Monitoring/Stream Physical Assessment/Monitoring Project: B2.2, C2.3	$200,000.00
22	N/A	LH9980	Small Watershed Grant Program: D2.1	$460,000.00
23	N/A	LH9978	Buffer Monitoring Project: B1.3	$345,000.00
24	N/A	LH9981	Street Sweeping Program: C1.2	$460,000.00
25	N/A	LH9974	Conservation Acquisition Project: B2.3, B3.3	$200,000.00
26	NLHC9	LH9819	New Commercial LID along Richmond Highway	$590,000.00
27	N/A	LH9986	Fecal Coliform Source Study Project: C2.1	$320,000.00
28	PSB29	LH9147	New BMP at 1600 Paul Spring Road	$260,000.00
29	N/A	LH9985	Wetlands Survey Project: B3.1	$320,000.00
30	N/A	LH9987	PCB Contamination Study Project: C3.1	$30,000.00
31	NB1	LH9111	New School LID at Whitman M.S., Hollin Meadows E.S., and Stratford Landing E.S.	$580,000.00

Figure 4.1 Implementation Timeline

ID	Map No.	CIP No.	Project Description	Cost
32	NB14	LH9116	New BMP at 8200 West Boulevard Drive, and 1138, 1200, 1204, and 1208 Cedar Dale Lane	$160,000.00
33	PSB30	LH9150	New BMP at 7509 Fort Hunt Road	$210,000.00
34	NB12	LH9142	New BMP at 2500 Woodlawn Terrace	$200,000.00
35	PSB26	LH9165	New BMP at 2501 Beacon Hill Road	$150,000.00
36	PSB4	LH9132	Retrofit BMP at 7628 Essex Manor Place	$110,000.00
37	NLHC24	LH9141	New BMP at the Mount Vernon Square Apartments at 2722 Arlington Drive	$170,000.00
38	PSB7	LH9152	Retrofit BMP at 7116 Fort Hunt Road	$110,000.00
39	PSB15	LH9264	Stream Restoration at Paul Spring Branch	$2,620,000.00
40	N/A	LH9988	Dredging Feasibility Study Project: C1.1	$510,000.00
41	NB13	LH9126	New BMP at 2500 Parkers Lane	$150,000.00
42	NB2	LH9125	Retrofit BMP at 8033 Holland Road	$250,000.00
43	NLHC11	LH9320	Buffer Restoration at North Little Hunting Creek	$400,000.00
44	NLHC14	LH9234	Stream Restoration at North Little Hunting Creek	$350,000.00
45	NLHC19	LH9136	New BMP at the Grove at Huntley Meadows	$210,000.00
46	NLHC4	LH9122	Retrofit BMP at 3115 Sherwood Hall Lane	$30,000.00
47	NLHC6	LH9117	Retrofit BMP at 3742 Roxbury Lane	$70,000.00
48	PR2	LH9706	Wetland Restoration at Various Locations	$200,000.00
49	PR3	LH9812	New School LID at the Waynewood Elementary School	$80,000.00
50	PSB14	LH9331	Buffer Restoration at Paul Spring Branch	$30,000.00
51	PSB27	LH9166	New BMP at 6925 University Drive	$100,000.00
52	PSB28	LH9167	New BMP at 2424 Ross Street	$70,000.00
53	PSB9	LH9748	New Wetland BMP at Paul Spring Branch	$230,000.00
54	SLHC11	LH9708	Wetland Restoration at Martin Luther King Jr. Park	$390,000.00
55	SLHC17	LH9790	Wetland Restoration at the Main Stem of Little Hunting Creek	$230,000.00
56	SLHC3	LH9804	New School LID at the Fort Hunt Elementary School	$270,000.00
57	SLHC6	LH9301	Buffer Restoration at South Little Hunting Creek	$20,000.00
58	SLHC7	LH9305	Buffer Restoration at South Little Hunting Creek	$40,000.00
59	NB3	LH9114	Retrofit BMP at 8306 Rampart Court	$60,000.00
60	NB7	LH9227	Stream Restoration at North Branch	$390,000.00
61	NB9	LH9115	Retrofit BMP at 8225 Stacey Road	$90,000.00
62	NLHC12	LH9235	Stream Restoration at North Little Hunting Creek	$800,000.00

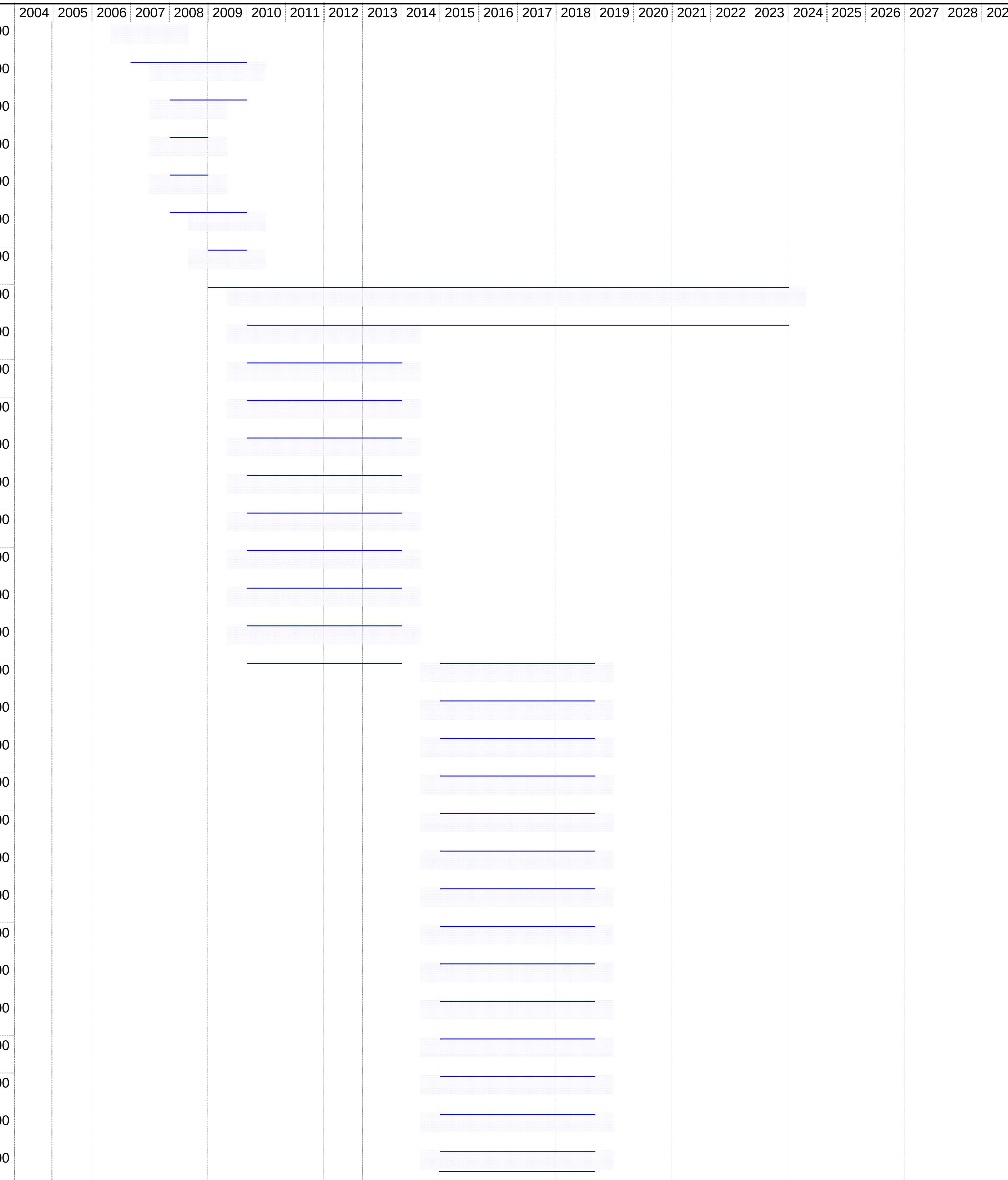
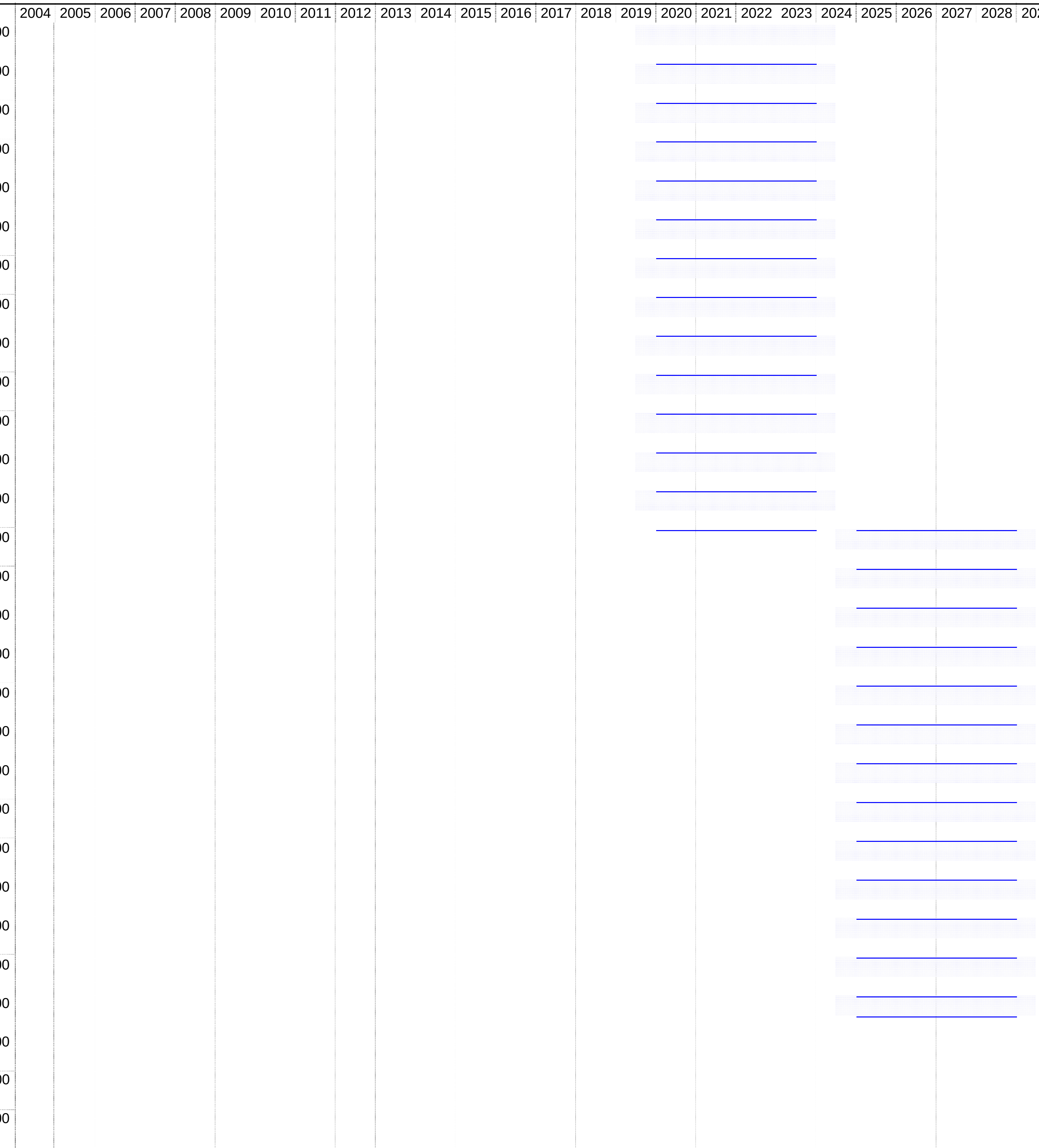
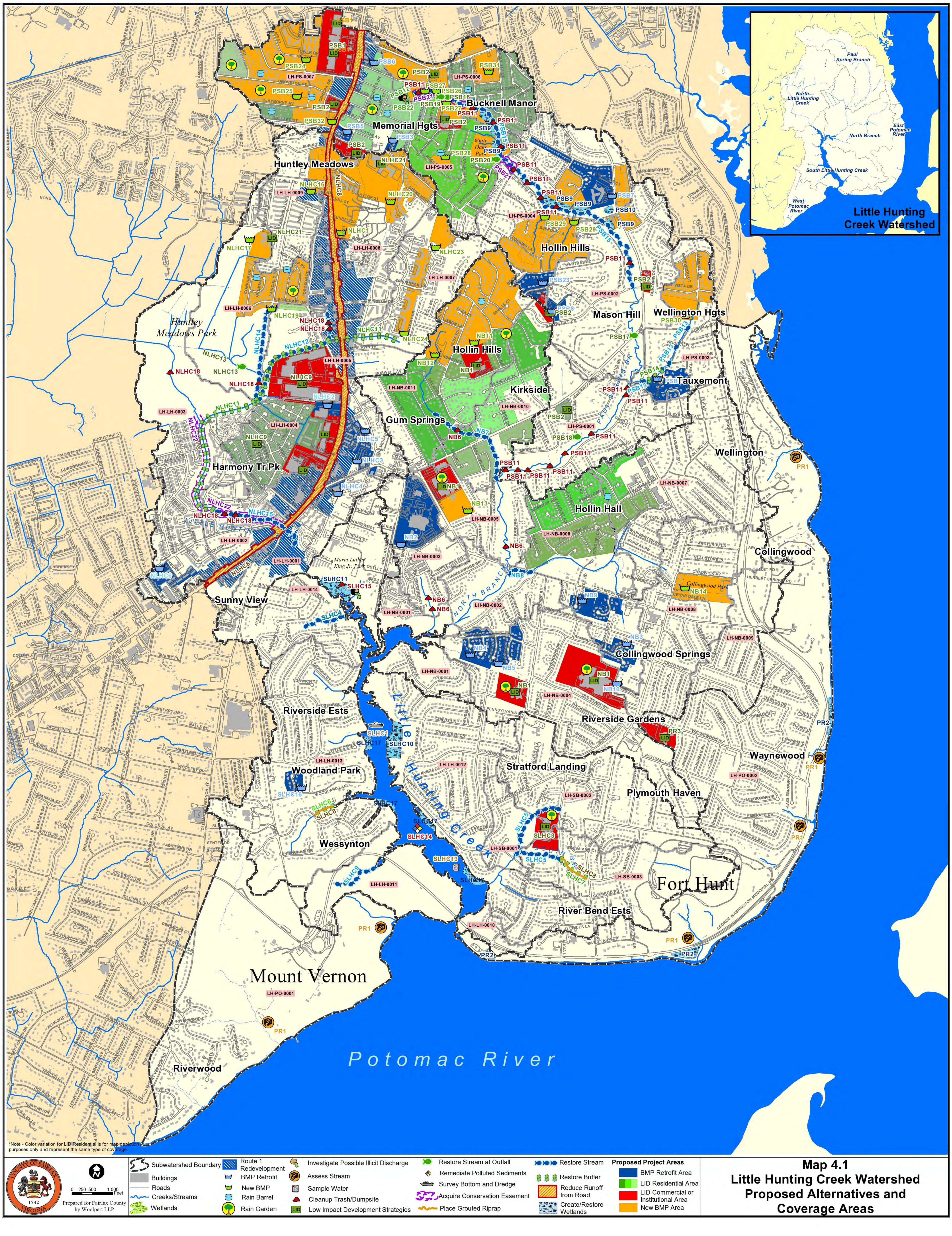


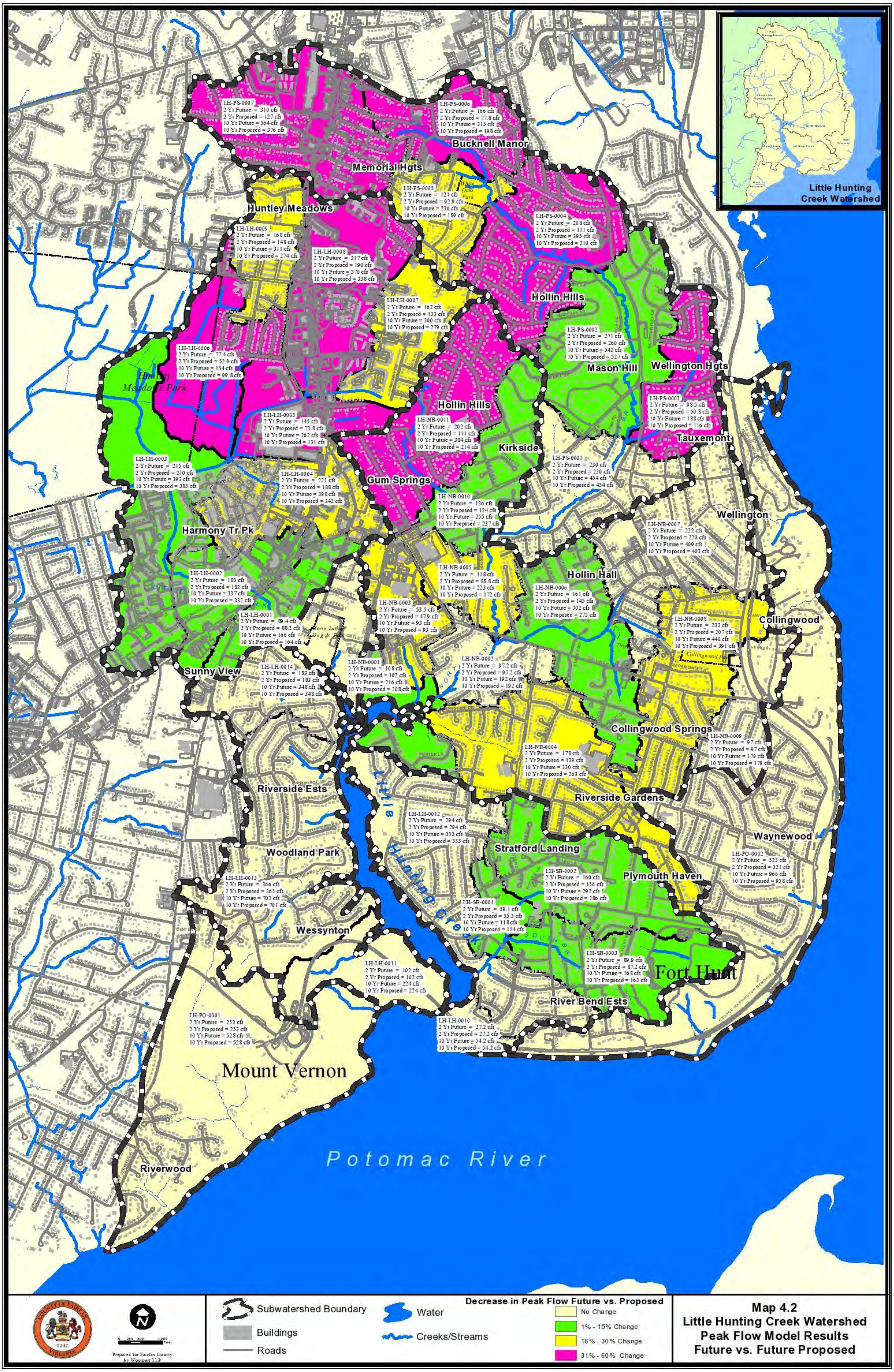
Figure 4.1 Implementation Timeline

ID	Map No.	CIP No.	Project Description	Cost
63	NLHC15	LH9218	Stream/Buffer Restoration at North Little Hunting Creek	$820,000.00
64	NLHC2	LH9121	Retrofit BMP at 7770 Richmond Highway	$90,000.00
65	NLHC5	LH9124	Retrofit BMP at the Village at Gum Springs Townhomes	$110,000.00
66	PSB10	LH9751	New Wetland BMP Paul Spring Branch at Fort Hunt Road	$200,000.00
67	PSB3	LH9159	Retrofit BMP at 7008 Bryant Towne Court	$50,000.00
68	PSB5	LH9157	Retrofit BMP at 2923 Preston Avenue	$60,000.00
69	PSB6	LH9158	Retrofit BMP at 6733 Richmond Highway	$70,000.00
70	SLHC5	LH9204	Stream Restoration at South Little Hunting Creek	$560,000.00
71	SLHC9	LH9203	Stream Restoration at South Little Hunting Creek	$230,000.00
72	NB10	LH9113	Retrofit BMP at Noral Place	$30,000.00
73	NB4	LH9109	Retrofit BMP at 8306 Marble Dale Court	$80,000.00
74	NB5	LH9110	Retrofit BMP at 8313 Riverton Lane	$90,000.00
75	NB8	LH9270	Stream Restoration at North Branch	$110,000.00
76	NLHC13	LH9233	Stream Restoration at North Little Hunting Creek	$150,000.00
77	NLHC3	LH9123	Retrofit BMP at 7836 Fordson Road	$60,000.00
78	PSB12	LH9360	Buffer Restoration at Paul Spring Branch	$20,000.00
79	PSB13	LH9230	Stream Restoration at Paul Spring Branch	$1,370,000.00
80	PSB16	LH9263	Stream Restoration at Paul Spring Branch	$100,000.00
81	PSB17	LH9249	Stream Restoration at Paul Spring Branch	$40,000.00
82	PSB18	LH9229	Stream Restoration at Paul Spring Branch	$100,000.00
83	PSB19	LH9262	Stream Restoration at Paul Spring Branch	$100,000.00
84	PSB20	LH9269	Stream Restoration at Paul Spring Branch	$100,000.00
85	PSB23	LH9146	Retrofit BMP at 2002 Windmill Lane	$80,000.00
86	SLHC16	LH9100	Retrofit BMP at Woodland Heights	$60,000.00
87	SLHC4	LH9207	Stream Restoration at South Little Hunting Creek	$200,000.00
88	SLHC8	LH9302	Buffer Restoration at South Little Hunting Creek	$150,000.00
89	N/A	LH9975	Inspection Enhancement Project: A3.1 (Start date unknown)	$200,000.00
90	N/A	LH9976	Enforcement Enhancement Project: C2.4, D1.3 (Start date unknown)	$1,920,000.00
91	N/A	LH9989	Stormwater Infrastructure Condition Assessment A3.11 (Start date unknown)	$216,000.00





Map 4.1
Little Hunting Creek Watershed Proposed Alternatives and Coverage Areas



Map 4.2
Little Hunting Creek Watershed
Peak Flow Model Results
Future vs. Future Proposed

Subwatershed Boundary

Buildings

Roads

Water

Creeks/Streams

Erosion

Stream Velocities

Future	Future Proposed
0 fps - 3 fps - Good	0 fps - 3 fps - Good
3 fps - 5 fps - Fair	3 fps - 5 fps - Fair
5 fps and Greater - Poor	5 fps and Greater - Poor

0 250 500 1,000 Feet

Prepared for Fairfax County by Woolpert LLP

Map 4.3
Little Hunting Creek Watershed
Stream Velocities Model Results
Future vs. Future Proposed

Map 4.4
Little Hunting Creek Watershed
Stream Velocities Percent Reduction
Between Future Proposed and Future

COUNTY OF FAIRFAX VIRGINIA 1742

0 250 500 1,000 Feet

Prepared for Fairfax County by Woolpert LLP

Subwatershed Boundary

Buildings

Roads

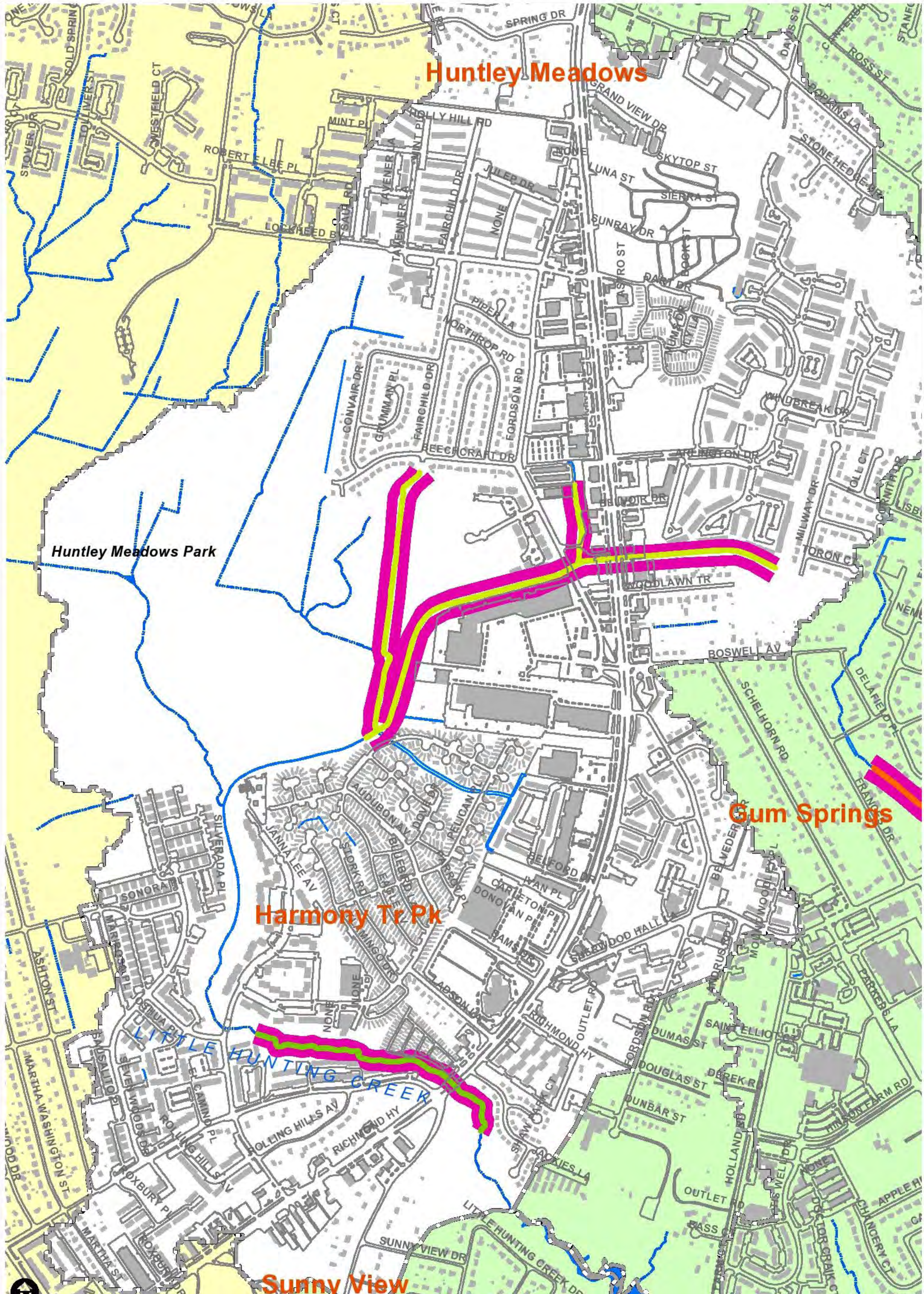
Water

Creeks/Streams

5 ft Contours

10 Year Future Proposed Floodplain

Map 4.5
Little Hunting Creek Watershed
10 Year Future
Proposed Floodplain



Subwatershed Boundary
Roads
Buildings
Paved Ditch
Creeks/River
Water

0 200 400 800 Feet

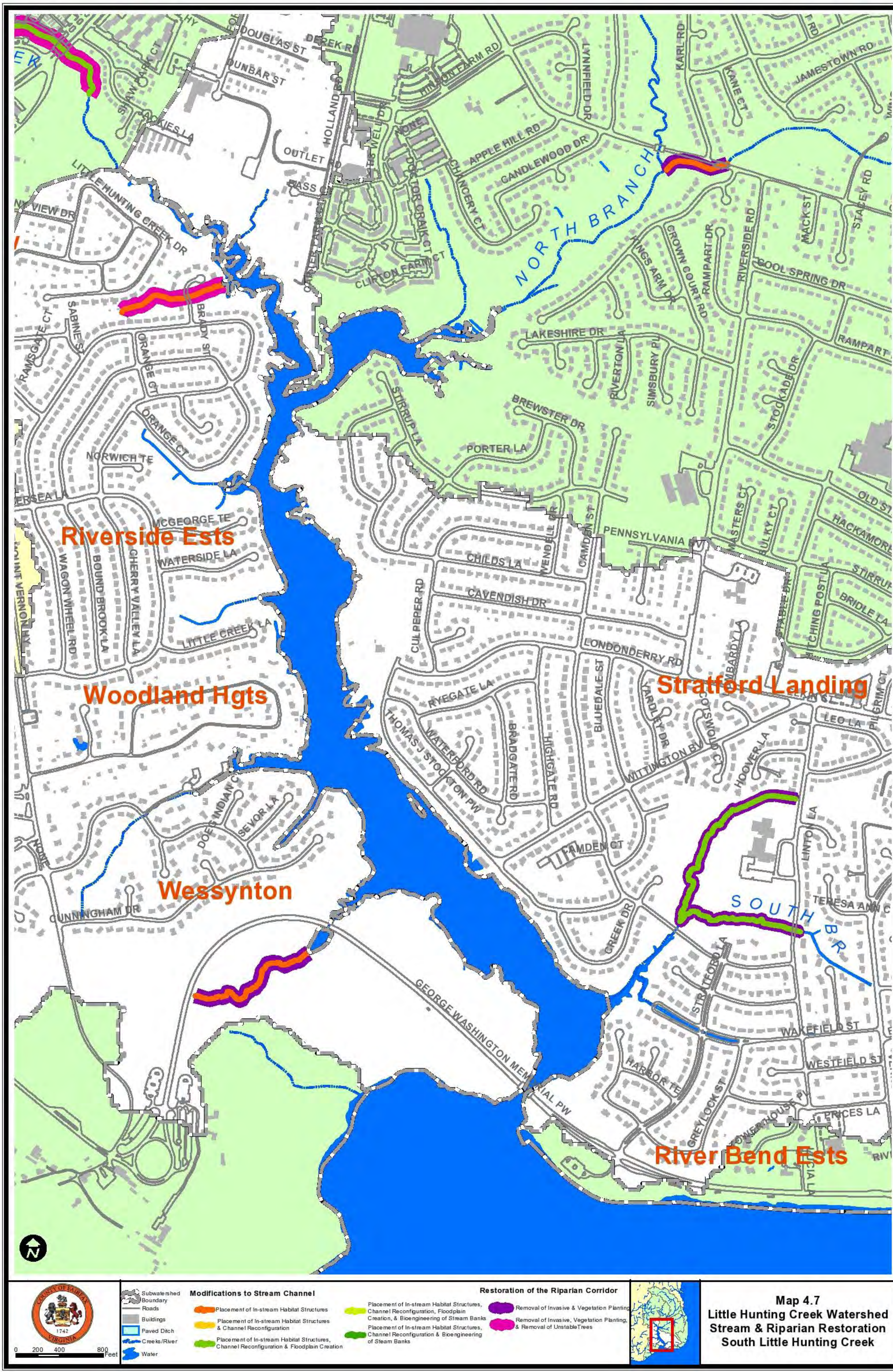
Modifications to Stream Channel

- Placement of In-stream Habitat Structures
- Placement of In-stream Habitat Structures & Channel Reconfiguration
- Placement of In-stream Habitat Structures, Channel Reconfiguration & Floodplain Creation
- Placement of In-stream Habitat Structures, Channel Reconfiguration, Floodplain Creation, & Bioengineering of Stream Banks
- Placement of In-stream Habitat Structures, Channel Reconfiguration & Bioengineering of Steam Banks

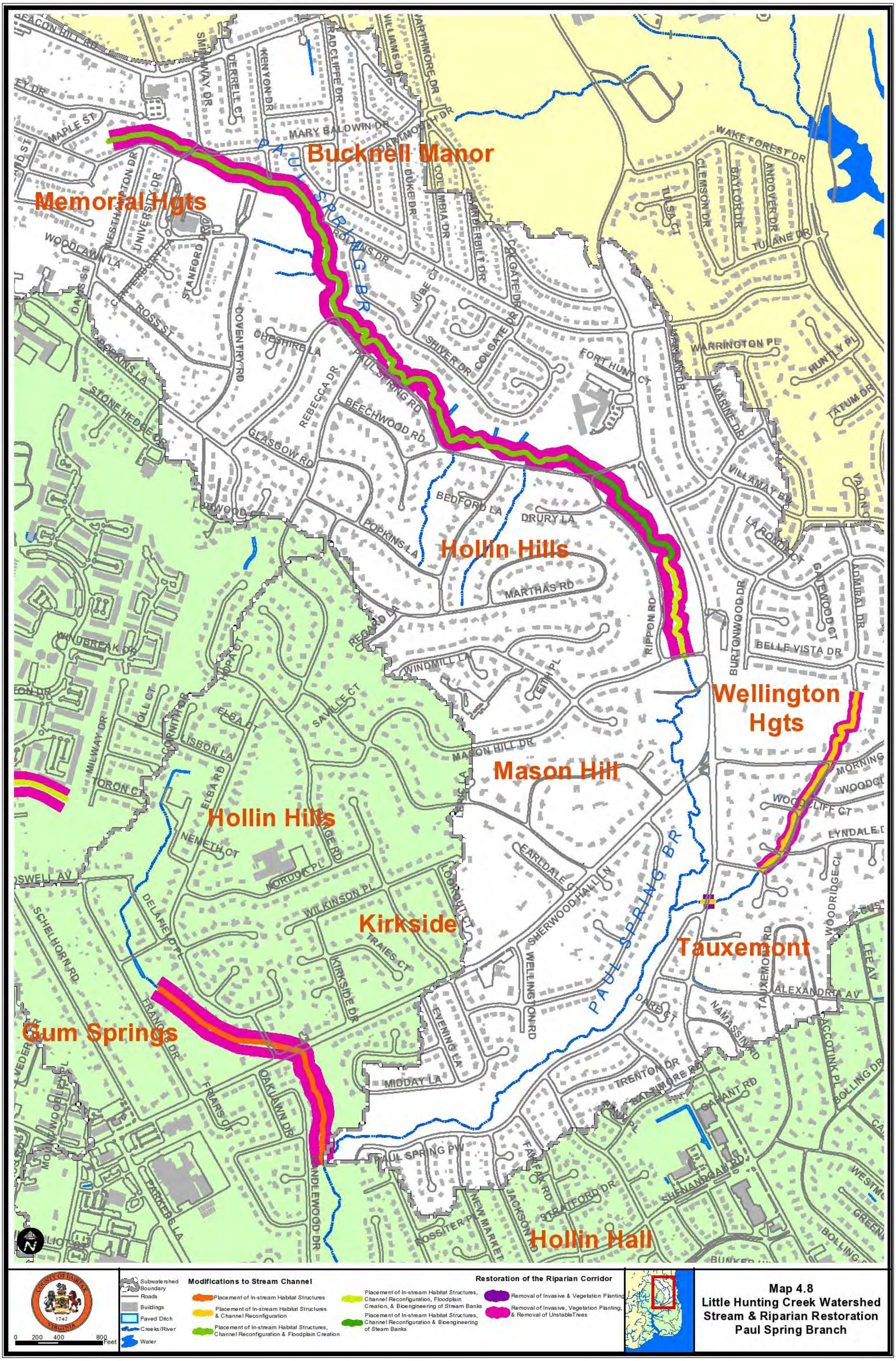
Restoration of the Riparian Corridor

- Removal of Invasive & Vegetation Planting
- Removal of Invasive, Vegetation Planting, & Removal of UnstableTrees

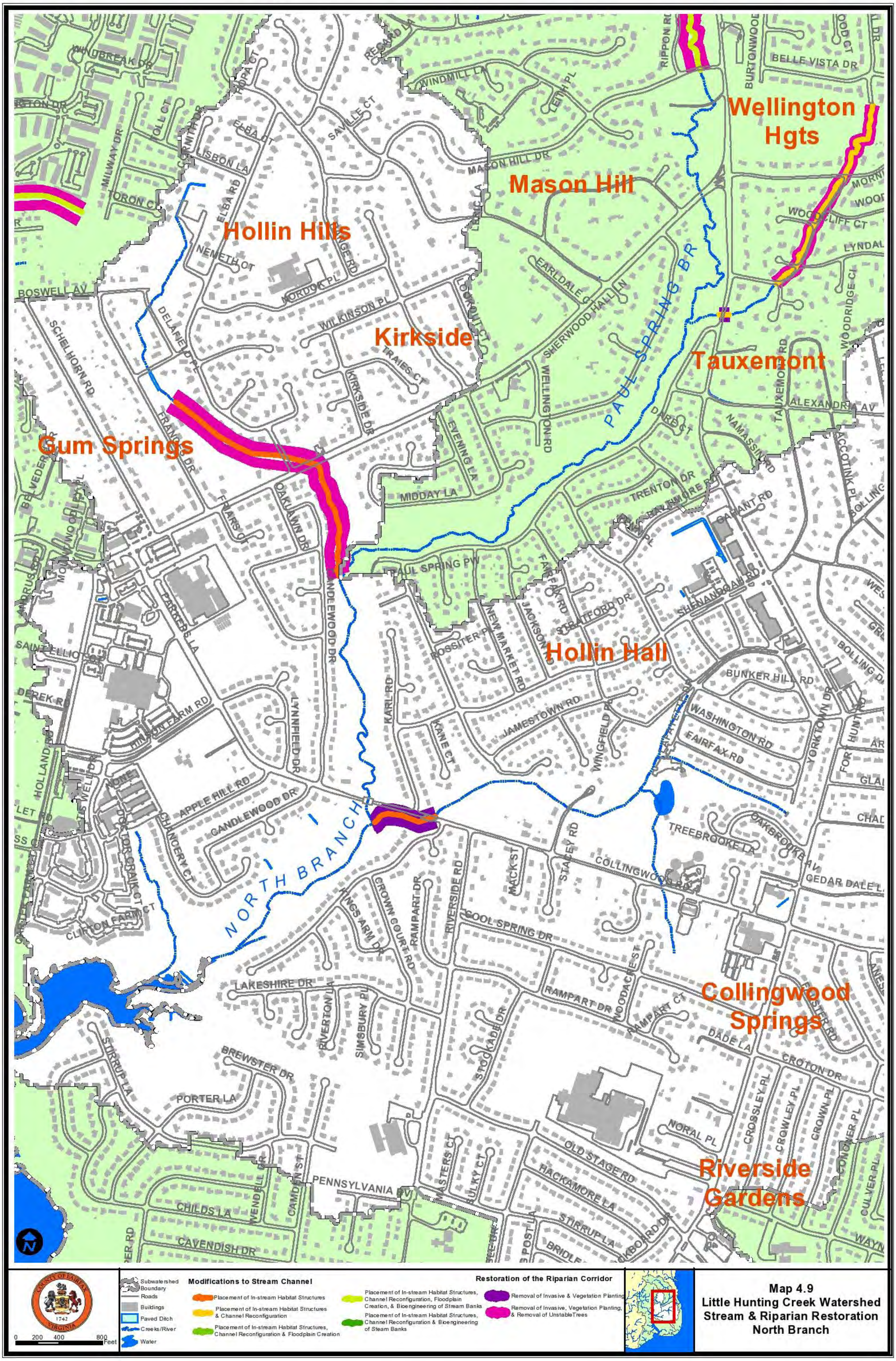
Map 4.6
Little Hunting Creek Watershed
Stream & Riparian Restoration
North Little Hunting Creek



Riverside Ests
Woodland Hgts
Wessynton
Stratford Landing
River Bend Ests
NORTH BRANCH
SOUTH BR
LITTLE HUNTING CREEK DR
GEORGE WASHINGTON MEMORIAL PW
PENNSYLVANIA BV
LONDONDERRY RD
WITTINGTON BV
CUNNINGHAM DR
Subwatershed Boundary
Roads
Buildings
Paved Ditch
Creeks/River
Water
0 200 400 800 Feet
Modifications to Stream Channel
Placement of In-stream Habitat Structures
Placement of In-stream Habitat Structures & Channel Reconfiguration
Placement of In-stream Habitat Structures, Channel Reconfiguration & Floodplain Creation
Placement of In-stream Habitat Structures, Channel Reconfiguration, Floodplain Creation, & Bioengineering of Stream Banks
Placement of In-stream Habitat Structures, Channel Reconfiguration & Bioengineering of Steam Banks
Restoration of the Riparian Corridor
Removal of Invasive & Vegetation Planting
Removal of Invasive, Vegetation Planting, & Removal of UnstableTrees
Map 4.7
Little Hunting Creek Watershed
Stream & Riparian Restoration
South Little Hunting Creek



Bucknell Manor
Memorial Hgts
PAUL SPRING BR
Hollin Hills
Wellington Hgts
Mason Hill
Hollin Hills
Kirkside
Tauxemont
PAUL SPRING BR
Gum Springs
Hollin Hall
Subwatershed Boundary
Roads
Buildings
Paved Ditch
Creeks/River
Water
0 200 400 800 Feet
Modifications to Stream Channel
Placement of In-stream Habitat Structures
Placement of In-stream Habitat Structures & Channel Reconfiguration
Placement of In-stream Habitat Structures, Channel Reconfiguration & Floodplain Creation
Placement of In-stream Habitat Structures, Channel Reconfiguration, Floodplain Creation, & Bioengineering of Stream Banks
Placement of In-stream Habitat Structures, Channel Reconfiguration & Bioengineering of Steam Banks
Restoration of the Riparian Corridor
Removal of Invasive & Vegetation Planting
Removal of Invasive, Vegetation Planting, & Removal of UnstableTrees
Map 4.8
Little Hunting Creek Watershed
Stream & Riparian Restoration
Paul Spring Branch



Map 4.9
Little Hunting Creek Watershed
Stream & Riparian Restoration
North Branch

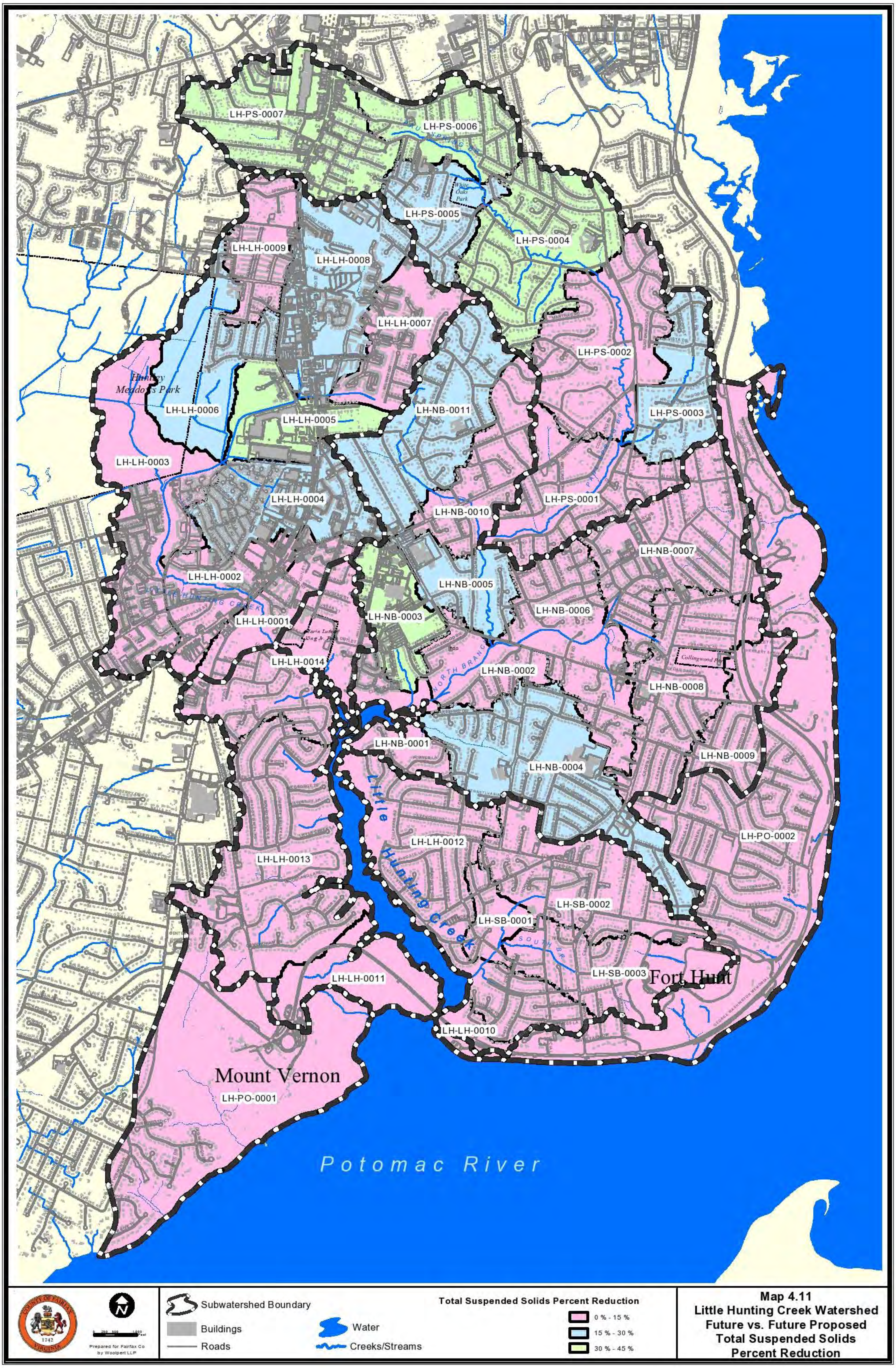
Prepared for Fairfax Co by Woolpert LLP

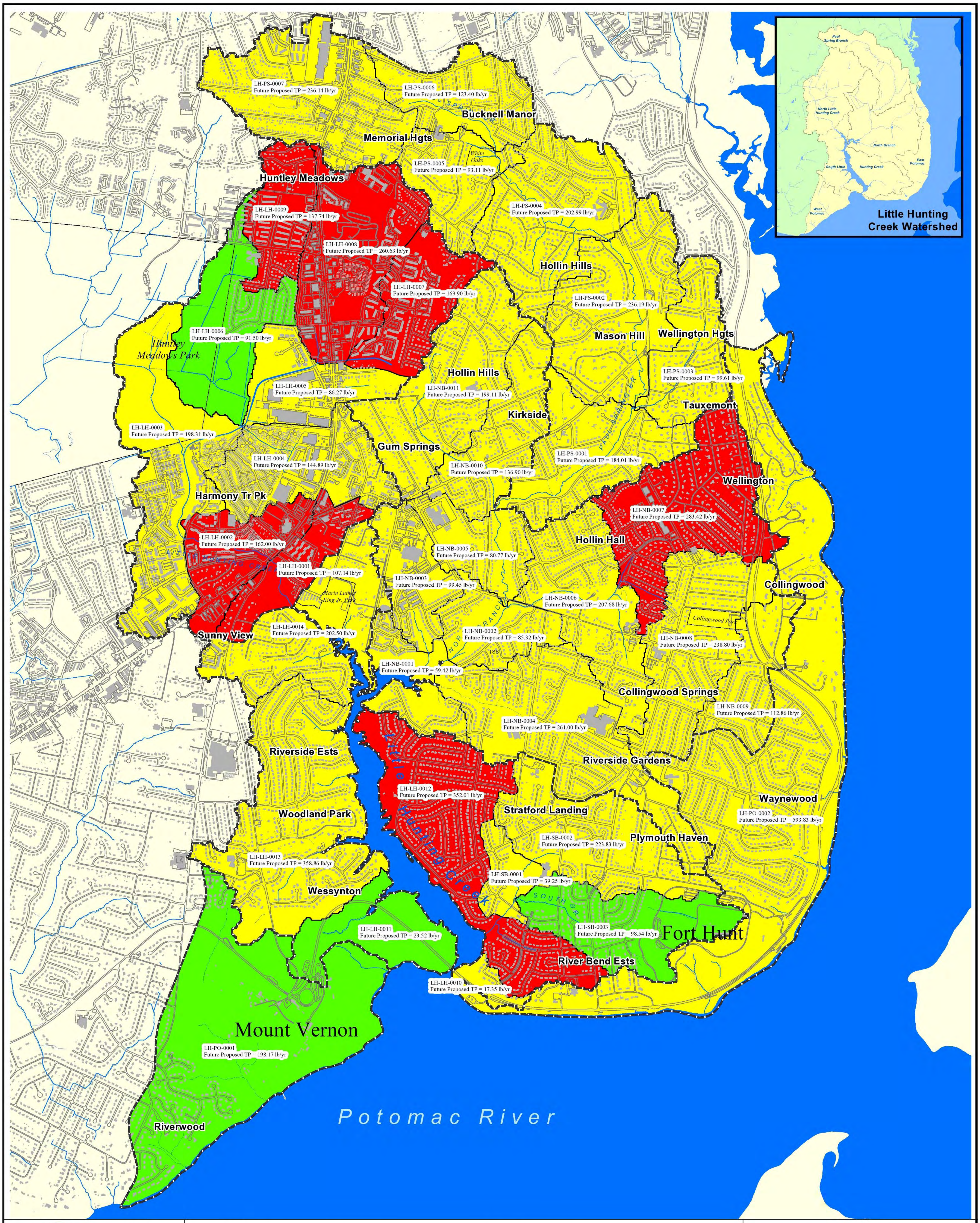
Subwatershed Boundary
Buildings
Roads
Water
Creeks/Streams

Total Suspended Solids

- 78 lb/ac/yr or less - Good
- 78 lb/ac/yr to 163 lb/ac/yr - Fair
- Greater than 163 lb/ac/yr - Poor

Map 4.10
Little Hunting Creek Watershed
Future Proposed Total Suspended Solids Pollutant Model Results


LH-PS-0007
LH-PS-0006
LH-PS-0005
LH-PS-0004
LH-LH-0009
LH-LH-0008
LH-LH-0007
LH-PS-0002
Huntley Meadows Park
LH-LH-0006
LH-LH-0005
LH-NB-0011
LH-PS-0003
LH-LH-0003
LH-LH-0004
LH-NB-0010
LH-PS-0001
LH-NB-0007
LH-LH-0002
LH-NB-0005
LH-NB-0006
LH-LH-0001
LH-NB-0003
LH-LH-0014
LH-NB-0002
LH-NB-0008
LH-NB-0001
LH-NB-0009
LH-NB-0004
Little Hunting Creek
LH-LH-0012
LH-PO-0002
LH-LH-0013
LH-SB-0002
LH-SB-0001
LH-SB-0003
Fort Hunt
LH-LH-0011
LH-LH-0010
Mount Vernon
LH-PO-0001
Potomac River
Prepared for Fairfax Co by Woolpert LLP
Subwatershed Boundary
Buildings
Roads
Water
Creeks/Streams
Total Suspended Solids Percent Reduction
0 % - 15 %
15 % - 30 %
30 % - 45 %
Map 4.11
Little Hunting Creek Watershed
Future vs. Future Proposed
Total Suspended Solids
Percent Reduction



Prepared for Fairfax Co by Woolpert LLP

Subwatershed Boundary

Buildings

Roads

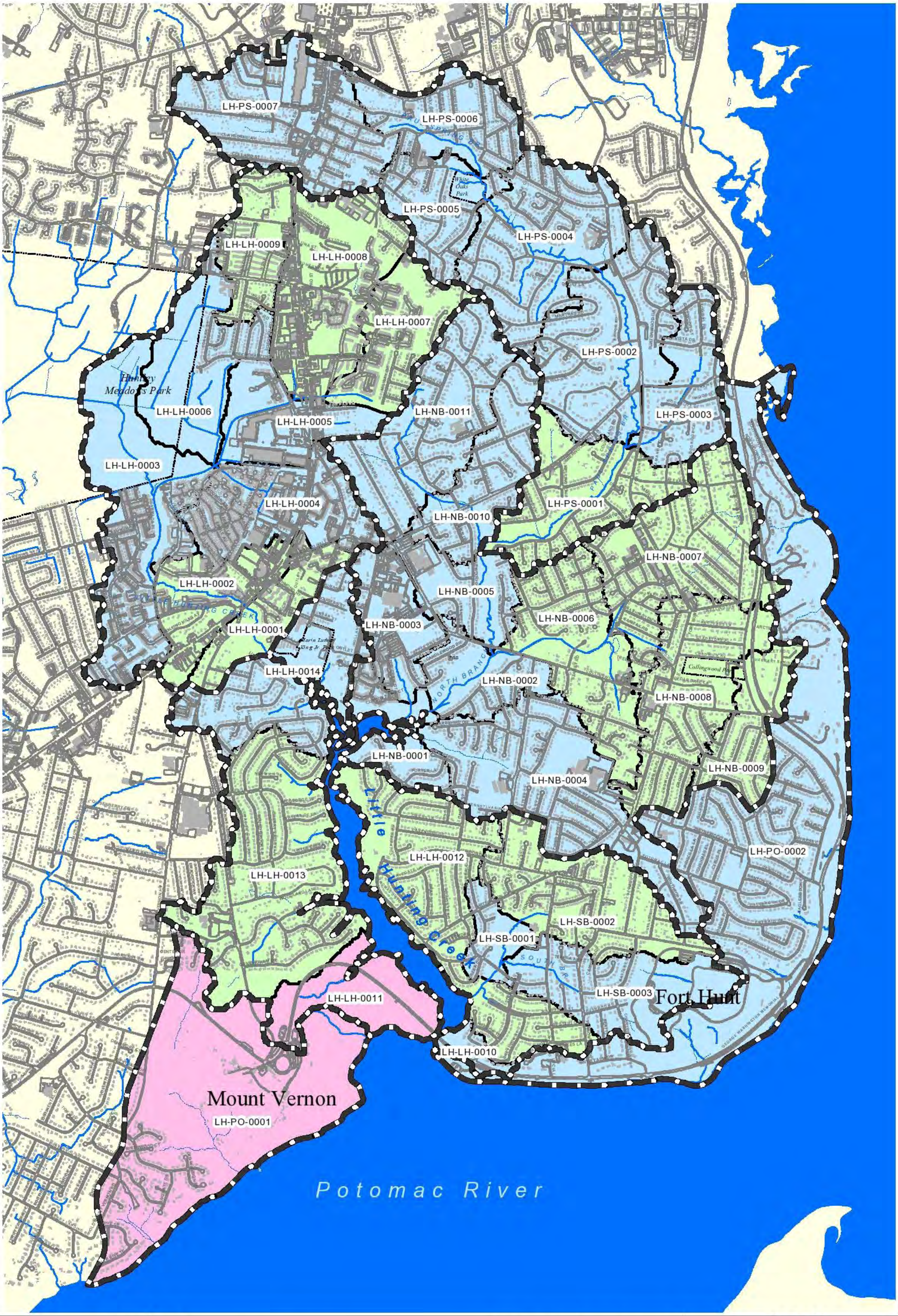
Water

Creeks/Streams

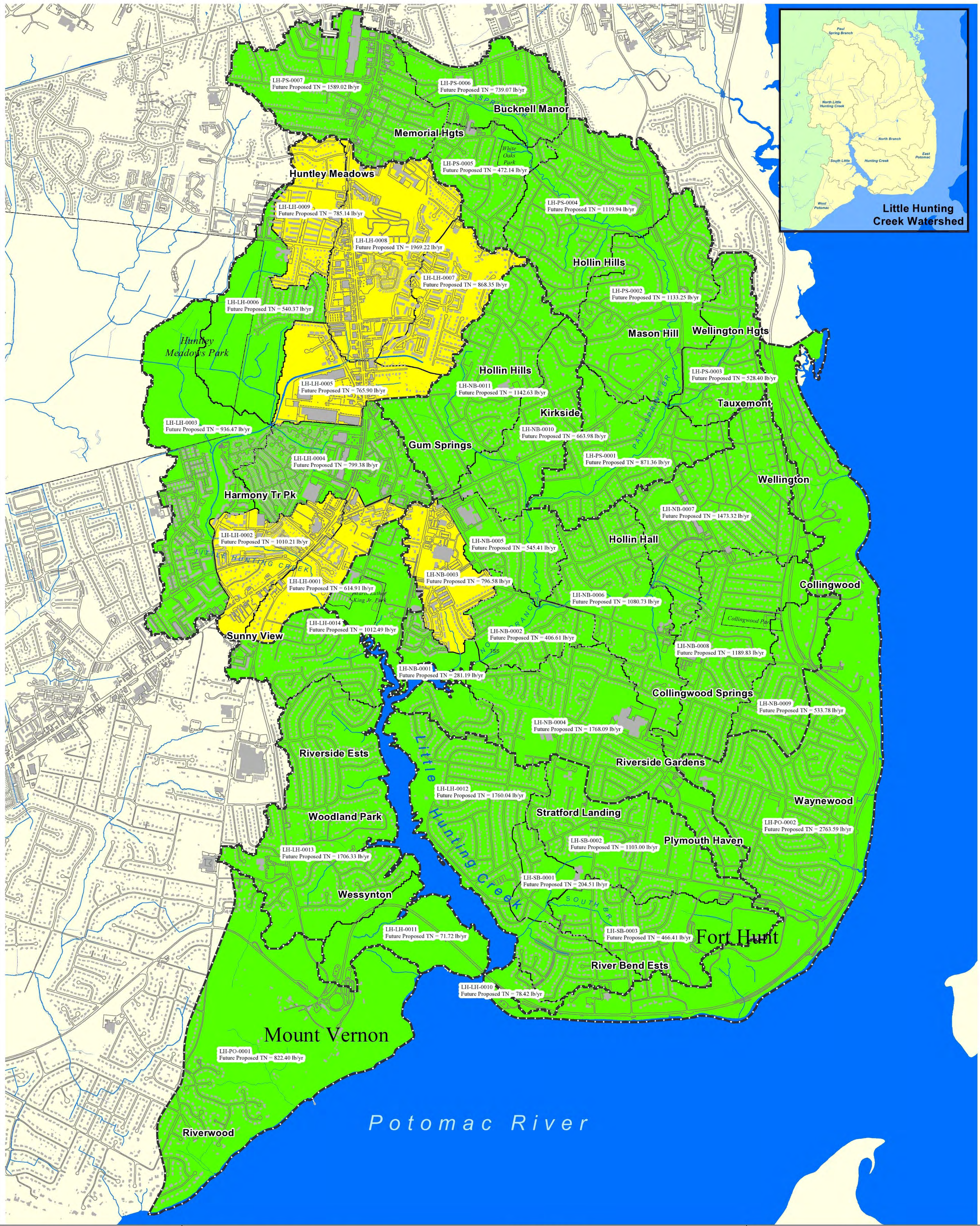
Total Phosphorus

- 0.67 lb/ac/yr or less - Good
- 0.67 lb/ac/yr to 1.15 lb/ac/yr - Fair
- Greater than 1.15 lb/ac/yr - Poor

Map 4.12
Little Hunting Creek Watershed
Future Proposed Total Phosphorus
Pollutant Model Results



Map 4.13
Little Hunting Creek Watershed
Future vs. Future Proposed
Total Phosphorus
Percent Reduction



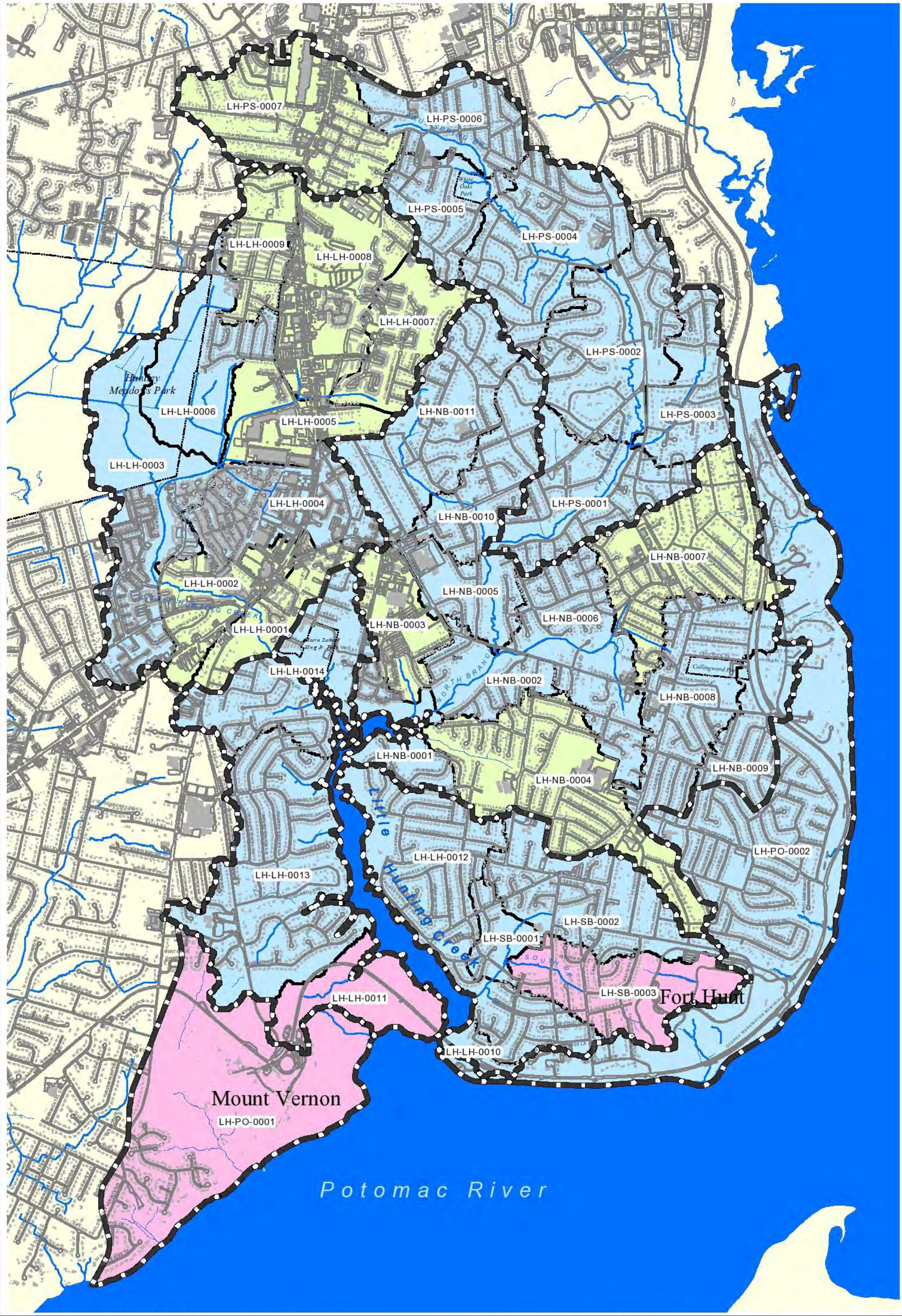
Prepared for Fairfax Co by Woolpert LLP

Subwatershed Boundary
Buildings
Roads
Water
Creeks/Streams

Total Nitrogen

- 6.5 lb/ac/yr or less - Good
- 6.5 lb/ac/yr to 9.8 lb/ac/yr - Fair
- Greater than 9.8 lb/ac/yr - Poor

Map 4.14
Little Hunting Creek Watershed
Future Proposed Total Nitrogen
Pollutant Model Results



Prepared for Fairfax Co by Woolpert LLP

Subwatershed Boundary

Buildings

Roads

Water

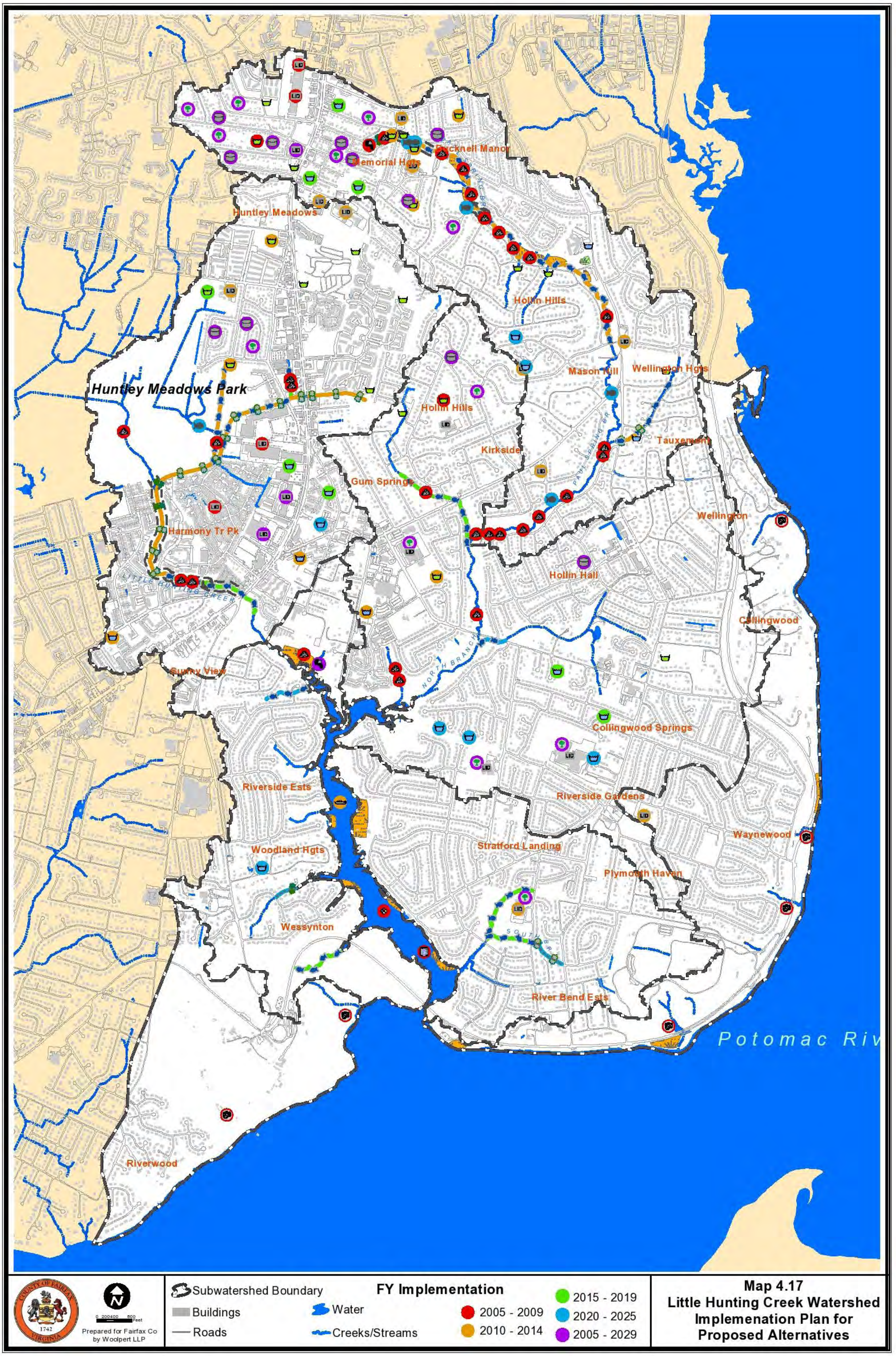
Creeks/Streams

Total Nitrogen Percent Reduction

- 0 % - 3 %
- 3 % - 6 %
- 6 % - 9 %

Map 4.15
Little Hunting Creek Watershed
Future vs. Future Proposed
Total Nitrogen
Percent Reduction

Map 4.16
Little Hunting Creek Watershed
Cumulative Stream
Flow Reduction



Map 4.17
Little Hunting Creek Watershed Implemenation Plan for Proposed Alternatives

Chapter 5:
Policy and Land Use Recommendations

5.1 Watershed Plan Vision

The strategy for achieving the vision of minimizing runoff, reducing pollution, and restoring the quality of Little Hunting Creek includes a wide range of recommendations. Not only are the capital improvement program projects described in Chapter 4 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 Little Hunting Creek 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 current planned approach for processing the policy recommendations from the Little Hunting Creek Watershed Management Plan is to integrate these recommendations with similar recommendations developed with the Popes Head Creek, Cameron Run, Cub Run, and Difficult Run Watershed management plans over the next few years. 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. Land use recommendations will be further evaluated as part of the county's comprehensive plan area plan review (APR) process. Land use recommendations adopted through the APR process will become part of the comprehensive plan.

Staff-year-equivalents (SYE) for each recommended action represent an annualized estimate of the additional staff time for various county agencies to evaluate and implement the recommendation.

5.2 Goals, Objectives, and Actions

The goals put forward in Chapter 4 are restated in this chapter to demonstrate the interaction of these recommendations with the structural and non-structural projects. To facilitate the tracking of all plan recommendations by the community and county agencies, the numbering scheme depicted in the May 2004 final draft plan has been retained.

Goal A: Reduce stormwater impacts on the Little Hunting Creek Watershed from impervious areas to help restore and protect the streams.

Objective A1: Provide incentives for developers to reduce imperviousness.

Rationale: Developers cannot increase the existing peak stormwater runoff rate from development sites, which include the construction, rehabilitation, rebuilding, or substantial alteration of residential, industrial, or commercial properties, unless they can demonstrate that there is adequate capacity for the increased runoff in the downstream drainage system. There should be incentives for the development community, which includes designers, architects, developers, builders, and contractors, to exceed the minimum criteria of matching the existing peak stormwater runoff rate for development and redevelopment projects. Redevelopment projects include substantial alteration, rehabilitation, or rebuilding of a property for residential, commercial, industrial, or other purposes. Additionally, there should be an incentive for runoff from sites to be reduced even if they are not being redeveloped. The environment section of the county's Policy Plan, Objective 2, Policy "k" states, "For new development and redevelopment, apply low-impact site design techniques,…and pursue commitments to reduce stormwater runoff volumes and peak flows…"

The future redevelopment along Richmond Highway is a great opportunity for the county and developers to work together to reduce the existing imperviousness. Any zoning incentives or changes in county ordinances should be coordinated with the Zoning Administration Division of the Department of Planning and Zoning and the Code Analysis Division of the Department of Public Works and Environmental Services. If these incentives are not implemented countywide, they should still be applied in the Little Hunting Creek Watershed.

Action A1.1: Provide a new, expedited review process for developers who include conservation design techniques and low-impact development features in their site plans. This expedited review process should be a separate expedited track from the current process.

Strategy to Achieve Action: The county's zoning and subdivision ordinances may need to be amended for implementing an expedited review process for site and subdivision plans that incorporate a certain minimum percentage of conservation design techniques, low-impact development, or green technologies. It is possible that the board of supervisors can adopt a policy for the expedited site plan review process similar to what was implemented for the expedited site plan review process for commercial revitalization districts.

The Office of Site Development Services (OSDS) staff will need to have an expanded list of approved low-impact development (LID) methods and design objectives and a percentage of use that qualifies a site or subdivision plan for expedited review. The development community and designers will also need to have this list. At this point, this expedited review is only proposed to apply to site and subdivision plan review and would not apply to projects subject to zoning approval and by-right approval. Expedited site plan review would not change the requirements of the county's public hearing process. Any development proposals that go before the Planning Commission and Board of Supervisors will still be subject to relevant state codes for the timing of hearings, decisions, and appeals.

Documentation, training, and public relations will be needed to prepare for implementation of this system. Training must include the Board of Supervisors and its staff, Planning Commissioners, Department of Planning and Zoning (DPZ) staff, and OSDS staff. Training should also be provided for the private sector to include developers, designers, architects, realtors, large landholders, tenants, etc. Training must be ongoing to provide new staff and developers with information on how to prepare site plans. Develop and codify in the Public Facilities Manual an improved method for quantifying the detention provided with a complete LID layout. Refer to methodologies already in place in Stafford County, Virginia, and Prince George's County, Maryland.

Watershed Benefit: A quantitative evaluation of this action's impact was not made since it is difficult to accurately estimate developer participation in the event that it is implemented. It is anticipated that if this action was implemented, the expedited site plan review would encourage developers to implement conservation design techniques and low-impact development methods that would help control the peak runoff from frequent small storms. Controlling the runoff from frequent small storms will help to reduce the amount of erosion in the streams. For example, if the county allowed the expedited review process for projects that implement LID technologies for 10% of their project's impervious areas, there would be an approximate 182-cubic-foot reduction in runoff volume for each project acre. This example assumes that the LID is designed to detain and treat the first half inch of runoff.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action A1.2: Provide zoning incentives for developers to reduce imperviousness.

Strategy to Achieve Action: Provide the following incentives for those developers who exceed the minimum runoff reduction standard by 10% if there is a requirement for net reduction. If the runoff reduction program is voluntary, provide these incentives to developers who reduce post development runoff for already developed sites by 10%. The implications of these zoning incentives will need to be considered in coordination with county land use, transportation, and revitalization goals. The zoning incentives proposed below would need to be added to the county code, if implemented, and will require extensive coordination with the Zoning Administration Division of DPZ.

In addition to parking minimums, add a parking maximum so that parking is not overbuilt. In addition to incentives, developers should consider marketing assets of green sites and possibly charging higher rents for sites that are in green developments (as is done for ecologically friendly housing developments). This may be especially palatable to businesses that benefit from being seen as green (e.g., Whole Foods Supermarket).

Recommended Incentives:

- Allow zero setbacks to property lines (side yards) on one side of a building. Allowing zero setbacks should work to result in impervious area reduction and not increase development densities.
- Reduce parking requirement minimums by 20% for commercial developments. This incentive should be evaluated on a case-by-case basis by the county and take into consideration the actual use of the development and potential impacts to surrounding areas.

- Provide for an additional story on the buildings by way of floor area ratio and bulk plane provisions.
- If a stormwater user fee is instituted in the future, provide a reduced rate for LID sites.
- Provide density bonuses, such as allowing 10% more units per acre for residential construction or allowing a 30% to 40% increase in the floor area ratio for commercial construction. However, additional densities must not increase the building footprint and should allow for more onsite integration of LID practices. Other factors, such as air pollution, impacts on traffic and transportation, and impacts on public schools, should be considered when evaluating the benefit of this incentive.

Watershed Benefit: A quantitative evaluation of these zoning incentives was not made since it is difficult to accurately estimate developer participation in the event that they are implemented. However, for every impervious acre that is reduced for a development project, there would be over an approximate 65% reduction in runoff, assuming that area that would have been changed to an impervious land use would remain a pervious land use. Zoning incentives would benefit the watershed by encouraging developers to reduce their site imperviousness, which in turn, would reduce the stormwater runoff that causes stream erosion and nonpoint source pollution.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Objective A2: Require commercial and residential redeveloped sites to have an effective imperviousness that reduces the post-development runoff rate and volume to a targeted percentage below the pre-development runoff rate and volume.

Rationale: Current regulations require that the post-development runoff rate not exceed the pre-development runoff rate. However, similar to many older urban watersheds, much of the Little Hunting Creek Watershed was developed before stormwater controls were required. Redevelopment of sites may result in the same level of untreated runoff water, thus preventing realization of net improvements to the watershed condition.

Action A2.1: Amend the county erosion and sedimentation control ordinance, Chesapeake Bay Preservation ordinance, and other applicable ordinances to require that commercial and residential redevelopment of sites demonstrate a 10% net decrease in runoff. A 10% reduction was selected because it will make a significant difference in reducing runoff without being unmanageable or cost prohibitive for developers. The county may also consider graduated incentives, such as those mentioned in the previous action, for projects that exceed the 10% minimum.

Strategy to Achieve Action: The Virginia Stormwater Management Law under section § 10.1-603.7 states that localities are authorized to adopt more stringent stormwater management regulations than those necessary to ensure compliance with the state's minimum regulations, (with the exception of regulations related to plan approval) provided that the more stringent regulations are based upon the findings of local comprehensive watershed management studies, and that prior to adopting more stringent regulations, a public hearing is held after giving due notice.

The ordinance amendment could be written to apply only to the Little Hunting Creek Watershed with a recommended overlay district for the Richmond Highway commercial corridor, or it could be written to apply to all watersheds in the county. If implemented countywide, each watershed should have its own calculated target reduction percentage. The targeted percentage of reduction should be the same for all subwatersheds in a watershed to make it easier for the county to administer the requirement.

Based on input from the Southeast Fairfax Development Corporation, it could be conservatively estimated that within the Richmond Highway corridor, approximately 25% of the commercial properties may be redeveloped over the next 25 years. The stormwater reduction overlay district would target those properties to reduce their redeveloped imperviousness or to implement BMPs to achieve the desired runoff reduction. The county should partner with the Southeast Fairfax Development Corporation to help developers comply with this recommended action. Current redevelopment sites that may have opportunities for the county to work with developers to implement this strategy and set a positive example for the future include the Groveton Corporate Center, Holly Acres, Shurguard Storage, ServiceMaster of Alexandria, and Mount Vernon Plaza and South Valley Shopping Centers. Adjacent property owners may want to work to together to manage stormwater collectively which may provide cost savings over separate, onsite facilities.

Watershed Benefit: The benefit to the watershed is a 10% net decrease in the two-year peak runoff from the Richmond Highway commercial corridor overlay district for any properties that are redeveloped. Peak flow reduction benefits for this action are included in the peak flow reductions shown on Map 4.2.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Objective A3: Increase the effectiveness and use of BMPs to reduce impacts from impervious areas.

Action A3.1: Increase the frequency of inspection for private BMPs with maintenance agreements from approximately once every three to five years to annually, and provide education to ensure proper maintenance by owners. For those private sites without maintenance agreements, provide education for owners on why and how to provide adequate maintenance. County-owned BMPs are currently inspected once a year and are not included in this action.

Strategy to Achieve Action: Hire additional inspectors or a contractor to increase the frequency of inspection of private BMPs. Inform both residential and commercial property owners of private BMPs with existing maintenance agreements about the more frequent inspections. Tenants will also need to be notified. Educational materials and training may need to be provided by the county for the residential and commercial property owners of all private BMPs and their tenants. The educational materials should include checklists and schedules for maintenance actions for different types of BMPs and information about additional resources for proper maintenance of a BMP.

Watershed Benefit: Routine inspection and proper maintenance of existing BMPs will help to ensure that they perform as intended. A typical dry detention BMP provides storage to manage runoff volumes to match predevelopment two- and 10-year storm flow rates and may also provide water quality treatment for the first half inch of runoff from each rainfall event. Over a 24-hour period, the pollutant removal efficiency for a properly functioning dry detention basin with a water quality component is approximately 75% for suspended solids, 45% for phosphorous, and 30% for nitrogen. This action will help in maintaining existing conditions and aid in preventing the further degradation of the watershed.

Responsible Party: Fairfax County
Cost: $200,000
Staff: 0.1 SYE

Action A3.2: Amend the county's Chesapeake Bay Preservation Ordinance, storm drainage ordinance, and other applicable ordinances to give the county the authority to require property owners to maintain privately owned BMPs and allow the county to inspect the BMPs for compliance with those ordinances.

Strategy to Achieve Action: If the county does not have a maintenance agreement for a privately owned BMP, then the county is not able to inspect the facility to ensure that it is functioning properly. The total number of private stormwater facilities or BMPs in the watershed without maintenance agreements is unknown. Amendments should be prepared for the existing Chesapeake Bay Preservation Ordinance, storm drainage ordinance, and other applicable ordinances to give the county the authority to require a maintenance agreement from the property owner. Education regarding why maintenance is needed and how to provide it should be given to the property owner. A grace period before the first inspection should be provided to allow property owners to fix their BMPs if in disrepair. If a BMP is not working properly after the grace period, the property owner should be assessed a penalty fee. Hire additional inspectors or hire a contractor to inspect the additional BMPs.

Watershed Benefit: This action will help ensure all BMPs in the watershed are functioning properly which will benefit the watershed by maintaining pollutant removal and control of stormwater runoff as originally designed for the facility, thus preventing the further degradation of the watershed. These benefits are the same as those discussed for dry detention BMPs in Action A3.1.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action A3.3: Evaluate the current list of recommended BMPs and integrated BMPs (dated October 2, 2001) to determine their effectiveness based on current literature, and revise this list to go beyond those found in the Virginia Stormwater Management Handbook. Porous pavement is permitted for stormwater detention in the county and could be added to the recommended BMP list. Green rooftops could also be added. Details on the applicability and use of porous pavement were distributed to the engineering and development community in a county letter to industry, dated March 2004. These practices are currently in use in Fairfax

County, and adding them to the recommended list will make it easier for developers to submit their site plan for review. As new stormwater management technologies become available in the future, they should also be evaluated, and if approved, added to the county's recommended list. The use of experimental BMPs should be allowed with a system for monitoring their effectiveness so as not to preclude innovation.

Action A3.4: Adopt a comprehensive methodology to quantify the detention and retention achieved for integrated BMPs to enable developers and DPZ/OSDS review staff to consistently and quickly calculate whether adequate stormwater control is achieved. Methods such as those described in Prince George's County Low Impact Development Design Strategies: An Integrated Design Approach and the credit system developed by Center for Watershed Protection for the Maryland Stormwater Design Manual are recommended based on their documented evaluation and support by the regulatory and engineering communities.

Action A3.5: Allow for the siting of integrated LID management practices, such as bioretention, on individual residential lots. Currently, they are only allowed on non-residential lots if they service more than one lot.

Strategy to Achieve Actions: Distribute an industry letter, which can be used to quickly accomplish Actions A3.3, A3.4, and A3.5, or if necessary, amend the Public Facilities Manual.

Watershed Benefit: The benefit of implementing these actions was not quantified, however they will result in more flexibility in the selection and siting of BMPs for developers in the case of Actions 3.3 and 3.5. By allowing the implementation of LID management practices, stormwater runoff can often be treated more directly at the source. The typical LID practice treats the first half inch of runoff, which equals 1,815 cubic feet per acre. Action 3.4 will provide developers and the county with consistency and efficiency during the site plan review process. The benefit to the watershed will be the siting and use of effective BMPs to reduce runoff and nonpoint source pollution.

Responsible Party: Fairfax County
Cost: $600,000
Staff: 0.1 SYE for each action = 0.3 SYE

Action A3.9: Fairfax County staff should not grant waivers of water quality controls for non-bonded lots exceeding 18% imperviousness. Non-bonded lots refer to existing lots that were created with an older development project for which the performance bond has already been released.

Strategy to Achieve Action: In the past, the county often granted waivers to county policy requiring water quality controls for non-bonded lots exceeding 18% imperviousness. Granting waivers to water quality controls for non-bonded lots exceeding 18% imperviousness directly affects water quality in the watershed. County water quality standards and criteria are established based upon an average 18% imperviousness for residential lots. The average imperviousness of residential lots in the Little Hunting Creek watershed is approximately 19%, and water quality controls are absent on most properties that exceed the 18% standard. By no longer granting waivers to this policy, water quality controls will be installed on all residential lots exceeding the 18% future imperviousness. Adopt a policy of not granting waivers for water quality controls for non-bonded lots exceeding 18% imperviousness. Distribute a memo to all review and permit approving authorities to make them aware of this new policy. A brief training session should also be given on this policy and its enforcement. County personnel should enforce this policy for all future development plans and develop educational materials for property owners that describe ways to reduce site imperviousness.

Watershed Benefit: For every 1% over the maximum 18% imperviousness, this action will result in the treatment of over 100 square feet of imperviousness and approximately five cubic feet of stormwater runoff per lot. In light of the continued mansionization of properties within the watershed, this policy has the potential to make a significant impact on improving water quality.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action A3.10: Adopt a policy of implementing natural landscaping including native trees and vegetation and green building approaches at all county facilities in the watershed. The county should be a model for implementing these beneficial watershed management approaches so it can set the example for current and future development.

Strategy to Achieve Action: Adopt a policy of implementing natural landscaping and green building approaches, as related to stormwater quality, at future county facilities. Use guidelines developed by the Virginia Department of Conservation and Recreation for natural landscaping and the Environmental Protection Agency for green buildings.

Watershed Benefit: The benefits of this action are the implementation of more suitable landscaping materials for the watershed as a result of using natural landscaping, and water quality and quantity benefits when green building approaches are implemented. Natural landscaping promotes the use of native species, which may not be currently present at county facilities. Green building technologies focus on practices that will provide improved water quality and reduced stormwater runoff, which are significant problems within the watershed.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action A3.11: The county and the Virginia Department of Transportation (VDOT) should institute an inspection protocol and perform more frequent assessments of ditches, pipes, and outfalls within the watershed every five years and make repairs as necessary.

Strategy to Achieve Action: Based upon the planning team’s and advisory committee’s review of the watershed, there are numerous locations where ditches require cleaning, pipes are failing, and outfalls are excessively eroded. Appropriate county or VDOT personnel should document these observations and develop maintenance plans to correct deficiencies. County or VDOT field crews should perform a condition assessment of these drainage conveyances and submit a report to the county and VDOT to determine responsibility for correction of observed problems.

Watershed Benefit: Evaluating the condition of existing drainage systems will document the adequacy of those conveyances and prevent future drainage problems. This process will help the county and VDOT identify existing and potential future drainage problems and allow them to develop a prioritized approach to correcting any existing inadequacies and schedule future maintenance projects.

Responsible Party: Fairfax County and VDOT
Cost: $216,000
Staff: 0.1 SYE

Objective A5: Reduce stormwater impacts from existing and proposed roadways based on new countywide watershed management requirements.

Rationale: Roads make up 34% of the total impervious area. As public rights-of-way, they must be designed and maintained to VDOT standards. VDOT applies BMPs that are established for use by the Virginia Department of Conservation and Recreation. The county can request that VDOT meet more stringent standards by establishing a new county stormwater ordinance or amending its existing ordinances. Currently, curbs and gutters are required for streets in subdivisions with lots smaller than 18,000 square feet and for heavily traveled and multi-lane roadways with limited rights-of-way, precluding the use of grassed swales and channeling more water to stormwater structures. In older watersheds, such as Little Hunting Creek, much of the roadway system was developed before stormwater management was required. Thus, new standards and methods are needed to reduce impacts from existing roadways that have no stormwater management controls. Based on current Virginia stormwater management law, the only way to require new stormwater controls for roads is if a road improvement project increases the paved area, thus increasing the net imperviousness.

Action A5.1: Require that road widening projects be designed to control the runoff from existing paved areas that do not have any existing stormwater management controls and reduce the existing peak runoff rate by 5%.

Strategy to Achieve Action: The Virginia Stormwater Management Regulations, section 4 VAC 3-20-101.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. Amend the county erosion and sedimentation control ordinance, Chesapeake Bay Preservation Ordinance, and other applicable ordinances to require stormwater management for existing pavement

The proposed Richmond Highway improvement project would be a good opportunity to reduce the amount of stormwater runoff from existing paved areas that do not have any stormwater controls. The location of the existing pavement area to be controlled by this recommended action is shown on Map 4.1, NLHC8. The control of quantity and quality runoff could be achieved by implementing LID techniques and installing structural BMPs along the proposed improvement corridor.

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 will 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, or reducing overall pavement footprints.

Minor roadway improvement projects, such as the addition of turn lanes, should be excluded from this proposed ordinance. 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.

Watershed Benefit: The benefit to the watershed for this action is a net reduction of 5% in the two-year peak flow runoff from the Richmond Highway roadway. Peak flow reduction benefits for this action are included in the peak flow reductions shown on Map 4.2.

Responsible Party: VDOT and Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Goal B: Preserve, maintain, and improve watershed habitats to support native flora and fauna.

Objective B1: Preserve, restore, and manage riparian buffers to benefit native flora and fauna.

Action B1.4: Evaluate the enforcement and application of the Chesapeake Bay Preservation Ordinance, including the granting of waivers or exceptions, to determine if riparian buffers are being adequately preserved and protected. Changes should be made to the Chesapeake Bay Preservation Ordinance if the intent of the ordinance is not being carried out.

Strategy to Achieve Action: Review the existing policies that may permit construction in the RPA such as allowing the replacement of existing bulkheads or construction of new bulkheads that allow property owners to fill behind the bulkheads (thus changing the floodplain limits). Density calculations allow land area located below low tide to be included as part of the total land area, thus allowing construction on small parcels.

A recent amendment to the Chesapeake Bay Preservation Ordinance gives much of the authority for granting exceptions to the RPA requirements to an independent review committee. It may be appropriate to defer analysis of the waivers and the consideration of any amendments to the Chesapeake Bay Preservation Ordinance concerning the granting of waivers until this committee has developed a significant track record. Upon evaluation of these policies and the granting of waivers, the Chesapeake Bay Preservation Ordinance, wetlands zoning ordinance, and other applicable ordinances may need to be amended which will need to be considered within a countywide context. The review of the Chesapeake Bay Preservation Ordinance should determine if stricter enforcement using civil and criminal penalties is required.

The Code Analysis Division of the DPWES will need to be involved in any amendments to the ordinance. County DPZ and OSDS staff, developers, and property owners should be educated regarding any future changes to the ordinances.

Watershed Benefit: The benefit to the watershed for this action is that the riparian buffer area should not decrease as a result of waivers or exceptions granted to the Chesapeake Bay Preservation Ordinance. The typical quantified benefits of riparian buffers are discussed in Action B1.1.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action B1.5: Require restoration of vegetation in the riparian buffer for development or redevelopment sites within the RPA that do not have existing buffer vegetation. Native vegetation mixes, suitable for local habitat, should be used.

Strategy to Achieve Action: Revise the Chesapeake Bay Preservation Ordinance amendment to require the planting of trees in the RPA riparian buffers of development sites that have few or no existing trees in the buffer. This ordinance amendment should also be reviewed against requirements detailed in the county's Public Facilities Manual, and the manual should be revised if necessary. The planted trees will count towards the minimum tree cover requirements in the zoning ordinance, i.e. 10% tree coverage for commercial sites, 15% tree coverage for high-density residential sites, and 20% tree coverage for all other residential sites. Guidelines will need to be developed to describe the type of vegetation to be planted in the RPA. The minimum tree cover density in riparian buffer area immediately adjacent to the stream is recommended to be between 40% and 70%. The County Code Analysis Division and the Urban Forestry Division will need to be involved in this action to determine if the existing structure of the ordinance is sufficient to address this recommendation and to help write the amendments to address the tree cover densities recommended in the riparian buffer area.

A future strategy that will require more public support will be to require the planting of new and appropriate species mixes in the RPA riparian buffer in addition to the existing minimum tree cover requirements. This strategy will benefit the stream by providing more trees on development properties within the RPA. The county's Tree Preservation Task Force should be reconvened to study this recommended action and determine other actions that will help meet the goals of the county watershed plans.

Watershed Benefit: This action will benefit the watershed by providing the restoration of riparian buffers which will increase the amount of habitat area, protect the stream bank areas from erosion, and filter pollutants from runoff. Quantified benefits of typical riparian buffers are discussed in Action B1.1.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Objective B3: Preserve, restore, and manage wetlands to benefit native flora and fauna.

Action B3.4: Promote the use of natural shorelines instead of hardened shorelines such as bulkheads or riprap as described in the Wetlands Guidelines prepared for the Virginia Marine Resources Commission (reprinted in September 1993). The construction of replacement bulkheads should go through the wetland permitting process.

Strategy to Achieve Action: Promote natural shoreline protection measures, including bioengineering, through public education workshops and materials targeted at shoreline property owners. Permit applicants should also have to demonstrate that a vegetative or natural solution will not work because of active and detrimental erosion and that riprap or a bulkhead is the only solution. In order to adequately demonstrate that a vegetative or natural solution will not be sufficient to adequately control erosion, the permit applicant must have its claim substantiated by a qualified professional (e.g., a professional engineer). The county wetlands review board should review permits for bulkhead repair and replacement projects. The state should also provide clarification of the phrase "active and detrimental," when used in this context, to the county wetlands review board, so they will have a standard by which to measure the necessity of a proposed project.

Watershed Benefit: The benefit of this action is not quantifiable, but it will help to promote the establishment and health of wetlands along watershed shorelines and improve natural habitats in those areas.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action B3.6: All impacts to wetlands shall have mitigation such as buying into a wetlands bank or creating compensatory wetlands. Wetland banks used for mitigation shall be deemed appropriate by state regulatory agencies.

Strategy to Achieve Action: The county shall revise the appropriate ordinances to require mitigation for all wetland impacts.

Watershed Benefit: This action will help preserve the remaining wetlands located in the watershed or create new wetlands in the watershed.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Goal C: Preserve, maintain, and improve the water quality of the streams to benefit humans and aquatic life.

Objective C2: Reduce the amount of pollutants such as fecal coliform bacteria, phosphorous, and nitrogen in stormwater runoff.

Action C2.6: Strengthen enforcement of the "pooper scooper" regulation by instituting a $100 fine for violators.

Strategy to Achieve Action: Amend the county code to include the suggested fine to further deter dog owners from allowing their pets to defecate outdoors without cleaning up afterwards. Actual enforcement of this action may prove difficult for occasional violators, but including a fine could further deter this practice. However, frequent offenders could be easily identified and cited for violation.

Watershed Benefit: The potential benefit of this action would be to reduce the amount of fecal coliform in the watershed.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Action C2.7: Require all lawn management companies to participate in the Virginia Water Quality Improvement Program and sign agreements to apply nutrients within established criteria, to better control application rates and timing. Hire companies that have signed these agreements for work at county facilities. Provide a list of these companies to residential and commercial property owners and homeowner associations.

Strategy to Achieve Action: The county code should be amended to implement this action. The requirements for certification should include education of the lawn care retailer or company by the county in the application of fertilizer and then the signing of an agreement with the Department of Conservation and Recreation that states that the company will abide by the proper management methods. As of March 24th, 2004, 53 contractors throughout the state have agreed to safeguard the state's natural resources by following a nutrient management plan approved by the DCR (21 of those contractors are in northern Virginia).

Watershed Benefit: The requirements for enrollment in the Virginia Water Quality Improvement Program are minimal, but the benefits to the watershed are very large in terms of nutrient management. In addition, knowledge that the program exists could foster greater stewardship by homeowners who are more educated about application rates and timing of the application. Based on the program's recent record of accomplishment, it appears to be successful and one that could provide a significant benefit to the watershed.

Responsible Party: Fairfax County
Cost: $216,000
Staff: 0.1 SYE

Goal D: Provide a means for increasing community involvement for long-term watershed stewardship.

Objective D1: Reduce the amount of trash and dumpsites in the watershed to help protect and improve the streams.

Action D1.3: Enforce the solid waste ordinance and erosion and sedimentation control ordinance prohibition against illegal dumping. Target the locations experiencing frequent dumpings of trash and waste and identify private, potentially illegal dumpsites located in the watershed. Impose fines on persons caught dumping illegally, take legal action against the property owners of illegal dumpsites, and require restoration of the sites.

Strategy to Achieve Action: Investigate methods for increasing the enforcement of illegal dumping in the watershed, perhaps by hiring more inspectors or a contractor to perform dumpsite monitoring and investigation of potential illegal dumpsites. One potential illegal dumpsite may be located east of Martin Luther King Jr. Park, as shown on Map 4.1 at SLHC15.

Watershed Benefit: The benefit to the watershed will be less pollution as a result of illegal dumping. This action would help to improve the health and reduce the amount of pollutants in streams within the watershed.

Responsible Party: Fairfax County
Cost: Included in Action C2.4
Staff: 0.1 SYE

5.3 Benefits of Plan Actions

The recommended policy and land use plan actions will provide benefits to the watershed in mitigating the effects of existing development. Most of the recommended policy and land use recommendations were not included in the model because it was difficult to accurately determine the extent of implementation of the action. The policy and land use actions that were modeled included Action A2.1 for the 10% peak flow reduction for 25% of the commercial properties located along the Richmond Highway corridor and Action A5.1 for the 5% peak flow reduction for the Richmond Highway roadway. The modeling results for these actions are included on Map 4.2. These policy actions, along with the other recommended policy actions under Goal A, will help to reduce the peak runoff, especially in the headwater regions. The policy and land use recommendations described under Goals B, C, and D will help to improve the quality of the runoff by improving the enforcement of existing regulations and adding additional requirements for wetland protection, buffer restoration, and control of sources of pollution.

5.4 Implementation of Plan Actions

The recommended policy and land use actions described in Section 5.2 will be reviewed by the county in the next few years to evaluate countywide implications and to compare with similar recommendations provided in other watershed plans in the county. If ordinance amendments are needed, they would be developed to include other county initiatives and address the common ground that can be established between the various policy recommendations. Land use recommendations will be further evaluated as part of the county's APR process. Land use recommendations adopted through the APR process will become part of the comprehensive plan. The 25-year estimated funding requirements for all of the policy and land use action recommendations is $3.8 million.

The first step in developing a logical and feasible implementation schedule was to provide a prioritization of the actions to evaluate how well they met the plan goals. The objective of the prioritization was to determine which actions best meet the goals of the plan, and the Little Hunting Creek Steering Committee used this information to help prepare the implementation schedule. The following prioritization criteria were used:

1. Peak flow reduction: This criterion describes how much runoff is reduced by the action.
2. Habitat benefit: This criterion describes the amount and type of habitat that is improved or created by the action.
3. Water quality improvement: This criterion describes the amount of water quality improvement.
4. Promotion of watershed stewardship: This criterion describes the amount of community involvement and increase in stakeholder watershed ownership.

The actions in the plan were scored from 1 to 5 for each of the prioritization criteria, with 5 as the best score and 1 as the worst score. The information that was used to score the policy and land use actions according to the criteria included primarily qualitative information. The qualitative assessment evaluated how well an action would meet the criteria. For example, how well would a public education program motivate stakeholders to perform an action that would benefit the watershed.

The reduction of peak flows throughout the watershed is one of the primary goals of the plan, and the peak flow reduction criterion was weighted at 40% to reflect a greater need to have actions that mitigate the effects of the increased runoff from the existing and proposed imperviousness. With this focus in mind, recommendations that targeted the headwaters of the subwatersheds were given higher scores, since they would provide a more significant peak flow reduction benefit. All the other criteria were weighted at 15% and a total score was given for each action. The actions were ranked according to their total score.

Table 5.1 Policy Actions

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Total Score
Weighting Factor	40%	15%	15%	15%	
Reduce Existing Runoff from Redevelopment: A2.1	5	1	3	1	2.75
No Waivers for 18% Imperviousness A3.9	3	3	4	2	2.55
Countywide Maintenance Agreement Authority: A3.2	3	1	3	3	2.25
Wetland Mitigation for Impacts: B3.6	2	4	3	2	2.15
Reduce Existing Peak Runoff from Roads: A5.1	3	1	3	1	1.95
Require Buffer Vegetation Restoration for Development: B1.5	1	5	2	3	1.9
Zoning Incentives: A1.2	3	1	2	1	1.8

Project Description and ID	Peak Flow Reduction	Habitat Benefit	Water Quality Treatment	Watershed Stewardship	Total Score
Weighting Factor	40%	15%	15%	15%	
Evaluate CBPA Waivers: B1.4	1	4	2	2	1.6
Promote Use of Natural Shorelines: B3.4	1	4	2	2	1.6
Lawn Management Company Requirement: C2.7	1	2	3	3	1.6
BMP Siting on Individual Residential Lots: A3.5	2	1	2	2	1.55
County Facilities Natural Landscaping and Green Buildings A3.10	2	3	2	2	1.45
Expedited Review Process: A1.1	2	1	2	1	1.4
Evaluate Recommended BMP List: A3.3	2	1	2	1	1.4
Adopt Comprehensive LID Calculation Methodology: A3.4	2	1	2	1	1.4
Strengthen Pooper Scooper Ordinance: C2.6	1	1	2	3	1.3

5.5 Monitoring of Plan Actions

This section describes the monitoring actions and targets for determining the success or failure of the future policy and/or land use related plan actions. The monitoring will help to determine if the plan actions should be modified in the future because of a low success rate or as watershed conditions change.

Action A1.1: Provide a new expedited review process for developers who include conservation design techniques and low-impact development features in their site plans. This expedited review process should be a separate expedited track from the current process.

MONITOR: How many developers apply for and receive expedited review each year?

TARGET: 50% of development site plans using LID and conservation design by 2008 and 60% by 2010.

Action A1.2: Provide zoning incentives for developers to reduce imperviousness.

MONITOR: How many developers apply for and use green development techniques in exchange for incentives? What incentives were most/least popular based on those used in site plans?

TARGET: 50% of developments use green development in exchange for incentives.

Action A2.1: Amend the county erosion and sedimentation control ordinance, Chesapeake Bay Preservation Ordinance, and other applicable ordinances to require that commercial and residential redevelopment of sites demonstrate a 10% net decrease in runoff.

MONITOR: What is the number of sites that were redeveloped with a 10% net decrease in runoff? How can we account for the percentage of peak flow reduction overall (or by subbasin)?

TARGET: 10% net decrease in the two-year peak runoff from redevelopment sites along the Richmond Highway commercial corridor district.

Action A3.1: Increase the frequency of inspection for private BMPs with maintenance agreements from approximately once every three to five years to annually, and provide education to ensure proper maintenance by owners. For those private sites without maintenance agreements, provide education for owners on why and how to provide adequate maintenance. County-owned BMPs are currently inspected once a year and are not included in this action.

MONITOR: What is the number of BMP inspections per year and annual increase in sites inspected as well as compliance (e.g. how many failed to be maintained?)?

TARGET: 100% annual inspection rate achieved by FY 2009.

Action A3.2: Amend the county's Chesapeake Bay Preservation Ordinance, storm drainage ordinance, and other applicable ordinances to give the county the authority to require property owners to maintain privately owned BMPs and allow the county to inspect the BMPs for compliance with those ordinances.

MONITOR: What is the number of private BMPs without maintenance agreements inspected per year and annual increase in sites inspected as well as compliance (e.g. how many failed to be maintained?)?

TARGET: 100% inspection of all BMPs by FY 2008 and improved condition of BMPs.

Action A3.3: Evaluate the current list of recommended BMPs and integrated BMPs (dated October 2, 2001) to determine their effectiveness based on current literature, and revise this list to go beyond those found in the Virginia Stormwater Management Handbook.

MONITOR: What is the number of BMPs added to the list and evaluation of their proper functioning? What is the percentage of site plan applications which use innovative and/or experimental BMPs?

TARGET: Increase the use of new types of BMPs on site plan applications by 33% per year versus previous years.

Action A3.4: Adopt a comprehensive methodology to quantify the detention and retention achieved for integrated BMPs to enable developers and DPZ/OSDS review staff to consistently and quickly calculate whether adequate stormwater control is achieved. Methods such as those described in Prince George's County Low Impact Development Design Strategies: An Integrated Design Approach and the credit system developed by Center for Watershed Protection for the Maryland Stormwater Design Manual are recommended based on their documented evaluation and support by the regulatory and engineering communities.

MONITOR: What is the methodology development and training of DPZ/OSDS staff in methodology and increase in requests from developers to use integrated BMPs?

TARGET: Implement new review and permitting methodologies and processes for use of integrated BMPs by FY 2007.

Action A3.5: Allow for the siting of integrated LID management practices, such as bioretention, on individual residential lots. Currently, they are only allowed on non-residential lots if they service more than one lot.

MONITOR: What is the number of integrated LID management practices projects implemented on residential lots?

TARGET: Allow by FY 2007.

Action A3.10: Adopt a policy of implementing natural landscaping and green building approaches at all county facilities in the watershed. The county should be a model for implementing these beneficial watershed management approaches so it can set the example for future development.

MONITOR: Adopt natural landscaping and green building policy for county facilities.

TARGET: 100% compliance with this policy for new county facilities starting FY 2007 and 100% implementation of natural landscaping at existing county facilities by FY 2010.

Action A3.11: The county and VDOT should institute an inspection protocol and perform more frequent assessment of ditches, pipes, and outfalls within the watershed every five years and make repairs as necessary.

MONITOR: What is the development of an inspection protocol, assessment of the storm drain system, and performance of maintenance and repair?

TARGET: Develop an inspection protocol in FY 2005 and inspect 20% of the stormwater infrastructure every five years beginning FY 2007. Continue the five-year inspection cycle during the life of the plan and beyond.

Action A5.1: Require that road widening projects be designed to control the runoff from existing paved areas that do not have any existing stormwater management controls and reduce the existing peak runoff rate by 5%.

MONITOR: Revision of stormwater management requirements for road projects in Fairfax County and percent reduction in imperviousness

TARGET: 5% reduction in the existing peak runoff rate for the two-year storm for road widening projects.

Action B1.4: Evaluate the enforcement and application of the Chesapeake Bay Preservation Ordinance, including the granting of waivers or exceptions, to determine if riparian buffers are being adequately preserved and protected. Changes should be made to the Chesapeake Bay Preservation Ordinance if the intent of the ordinance is not being carried out.

MONITOR: Number, percentage, and types of waivers granted by independent review committee

TARGET: No waivers granted.

Action B1.5: Require restoration of vegetation in the riparian buffer for development or redevelopment sites within the RPA that do not have existing buffer vegetation. Native vegetation mixes, suitable for local habitat, should be used.

MONITOR: Number of trees planted in buffer areas and percentage increase in canopy coverage

TARGET: 50% increase in the amount of planted buffer area to protect the stream bank areas from erosion and filter pollutants from runoff.

Action B3.4: Promote the use of natural shorelines instead of hardened shorelines such as bulkheads or riprap as described in the Wetlands Guidelines prepared for the Virginia Marine Resources Commission (reprinted in September 1993). The construction of replacement bulkheads should go through the wetland permitting process.

MONITOR: What is the number of total linear feet of existing hardened shorelines, and what is the percentage of total number of linear feet of hardened shoreline converted to natural shorelines?

TARGET: 100 linear feet of new natural shoreline (net) every five years.

Action B3.6: All impacts to wetlands shall have mitigation such as buying into a wetlands bank or creating compensatory wetlands. Wetland banks used for mitigation shall be deemed appropriate by state regulatory agencies.

MONITOR: Mitigation actions for impacts to existing wetlands

TARGET: No net loss of wetlands.

Action C2.6: Strengthen enforcement of the "pooper scooper" regulation by instituting a $100 fine for violators.

MONITOR: Number of fines collected

TARGET: 90% participation of dog owners in picking up pet waste by FY 2029.

Action C2.7: Require all lawn management companies to participate in the Virginia Water Quality Improvement Program and to sign agreements to apply nutrients within established criteria to better control application rates and timing. Hire companies that have signed these agreements for work at county facilities. Provide a list of these companies to residential and commercial property owners and homeowner associations.

MONITOR: Number of lawn management companies participating in the Virginia Water Quality Improvement Program

TARGET: 100% participation of lawn management companies operating in Fairfax County.

Action D1.3: Enforce the solid waste ordinance and erosion and sedimentation control ordinance prohibition against illegal dumping. Target the locations experiencing frequent dumpings of trash and waste and identify private, potentially illegal dumpsites located in the watershed. Take legal action against the property owners of illegal dumpsites and require restoration of the sites.

MONITOR: What is the number of illegal dumping reports received by the county, and what is the number and location of illegal dump sites in the watershed?

TARGET: 100% reduction in illegal dump sites by FY 2020.