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Executive Summary

The *Sugarland Run and Horsepen Creek Watershed Management Plan* presents a strategy for preserving healthy ecosystems and improving the streams and natural environment within the watersheds. This plan was initiated by Fairfax County and developed with input from residents of these watersheds as part of a county-wide planning effort.

Background

The Sugarland Run and Horsepen Creek watersheds are located in northern Virginia, straddling the Fairfax and Loudoun County boundary. Both watersheds are located within the larger Chesapeake Bay watershed. Sugarland Run drains directly into the Potomac River and Horsepen Creek drains into Broad Run in Loudoun County, which drains into the Potomac River just upstream of the Sugarland Run outlet.

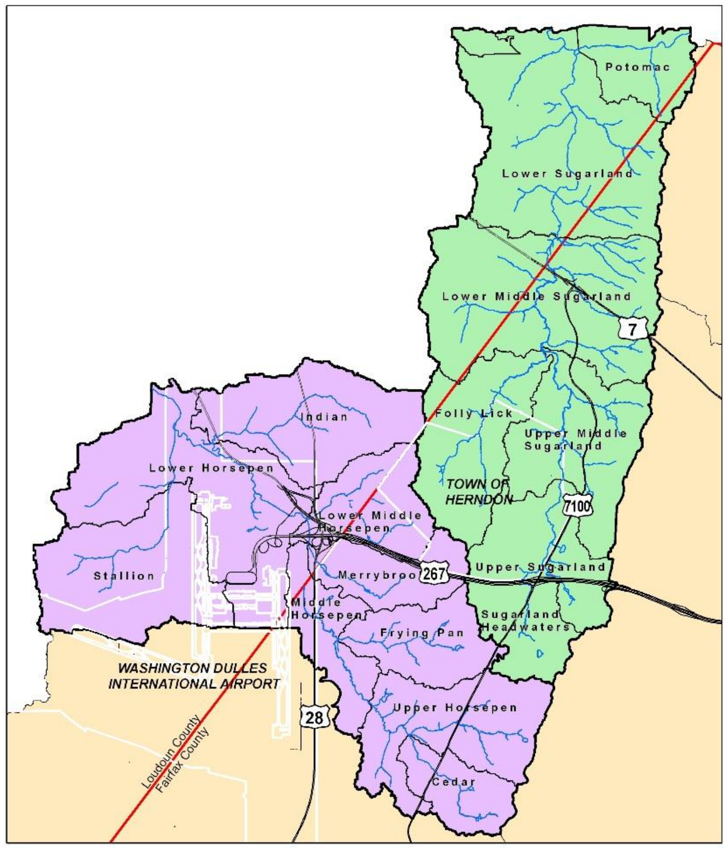

Figure ES.1 Sugarland Run & Horsepen Creek

In 1900 Fairfax County was largely agricultural, with dairy farming being the most important single industry. The population was just over 12,000. Beginning in the early 1940s, the County's economy shifted from agriculture to largely commercial. After World War II the population grew rapidly from roughly 50,000 to 500,000. In the 1970s the population of Fairfax grew to almost 900,000 residents, driven by technology-based businesses which were less dependent on urban centers than conventional industry, resulting in suburban expansion (Fairfax County, 2001). Today, Fairfax County is the most populous jurisdiction in Virginia as well as the Washington D.C. metropolitan area. The 2005 population was estimated at 1,047,500 and included 387,700 households (Fairfax County, 2006a). Most of the population expansion and associated development in Fairfax County occurred prior to the development and implementation of stormwater regulations that were promulgated to prevent flooding and protect water quality.

The Sugarland Run and Horsepen Creek Watershed Management Plan was developed in response to the watersheds' rapid growth and need for updated stormwater and overall watershed management. This plan presents issues affecting the quality of the watersheds, builds on previous management efforts and presents a comprehensive strategy for mitigating and reducing the impacts of development.

Purpose

Fairfax County has developed three primary goals to guide the progress of all county watershed management plans in the second phase of plan development. These goals were drafted by Fairfax County staff based on the goals and visions conceived by the watershed steering committees and watershed planning teams during the completion of the initial phase of watershed management plans. The countywide watershed planning goals are to:

1) Improve and maintain watershed functions in Fairfax County, including water quality, habitat, and hydrology.
2) Protect human health, safety, and property by reducing stormwater impacts.
3) Involve stakeholders in the protection, maintenance and restoration of county watersheds.

The *Sugarland Run and Horsepen Creek Watershed Management Plan* provides a plan of action to meet these goals by identifying watershed impairments, evaluating solutions for watershed restoration and preservation and involving a Watershed Advisory Group in plan development and project selection and prioritization.

Existing Watershed Conditions

The Sugarland Run watershed was divided into seven watershed management areas for watershed assessment purposes. Watershed management areas, or WMAs, are smaller subdivisions of a watershed used for planning and management purposes and typically range from two to five square miles in size. The Sugarland Run watershed was further broken down into 78 subwatersheds for more detailed analysis. Subwatersheds are the smallest watershed division used in this watershed management plan and range in size from 100 to 300 acres. The Horsepen Creek watershed was divided into nine WMAs and 77 subwatersheds for watershed management purposes.

Land use within Sugarland Run and Horsepen Creek watersheds is primarily residential in nature with commercial and industrial centers straddling the Dulles Toll Road (Route 267). Much of the open space within the Fairfax County portion of the watersheds is found along the Resource Protection Areas (RPAs) that border major streams. Resource Protection Areas are protected buffer areas established along the perennial streams in Fairfax County under the County's Chesapeake Bay Preservation Ordinance to improve the quality of streams and waterways draining to the Chesapeake Bay. However, many natural stream channels were replaced with concrete ditches or pipes prior to the establishment of RPAs and smaller headwater streams continue to be altered as watershed development continues.

The Fairfax County Stream Protection Strategy (SPS) program was completed in 2001 and included detailed biological and habitat data for five locations within Sugarland Run and Horsepen Creek watersheds. The data indicate that both watersheds are substantially degraded and are among the most negatively impacted in Fairfax County.

Fairfax County conducted a stream physical assessment (SPA) in 2005 to obtain baseline data for the County's streams (CH2MHill, 2005). The streams were evaluated based on habitat conditions, impacts to the stream from infrastructure and problem areas, general stream characteristics and geomorphic classification. The overall goal of the stream assessment program was to provide a consistent basis for protecting and restoring the receiving water systems and other natural resources in Fairfax County. Approximately 26 miles of stream were assessed in Sugarland Run watershed and approximately 17 miles of stream were assessed in the Horsepen Creek watershed. Both Sugarland Run and Horsepen Creek watersheds were given fair overall ratings. Most of the streams in both Sugarland Run watershed and Horsepen Creek watershed are classified as Stage 3 for stream morphology and show signs of active erosion. Stage 3 streams are the most unstable and typically exhibit steep banks, bank failures, channel widening and deepening.

Planning Process

Additional field reconnaissance was conducted to update and supplement existing Fairfax County GIS data so current field conditions were accurately represented. The reconnaissance effort included the identification of pollution sources, current stormwater management practices and potential restoration opportunities across the various watersheds. There are 157 existing stormwater management facilities in the Sugarland Run watershed within Fairfax County; however, nearly three-quarters of this area is untreated by any stormwater facilities. Correspondingly, there are 147 existing stormwater management facilities in the Horsepen Creek watershed within Fairfax County, yet more than two-thirds of this area is without stormwater controls.

Successful management of a watershed requires the assessment of the interactions between pollutant sources, watershed stressors, and conditions within streams and other waterbodies. In addition to field reconnaissance and previous watershed assessments, water quality and water quantity modeling was conducted for existing and forecasted future conditions. The goal of watershed characterization is to identify existing and potential problem areas and evaluate subwatershed restoration opportunities.

A standardized method of subwatershed ranking was conducted as a means to provide a systematic method of compiling available water quality and natural resources information. Ranking subwatersheds based on watershed characterization and modeling results provides a tool for planners and managers to set priorities and identify candidate restoration and preservation areas.

Subwatershed ranking indicators were developed to assess the condition of the environment, as early-warning signals of changes in the environment, and to diagnose causes of ecological problems. The indicators used by Fairfax County may be grouped into the following categories:

- **Watershed Impact Indicators –** Measure the extent that reversal or prevention of a particular watershed impact, sought by the goals and objectives, has been achieved ("What's there now, and how is it doing?").
- **Source Indicators –** Quantify the presence of a potential stressor or pollutant source ("Is there a problem, and what's causing it?").
- **Programmatic Indicators** –After the plans are adopted, these will assess outcomes of resource protection and restoration activities ("What's the County doing about the problem, and how is it doing?").

Watershed impact indicators and source indicators were evaluated based on existing conditions. Future condition metrics and scores were also evaluated for a sub-set of predictive indicators and reflect the simulated conditions at ultimate build-out based on the County's Comprehensive Plan. The resulting scores from the existing condition and future without projects condition were used to rank subwatersheds according to their problems and needs and to assist with candidate project identification.

Watershed Restoration Strategies

Priority subwatersheds were identified based on the results of final subwatershed ranking, priority restoration elements from the SPA, problem areas identified during subwatershed characterization and field reconnaissance and input from the Watershed Advisory Group (WAG). General subwatershed characteristics and impairments were recorded for each priority subwatershed. Sources of subwatershed impairments were identified where evident and improvement goals/strategies were developed for each priority subwatershed.

All subwatersheds draining to a planned, un-built regional pond were evaluated for potential restoration alternatives, and the alternatives were categorized as **regional pond alternative strategies**. **Subwatershed improvement strategies** are intended to reduce stormwater impacts for subwatersheds that do not drain to a planned, un-built regional pond. Regional pond alternative strategies and subwatershed improvement strategies may include a variety of project types including new stormwater ponds, stormwater pond retrofits, low impact development retrofits, culvert retrofits, outfall improvements and area-wide drainage improvements. **Stream restoration strategie**s are targeted to improve habitat, to promote stable stream geomorphology, and to reduce in-stream pollutants due to erosion. **Non-structural measures and preservation strategies** can provide significant benefits by improving the water quality of stormwater runoff, by reducing the quantity of stormwater runoff, by improving stream and riparian habitat and by mitigating the potential impacts of future development.

A universe of potential projects was complied as a result of these efforts. Additionally, potential alternatives were identified for each of the seven planned, un-built regional ponds within the watersheds. Watershed advisory group (WAG) members reviewed proposed candidate projects and discussed overall project selection methods and the location and scope of individual proposed projects. Field visits to candidate sites were conducted for all potential candidate structural projects to determine feasibility and modify project scopes based on site conditions.

An initial feasibility analysis was conducted to reduce the initial list of candidate structural projects. Factors considered during the initial feasibility analysis included constraints identified during field reconnaissance, the size and scale of the projects, the location and distribution of projects within a subwatershed, existing stormwater treatment in the subwatershed, project drainage area and specific WAG member comments. Candidate projects deemed viable were those which had few, if any, site constraints, would provide significant additional stormwater treatment to a subwatershed, and were considered to be of significant size and scope.

Project Prioritization

Viable structural projects were prioritized and ranked according to a standardized method developed by Fairfax County in order to ensure that all projects across the County could be compared and ranked in a County-wide fashion. Structural projects were scored based on five factors:

1. Effect on watershed impact indicators
2. Effect on source indicators
3. Location within priority subwatersheds
4. Sequencing
5. Implementability

An initial ranking composite score was calculated for each project based on the weighted average of the five project scores described above. This score was used to determine the overall initial rank of each project.

In addition to the quantitative project prioritization method developed by the County, WAG member comments, evaluation of projects in water quality modeling, cost benefit analysis and best professional judgment were integrated into the final project scoring and ranking. The final ranking scores were used to determine the priority of each project for the implementation process.

The 70 projects ranked most beneficial comprise the 10-year “Priority” Implementation Plan. The remaining 50 projects make up the 11-25 year “Long-Term” Implementation Plan. The 10-year projects were further analyzed with water quality modeling and a detailed cost benefit analysis to refine the priority ranking within the 10-year implementation plan.

Project fact sheets were created for each of the 10-year projects and include basic information about the project location, a description of the project scope, project benefits, design considerations, itemized cost estimates and detailed project maps. Some projects contain multiple parts or sub-projects; these project “suites” are summarized and contained on a single project fact sheet.

Plan Costs and Benefits

An integral element to evaluating the benefits of restoration strategies and projects is associated costs. Detailed cost estimates, as shown on the project fact sheets, were determined for structural projects in the 0-10 year implementation phase. The total cost of the 10-year implementation plan is $30 million. Associated costs for structural projects in the 11-25 year implementation phase were roughly approximated based on the overall costs associated with similar projects in the 10 year implementation plan and are estimated at approximately $13 million. Cost estimates were not calculated for non-structural projects, as they do not require traditional construction measures to be implemented and may be programmatic in nature. The 10-year implementation plan consists of 70 total structural projects. The 11-25 year implementation plan consists of 50 additional structural projects. There are 19 non-structural projects identified in the plan.

Implementation of all projects and restoration strategies in the 10-year priority list will result in significant overall reductions in stormwater flows and pollutant loads with associated improvements to habitat and stream quality. Stormwater runoff volume from the 2-year and 10-year storm events would decrease by 2 percent, or 45 inches per year and 91 inches per year, respectively. The peak flow rate would also decrease by 2 percent, resulting in a reduction of 0.005 CFS per acre for the 2-year storm event and 0.010 CFS per acre for the 10-year storm event. Total suspended solids would be reduced by 5% overall or 21 pounds per acre per year. Total nitrogen would be reduced by 2% or 0.24 pounds per acre per year, and total phosphorus would be reduced by 3% or 0.04 pounds per acre per year.

Implementation of all projects within the plan, including projects in the 25-year implementation plan will result in additional reductions in stormwater flows and pollutant loads. Total suspended solids would be reduced by 7 percent overall or 30 pounds per acre per year. Total nitrogen would be reduced by 3 percent or 0.32 pounds per acre per year, and total phosphorus would be reduced by 4 percent or 0.06 pounds per acre per year.

The following provisions address the funding and implementation of projects and programs in Fairfax County watershed plans. These provisions as recommended by the Board were developed for the Popes Head Creek Watershed Management Plan in February 2006 and have been applied to the Sugarland Run and Horsepen Creek Watershed Management Plan:

i. Projects and programs (both structural and non-structural) will first undergo appropriate review by County staff and the Board (please see iii below) prior to implementation. Board adoption of the Watershed Management Plan will not set into motion automatic implementation of projects, programs or initiatives that have not first been subject to sufficient scrutiny to ensure that the projects that are funded give the County the greatest environmental benefit for the cost.

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

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

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

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

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

Table ES.1 provides a list of all projects in the 10-year implementation plan, the 25-year implementation plan and the non-structural projects.

Table ES.1 Master Project List				
Priority Structural Projects (10 Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
HC9007	Regional Pond Alternative Suite	Horsepen - Cedar	Between Ladybank Lane & Mother Well Court	$790,000
HC9013	Regional Pond Alternative Suite	Horsepen - Cedar	Between Franklin Farm Rd, West Ox Rd & Ashburton Ave	$1,970,000
HC9102	New Stormwater Pond	Horsepen - Middle	Legacy Circle & Sunrise Valley Drive	$150,000
HC9106	Stormwater Pond Retrofit	Horsepen - Frying Pan	Frying Pan Road & Centreville Road	$310,000
HC9107	New Stormwater Pond	Horsepen - Merrybrook	Palmer Drive & Dogwood Court	$210,000
HC9108	Stormwater Pond Retrofit	Horsepen - Middle	Near Copper Creek Road & Copper Creek Court	$190,000
HC9109	Stormwater Pond Retrofit	Horsepen - Frying Pan	Between Coppermine Rd, Thomas Jefferson Dr & Masons Ferry Dr	$400,000
HC9110	New Stormwater Pond	Horsepen - Merrybrook	Herndon Parkway & Campbell Way	$160,000
HC9114	Stormwater Pond Retrofit	Horsepen - Frying Pan	Fox Mill Road & Cabin Creek Road	$340,000
HC9116	New Stormwater Pond	Horsepen - Frying Pan	Near Halterbreak Court & Curved Iron Road culs-de sac	$220,000
HC9118	Stormwater Pond Retrofit	Horsepen - Upper	Between Floris Lane & Merricourt Lane culs-de-sac	$120,000
HC9119	Stormwater Pond Retrofit	Horsepen - Frying Pan	Colts Brook Drive & Fox Mill Road	$450,000
HC9121	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	Centreville Road & Lake Shore Drive	$590,000
HC9122	Stormwater Pond Retrofit	Horsepen - Upper	Lake Shore Drive & Running Pump Lane	$70,000
HC9123	Stormwater Pond Retrofit	Horsepen - Upper	Near Point Rider Lane & Equus Court	$150,000
HC9126	Stormwater Pond Retrofit	Horsepen - Upper	Monterey Estates Drive & West Ox Road	$180,000
HC9127	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Meadow Hall Drive & New Carson Drive	$180,000
HC9128	Stormwater Pond Retrofit	Horsepen - Upper	Korean Orthodox Presbyterian Church, McLearen Road & Centreville Road	$430,000
HC9129	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	West Ox Road & New Parkland Drive	$490,000

Table ES.1 Master Project List				
Priority Structural Projects (10 Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
HC9132	Stormwater Pond Retrofit	Horsepen - Upper	Highland Mews Subdivision, Hutumn Court & Highland Mews Court	$210,000
HC9133	Stormwater Pond Retrofit, BMP/LID, Stream Restoration	Horsepen - Cedar	Near Glen Taylor Lane & Mother Well Court	$310,000
HC9134	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	Kinross Circle & Scotsmore Way	$310,000
HC9136	Stormwater Pond Retrofit	Horsepen - Upper	Near Viking Drive & Pinecrest Road	$150,000
HC9137	Stream Restoration, New Stormwater Pond	Horsepen - Upper	Between Tewksbury Drive & Kettering Drive	$430,000
HC9140	Stormwater Pond Retrofit	Horsepen - Upper	Huntington Drive cul-de-sac	$370,000
HC9142	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Upper	Quincy Adams Drive & Quincy Adams Court	$220,000
HC9143	Stormwater Pond Retrofit	Horsepen - Cedar	Off of Ashburton Avenue, near Thistlethorn Drive & Saffron Drive	$310,000
HC9149	New Stormwater Pond	Horsepen - Upper	Chasbarb Terrace & Chasbarb Court	$270,000
HC9200	Culvert Retrofit, Stream Restoration	Horsepen - Lower Middle	Near Parcher Avenue & Monaghan Drive, next to the Reflection Lake pool	$1,070,000
HC9201	Stream Restoration	Horsepen - Upper	Between Claxton Drive & Conquest Place culs-de-sac	$230,000
HC9202	Stream Restoration	Horsepen - Upper	Between Quincy Adams Court, Viking Court & Prince Harold Court culs-de-sac	$950,000
HC9500	BMP/LID	Horsepen - Middle	Wellesley Subdivision, Stratford Glen Place	$250,000
HC9503	BMP/LID	Horsepen - Frying Pan	Frying Pan Park/Kidwell Farm	$90,000
SU9002	Regional Pond Alternative Suite	Sugarland - Upper Middle	Near Wheile Ave, between Pellow Circle Terrace & Reston Ave	$860,000
SU9005	Regional Pond Alternative Suite	Sugarland - Lower Middle	Near Leesburg Pike, between Rolling Holly Drive & Sugarland Road	$780,000
SU9007	Regional Pond Alternative Suite	Sugarland - Lower Middle	Between Leesburg Pike, Fairfax County Parkway & Wiehle Avenue	$1,010,000
SU9100	Stormwater Pond Retrofit	Sugarland - Lower	Jackson Tavern Way cul-de-sac	$170,000
SU9101	Stormwater Pond Retrofit	Sugarland - Lower	Near Great Falls Way & Jackson Tavern Way	$390,000
SU9103	Stormwater Pond Retrofit	Sugarland - Lower	Thomas Run Drive	$210,000
SU9106	Stormwater Pond Retrofit, BMP/LID	Sugarland - Lower Middle	Near Tralee Drive & Old Holly Drive	$400,000

Table ES.1 Master Project List				
Priority Structural Projects (10 Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
SU9108	Stormwater Pond Retrofit	Sugarland - Lower Middle	Dranesville Road & Woodson Drive	$210,000
SU9110	Stormwater Pond Retrofit	Sugarland - Lower Middle	Methven Court cul-de-sac	$130,000
SU9117	Stormwater Pond Retrofit	Sugarland - Folly Lick	Dranesville Road & Hiddenbrook Drive	$500,000
SU9123	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near Philmont Drive & Judd Court	$310,000
SU9129	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Quail Ridge Court cul-de-sac	$190,000
SU9130	New Stormwater Pond	Sugarland - Upper Middle	Near Jenny Ann Court cul-de-sac	$150,000
SU9135	Stormwater Pond Retrofit, BMP/LID	Sugarland - Upper Middle	Trinity Presbyterian Church	$320,000
SU9136	New Stormwater Pond	Sugarland - Upper Middle	Near Queens Row Street & Herndon Parkway	$110,000
SU9139	Stormwater Pond Retrofit	Sugarland - Upper	Towns at Stuart Pointe Subdivision, Stuart Pointe Lane	$70,000
SU9143	Stormwater Pond Retrofit	Sugarland - Upper	Near Grove Street & Herndon Parkway	$140,000
SU9144	New Stormwater Pond, BMP/LID	Sugarland - Upper Middle	Bowman Towne Drive & Fountain Drive	$200,000
SU9146	Stormwater Pond Retrofit, New Stormwater Pond	Sugarland - Upper	Next to St. Timothy's Episcopal Church, Spring Street	$130,000
SU9147	Stormwater Pond Retrofit	Sugarland - Upper	Near Edmund Halley Drive & Sunrise Valley Drive	$140,000
SU9149	New Stormwater Pond, Stream Restoration, Stormwater Pond Retrofit	Sugarland - Headwaters	Polo Fields Subdivision	$1,930,000
SU9150	New Stormwater Pond	Sugarland - Headwaters	Near Nutmeg Lane cul-de-sac	$250,000
SU9201	New Stormwater Pond, Stream Restoration	Sugarland - Folly Lick	Folly Lick stream corridor between Fantasia Drive & Monroe Street	$910,000
SU9203	Stream Restoration	Sugarland - Upper Middle	Hunters Creek HOA and Runnymede Park	$290,000
SU9204	Stream Restoration	Sugarland - Folly Lick	Herndon Centennial Park golf course	$1,880,000
SU9205	Stream Restoration	Sugarland - Upper Middle	Fairfax County Parkway & Walnut Branch Road	$810,000
SU9208	Stream Restoration	Sugarland - Headwaters	Near Sanibel Drive & Tigers Eye Court culs-de-sac	$1,170,000
SU9209	Stream Restoration	Sugarland - Headwaters	Pinecrest Road & Glade Drive	$290,000
SU9210	Stream Restoration	Sugarland - Headwaters	Fox Mill Road & Keele Drive	$80,000
SU9500	BMP/LID	Sugarland - Upper Middle	Herndon High School	$850,000
SU9502	BMP/LID	Sugarland - Upper Middle	Herndon Elementary School	$580,000
SU9504	BMP/LID	Sugarland - Upper Middle	Reston North Park	$130,000

Table ES.1 Master Project List				
Priority Structural Projects (10 Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
SU9505	BMP/LID	Sugarland - Upper	Near Elden Street & Van Buren Street	$380,000
SU9509	BMP/LID	Sugarland - Upper Middle	Trader Joe's	$330,000
SU9512	BMP/LID	Sugarland - Upper Middle	Reston Hospital	$200,000
SU9514	BMP/LID	Sugarland - Upper	Sunset Hills Road & Fairfax County Parkway	$290,000
SU9515	BMP/LID	Sugarland - Upper	Sunset Hills Road & Town Center Parkway	$200,000
			Total Cost:	***$29,560,000***

Long-term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
HC9100	Stormwater Pond Retrofit	Horsepen - Lower Middle	Rock Hill Road & Turquoise Lane
HC9101	Stormwater Pond Retrofit	Horsepen - Lower Middle	Near Spring Knoll Drive & Summerset Place
HC9103	Stormwater Pond Retrofit	Horsepen - Middle	Dulles Int'l Airport, near Sully Rd & electric substation
HC9104	New Stormwater Pond	Horsepen - Merrybrook	Centreville Road & McNair Farms Drive
HC9111	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Frying Pan Road & Coppermine Road
HC9113	Stormwater Pond Retrofit	Horsepen - Middle	Towerview Road cul-de-sac
HC9115	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Middle	Near Mustang Drive & Maverick Lane
HC9117	Stormwater Pond Retrofit	Horsepen - Frying Pan	Monroe Manor Drive cul-de-sac
HC9124	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Locksley Court cul-de-sac
HC9125	New Stormwater Pond	Horsepen - Upper	Near Spring Chapel Court cul-de-sac
HC9130	Stormwater Pond Retrofit	Horsepen - Upper	Middleton Farm Subdivision, between Middleton Farm Lane & Blue Holly Lane culs-de-sac
HC9131	Stormwater Pond Retrofit, Culvert Retrofit	Horsepen - Upper	Near West Ox Road & McLearen Road
HC9135	Stormwater Pond Retrofit	Horsepen - Cedar	Near Emerald Chase Drive & Rover Glen Court
HC9138	New Stormwater Pond	Horsepen - Cedar	Near Emerald Chase Drive & Ruby Lace Court
HC9139	New Stormwater Pond	Horsepen - Upper	Near Bradwell Road & Litchfield Drive
HC9146	Stormwater Pond Retrofit, BMP/LID	Horsepen - Cedar	Near Ashburton Avenue & Wheeler Way
HC9148	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Upper	Near Glenbrooke Woods Drive cul-de-sac
HC9302	Area-wide Drainage Improvement	Horsepen - Cedar	Burchlawn Street cul-de-sac

Long-term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
HC9400	Culvert Retrofit	Horsepen - Lower Middle	Near Rock Hill Road & Innovation Avenue
HC9401	Culvert Retrofit	Horsepen - Lower Middle	Near Rock Hill Road & Innovation Avenue
HC9501	BMP/LID	Horsepen - Middle	Along stream corridor between Floris Street & Mountainview Court
HC9502	BMP/LID	Horsepen - Middle	Floris Elementary School
HC9505	BMP/LID	Horsepen - Upper	Near Emerald Chase Drive & Lazy Glen Court
SU9001	Regional Pond Alternative Suite	Sugarland - Lower Middle	Near Rowland Drive & Heather Way
SU9105	Stormwater Pond Retrofit	Sugarland - Lower	Air View Lane
SU9107	Stormwater Pond Retrofit	Sugarland - Lower Middle	Near Leesburg Pike & Fairfax County Parkway
SU9111	Stormwater Pond Retrofit	Sugarland - Lower Middle	Dranesville Road & Woodson Drive
SU9112	Stormwater Pond Retrofit	Sugarland - Lower Middle	East of Dranesville Road & Butter Churn Drive
SU9115	Stormwater Pond Retrofit	Sugarland - Lower Middle	Hastings Hunt Section 6 and Jenkins Ridge Subdivisions
SU9118	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near stream corridor in Dranesville Estate Section 1 and 2
SU9120	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Eddyspark Drive & Kingsvale Circle
SU9121	Stormwater Pond Retrofit, New Stormwater Pond	Sugarland - Folly Lick	East of Millikens Bend Road near Millbank Way & Westlodge Court
SU9122	Stormwater Pond Retrofit	Sugarland - Folly Lick	Baptist Temple of Herndon
SU9124	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Rosiers Branch Drive & Heather Down Drive
SU9127	Stormwater Pond Retrofit	Sugarland - Folly Lick	Herndon United Methodist Church
SU9128	Stormwater Pond Retrofit	Sugarland - Upper Middle	Between the Fawn Ridge Lane culs-de-sac
SU9133	New Stormwater Pond, BMP/LID	Sugarland - Folly Lick	Near Crestview Drive & Bond Street
SU9137	New Stormwater Pond	Sugarland - Upper Middle	Walnut Branch Road & Purple Sage Court
SU9140	New Stormwater Pond, Stormwater Pond Retrofit	Sugarland - Upper	Safeway; corner of Post Drive & Grove Street
SU9141	Stormwater Pond Retrofit	Sugarland - Upper	Substation near Grove Street & Grant Street
SU9142	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near Spring Street & Wood Street
SU9200	Stream Restoration	Sugarland - Lower Middle	Near Dranesville Road & Woodson Drive
SU9202	Stream Restoration	Sugarland - Folly Lick	Near Herndon Parkway & Stevenson Court
SU9206	Stream Restoration	Sugarland - Upper	Near Herndon Parkway & Tamarack Way
SU9207	Stream Restoration	Sugarland - Upper	Near Fairfax County Parkway & New Dominion Parkway

Long-term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
SU9400	Culvert Retrofit	Sugarland - Lower	Near Kentland Drive & Parrish Farm Lane
SU9501	BMP/LID	Sugarland - Upper Middle	Lake Newport Road & North Point Drive
SU9510	BMP/LID	Sugarland - Upper	Near Elden Street & Fairfax County Parkway
SU9511	BMP/LID	Sugarland - Folly Lick	Dulles Park Court & Alabama Drive
SU9513	BMP/LID	Sugarland - Upper	Near Old Dominion Avenue & Aspen Drive

Non-Structural Projects			
Project #	**Project Type**	**WMA**	**Location**
HC9901	Buffer Restoration, Rain Barrel Programs	Horsepen - Cedar	Near Ashburton Avenue & Thistlethorn Drive
HC9902	Buffer Restoration	Horsepen - Frying Pan	Stream corridors near Copper Bed Road & Copper Hill Road
HC9903	Buffer Restoration, Rain Barrel Programs	Horsepen - Lower Middle	Reflection Lake HOA & Four Season HOA (Herndon)
HC9904	Conservation Acquisition Project/ Land Conservation Coordination Project	Horsepen - Middle	Stream corridors near Sully Road & Park Center Road
HC9905	Conservation Acquisition Project/ Land Conservation Coordination Project, Dumpsite/ Obstruction Removal, Buffer Restoration	Horsepen - Upper	Stream corridors near McLearen Road & Cobra Drive
HC9906	Rain Barrel Programs	Horsepen - Upper	Chantilly Highlands
HC9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	Horsepen - Merrybrook	Centreville Road & Woodland Park Road
SU9900	Rain Barrel Programs	Sugarland - Folly Lick	Westfield, Fortnightly Square, Haloyon of Herndon Sect 5, Van Vlecks, Ballou, Saubers, Herndon Station, Herndon Park Station, and Chandon Subdivisions
SU9901	Buffer Restoration	Sugarland - Lower Middle	Near Leesburg Pike & Rolling Holly Drive
SU9902	Rain Barrel Programs	Sugarland - Lower Middle	Sugar Creek Sec. 1, Stuart Hills, Cedar Chase, Oak Creek Estates, Forest Heights Estates, Stoney Creek Woods, Hastings Hunt sec. 6, portion of Jenkins Ridge, Holly Knoll, and Crestbrook Subdivisions
SU9903	Conservation Acquisition Project/ Land Conservation Coordination Project	Sugarland - Lower Middle	Stream corridor near Leesburg Pike & Holly Knoll Drive
SU9904	Community Outreach/ Public Education	Sugarland - Lower Middle	Near Heather Way cul-de-sac
SU9905	Rain Barrel Programs	Sugarland - Upper	Crestview Sec. 1, Runnymede Manor, Stuart Woods, Reston Sec. 49, and Towns at Stuart Pointe Subdivisions

Non-Structural Projects			
Project #	**Project Type**	**WMA**	**Location**
SU9906	Buffer Restoration	Sugarland - Upper	Near Fairfax County Parkway & Sunset Hills Road
SU9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	Sugarland - Upper	Stream corridors near Herndon Parkway & Fairbrook Drive
SU9908	Rain Barrel Programs	Sugarland - Upper Middle	Stuart Ridge, Shaker Woods, Shaker Grove, Kingstream, Hunters Creek, Potomac Fairways, Iron Ridge Sec. 2, Graymoor, Chestnut Grove, Old Drainsville Hunt Club, Jeneba Woods, Reston Sec. 49, and Sugar Land Heights Subdivisions
SU9909	Rain Barrel Programs	Sugarland - Headwaters	Polo Fields Subdivision
SU9910	Buffer Restoration	Sugarland - Headwaters	Fairfax County Parkway & Dulles Access Road
SU9911	Conservation Acquisition Project/ Land Conservation Coordination Project	Sugarland - Headwaters	Sunrise Valley Wetland Park

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1.0 Introduction

1.1 Introduction to Watersheds

A watershed is an area of land that drains all of its water to a specific lake or river. As rainwater and melting snow run downhill, they carry sediment and other materials into our streams, lakes, wetlands and groundwater.

The boundary of a watershed is defined by the watershed divide, which is the ridge of highest elevation surrounding a given stream or network of streams. A drop of rainwater falling outside of this boundary will enter a different watershed and will flow to a different body of water.

Figure 1.1 Diagram of a watershed

Streams and rivers may flow through many different types of land use in their paths to the ocean. In the above illustration from the U.S. Environmental Protection Agency, water flows from agricultural lands to residential areas to industrial zones as it moves downstream. Each land use presents unique impacts and challenges on water quality.

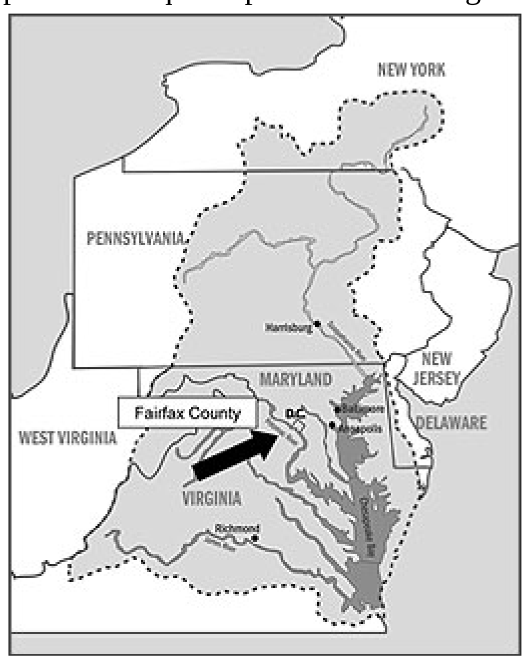

Figure 1.2 The Chesapeake Bay watershed

The size of a watershed can be subjective; it depends on the scale that is being considered.

The image to the left depicts the extent of the Chesapeake Bay watershed, "the big picture" that is linked to our local concerns. This watershed covers 64,000 square miles and crosses into six states: New York, Pennsylvania, Delaware, West Virginia, Maryland, Virginia and the District of Columbia.

One of the watersheds that comprise the Chesapeake Bay watershed is the Potomac River watershed. Fairfax County, as shown on the map, occupies approximately 400 square miles of the Potomac River watershed. This area contains 30 smaller watersheds. Think of watersheds as being "nested" within each successively larger one.

Each watershed in Fairfax County was subdivided to facilitate data management and to promote local awareness of the streams. Watersheds were divided into Watershed Management Areas (WMAs) approximately four square miles in size. WMAs are usually named for the local major tributary. These areas are further divided into subwatersheds, ranging in size from 100 to 300 acres. Subwatersheds represent the smallest modeling unit for watershed planning.

Beginning in the early 1940's, Fairfax County shifted from an agricultural community to an urbanized one whose population exceeds that of several states. While the County continued to develop, the condition of streams and aquatic life declined. In 1999, a Stream Protection Strategy (SPS) was initiated to monitor stream health and establish a baseline of countywide stream conditions. The results of the baseline monitoring effort indicated that only 25 percent of the County's streams were in good to excellent biological health. Stream condition is determined using an Index of Biological Integrity (IBI) that evaluates ecological health based on the community structure of bottom-dwelling aquatic invertebrates.

The baseline study found that roughly 75 percent of streams within the County had areas negatively impacted by impervious conditions within their watersheds. Due to increasing urbanization prior to implementation of modern stormwater controls, impervious land area rapidly increased, contributing to the degradation of the streams.

1.2 Introduction to Watershed Planning

The County's comprehensive stormwater management program is currently undergoing a transformation that addresses watershed health using a holistic approach. The mission for the stormwater program is dictated by the need to preserve and restore the natural environment and aquatic resources, which is consistent with the Fairfax County Board of Supervisors' Environmental Agenda adopted in June 2004. The County must also comply with all applicable local, state and federal laws and mandates. These include County ordinances and policies, Virginia's Chesapeake Bay Initiatives and the federal Clean Water Act. Under the Virginia Pollutant Discharge Elimination System (VPDES) the County has an individual Municipal Separate Storm Sewer System (MS4) Permit. This permit requires the creation of watershed management plans to facilitate compliance with the Clean Water Act. In addition, the County is doing its part to fulfill Virginia's commitment to the Chesapeake Bay 2000 Agreement to restore the ecological health of the Chesapeake Bay Watershed.

Fairfax County's first set of watershed plans were completed in the 1970s. Land use has changed significantly since that time. Additionally, there have been many advances in technology and development in the field of stormwater management which have resulted in updates to stormwater policies and regulations. New plans were needed to reflect these changes and to plan for a future in which Fairfax County recognizes that there is a direct link between the vitality of ecological resources and the quality of life for our citizens.

The current watershed plans provide more targeted strategies for addressing stream health given current and future land uses and evolving regulations. These plans are one of several tools that enable the County to address program requirements and to improve and maintain watershed health. Each watershed plan includes a prioritized 25-year list of proposed capital improvement projects in addition to non-structural programs and projects. These projects and programs may lead to new and/or revised ordinances, public facilities manual requirements and policies. The plans promote the use of new and innovative practices in stormwater management such as Low Impact Development (LID) techniques and stream restoration using natural channel design. To maximize the effectiveness of these plans, community engagement and involvement from diverse interests were emphasized during the development process.

Watershed management plans were developed by grouping the County's 30 watersheds into 13 planning units (Figure 1.3). Watershed planning began in 2003. By 2007, roughly 50 percent of the County land area had completed watershed plans. This plan is part of the second group of watershed plans, which was initiated in 2007 for the remaining land area.

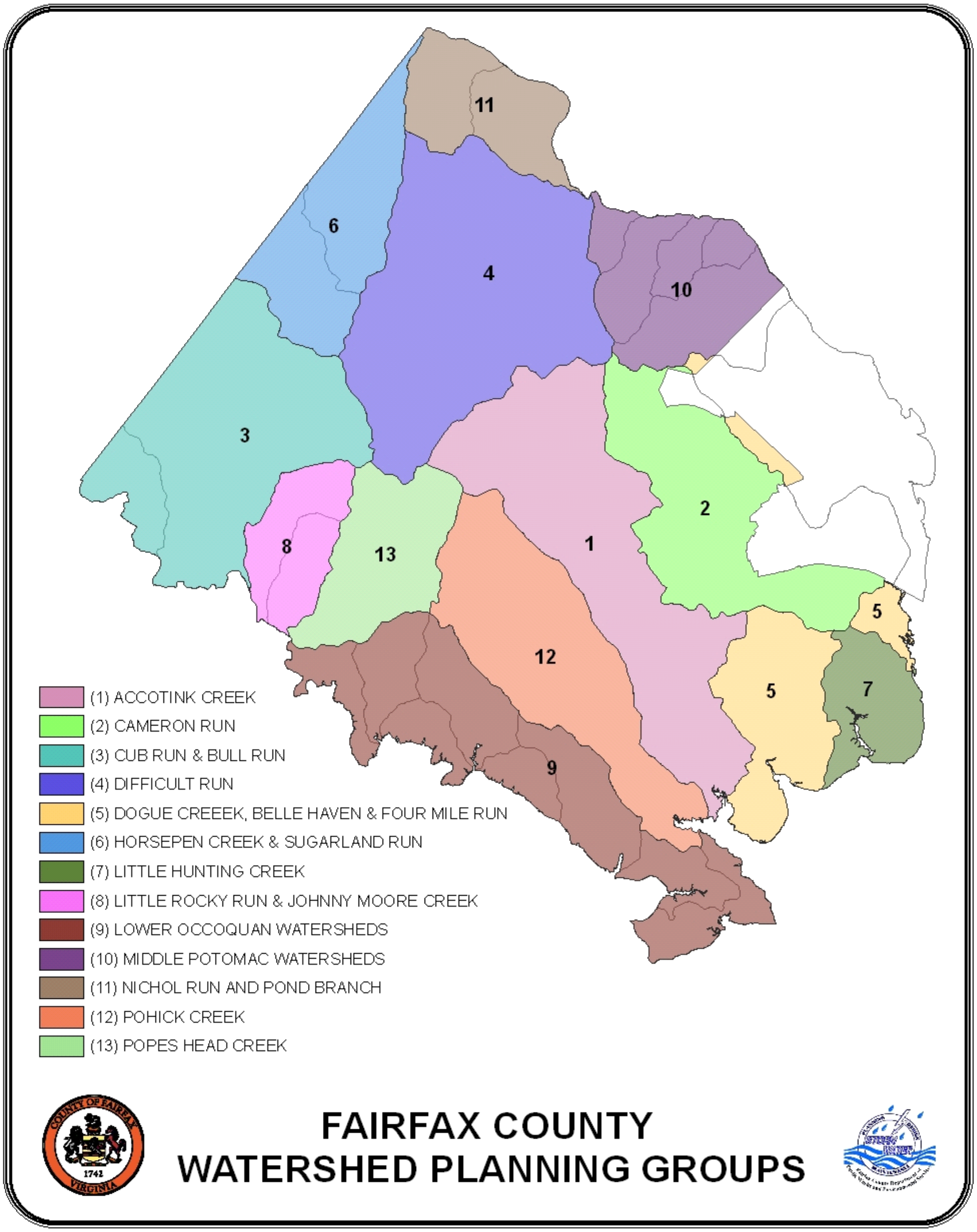

Figure 1.3 Watershed planning groups in Fairfax County

In general, the watershed management planning process consists of the following steps:

1. Review and synthesis of previous studies and data compilation
2. Public involvement to gain input, provide education and build community support
3. Evaluation of current watershed conditions and projection of stormwater runoff from present and ultimate development conditions
4. Development of non-structural and structural watershed improvement projects
5. Development of preliminary cost estimates, cost/benefit analysis and prioritization of capital projects
6. Adoption of the final watershed management plan by the Board of Supervisors

The watershed management planning process has been supported by the Board of Supervisors since its inception in 2003. In fiscal year 2006, the Board of Supervisors dedicated $0.01 per $100 of assessed value from the County's real estate tax revenue towards the overall stormwater management program. This supported the ongoing development and implementation of watershed plans and eventually evolved into the adoption of a stormwater service district starting in fiscal year 2010. The Board recently approved increasing the dedicated amount to a penny and a half for fiscal year 2011.

The following provisions address the funding and implementation of projects and programs in Fairfax County watershed plans. These provisions as recommended by the Board were developed for the Popes Head Creek Watershed Management Plan in February 2006 and have been applied to the Sugarland Run and Horsepen Creek Watershed Management Plan:

vii. Projects and programs (both structural and non-structural) will first undergo appropriate review by County staff and the Board (please see iii below) prior to implementation. Board adoption of the Watershed Management Plan will not set into motion automatic implementation of projects, programs or initiatives that have not first been subject to sufficient scrutiny to ensure that the projects that are funded give the County the greatest environmental benefit for the cost.

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

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

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

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

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

2.0 Watershed Planning Process

2.1 Watershed Goals and Objectives

The County's first six comprehensive watershed management plans outlined intentions for protecting, maintaining or improving streams and the measures that could be taken to meet them. Although the plans conveyed similar aims overall, there were some differences in the way goals and objectives were developed. As a result of these differences, the initial six plans were analyzed to identify common themes in order to create standardized goals and objectives for the remaining watershed management plans. Standardization improved efficiency in the planning process and achieved greater consistency among the plans.

As part of the standardization process, the County selected three overarching goals, or intended outcomes of the watershed management plans:

1. Improve and maintain watershed functions in Fairfax County, including water quality, habitat and hydrology
2. Protect human health, safety and property by reducing stormwater impacts
3. Involve stakeholders in the protection, maintenance and restoration of County watersheds

Ten objectives were developed related to the three goals. Each objective may achieve one or more goals, and each goal may be achieved by one or more objectives. These ten objectives were grouped into five categories based on certain aspects of watershed management the objectives could influence:

1. **Hydrology** - healthy movement and distribution of water through the environment in a way that is protective of streams and human dwellings
2. **Habitat** - suitable environment for sustaining plants and animals
3. **Stream water quality** - general chemical and physical properties of surface waters
4. **Drinking water quality** - quality of water used for human consumption
5. **Stewardship** - the roles the County, other jurisdictions and members of the general public can play in caring for the environment

Under the new approach, County staff and the public had the flexibility to add objectives that were unique and important to a particular watershed, but all plans included the standard goals and objectives as a baseline as presented in Table 2.1

Table 2.1 Countywide Objectives	
Objective	**Linked to Goal(s)**
CATEGORY 1. HYDROLOGY	
1A. Minimize impacts of stormwater runoff on stream hydrology to promote stable stream morphology, protect habitat, and support biota.	1
1B. Minimize flooding to protect property and human health and safety.	2
CATEGORY 2. HABITAT	
2A. Provide for healthy habitat through protecting, restoring, and maintaining riparian buffers, wetlands, and instream habitat.	1
2B. Improve and maintain diversity of native plants and animals in the County.	1
CATEGORY 3. STREAM WATER QUALITY	
3A. Minimize impacts to stream water quality from pollutants in stormwater runoff.	1, 2
CATEGORY 4. DRINKING WATER QUALITY	
4A. Minimize impacts to drinking water sources from pathogens, nutrients, and toxics in stormwater runoff.	2
4B. Minimize impacts to drinking water storage capacity from sediment in stormwater runoff.	2
CATEGORY 5 STEWARDSHIP	
5A. Encourage the public to participate in watershed stewardship.	3
5B. Coordinate with regional jurisdictions on watershed management and restoration efforts such as Chesapeake Bay initiatives.	3
5C. Improve watershed aesthetics in Fairfax County.	1, 3

Standardizing the goals and objectives made it easier to integrate plan recommendations into a countywide data management system for prioritizing projects, tracking implementation and evaluating the long-term influence of the plans on the health of County streams.

2.2 Indicators

Since accomplishment of objectives cannot be directly measured, indicators that are able to detect changes in the watershed were developed. Indicators are used to assess the condition of the environment, as early-warning signals of changes in the environment, and to diagnose causes of ecological problems. *Observed* indicators are based upon data and observations collected in the field/area of interest, and are useful in assessing existing watershed conditions. *Predictive* indicators respond in a predictable manner to ecosystem stressors, and can be used in models of hydrologic and ecosystem processes (such as soil erosion, pollutant loading, etc.) to compare existing and future conditions.

Each indicator was measured by one or more metrics. A metric is an analytical benchmark that responds in a predictable way to increasing human, climatic or other environmental stress. Metrics may be actual numeric values (such as pH or Dissolved Oxygen values) or parameters that have been scored to a numeric scale (such as 1 – 10).

The indicators used by Fairfax County may be grouped into the following categories:

- **Watershed Impact Indicators –** Measure the extent that reversal or prevention of a particular watershed impact, sought by the goals and objectives, has been achieved ("What's there now, and how is it doing?").
- **Source Indicators –** Quantify the presence of a potential stressor or pollutant source ("Is there a problem, and what's causing it?").
- **Programmatic Indicators** –After the plans are adopted, these will assess outcomes of resource protection and restoration activities ("What's the County doing about the problem, and how is it doing?").

2.2.1 Watershed Impact Indicators

One or more watershed impact indicators for each objective were identified, including predictive and observed indicators. These indicators and the objectives to which they are linked are shown in Table 2.2.

Table 2.2
Watershed Impact Indicators

Objective	Indicators
1A Stormwater Runoff	Observed: Benthic Communities, Fish Communities, Aquatic Habitat Predictive: Channel Morphology, Instream Sediment, Hydrology
1B Flooding Hazards	Observed: Flood Complaints Predictive: Number of Road Hazards, Magnitude of Road Hazards, Residential Building Hazards, Non-residential Building Hazards
2A Habitat Health	Observed: Aquatic Habitat Predictive: RPA Riparian Habitat, Headwater Riparian Habitat, Protected Wetland Habitat
2B Habitat Diversity	Observed: Benthic Communities, Fish Communities Predictive: None
3A Stream Water Quality	Observed: *E. coli*, Benthic Communities, Fish Communities Predictive: Upland Sediment, Instream Sediment, Nitrogen, Phosphorus
4A Drinking Water Quality	Observed: *E. coli* Predictive: Nitrogen, Phosphorus, Upland Sediment
4B Storage Capacity	Observed: None Predictive: Upland Sediment, Instream Sediment

Table 2.2 Watershed Impact Indicators	
Objective	**Indicators**
5A Public Participation	Programmatic Indicators to be tracked by the County
5B Regional Coordination	Programmatic Indicators to be tracked by the County
5C Aesthetics	Programmatic Indicators to be tracked by the County

For predictive indicators, three scenarios were considered. Metrics and scores were calculated for:

- Existing conditions
- Future without project implementation
- Future with project implementation

The future condition metrics and scores reflect the simulated conditions at ultimate build-out based on the County's Comprehensive Plan.

The watershed impact indicator scores were used at multiple stages of watershed planning. First, they were used to assess current and future conditions without project implementation in the watershed. Indicator scores were then used to identify management needs and problem areas during subwatershed ranking (see Section 2.3). Once candidate projects were identified, the indicators were used to prioritize projects alongside cost and feasibility.

2.2.2 Source Indicators

Source indicators were used to evaluate the sources and stressors that impact watershed processes. Examples include:

- Numeric Source Indicators
    - Amount of Channelized/Piped Streams
    - Amount of Directly Connected Impervious Area (DCIA) (predictive)
    - Amount of Impervious Surface (predictive)
    - Number of Stormwater Outfalls
    - Number of Sanitary Sewer Crossings
    - Streambank Buffer Deficiency
    - Total amount of Nitrogen (predictive)
    - Total amount of Phosphorus (predictive)
    - Total Suspended Solids (predictive)
- Field Reconnaissance Observations
    - Hot Spot Investigations
    - Neighborhood Source Assessments
    - All other field reconnaissance observations

The contributions of these indicators to existing and future watershed impacts were evaluated. Metrics and scores were developed for all source indicators under existing conditions. In addition, three scenarios were considered for the predictive indicators, as noted in the list above. Metrics and scores were calculated for these scenarios:

- Existing conditions
- Future without project implementation
- Future with project implementation

The future condition metrics and scores reflect the simulated conditions at ultimate build-out based on the County's Comprehensive Plan.

Like the watershed impact indicators, source indicator scores were used to rank subwatersheds according to their problems and needs and to assist with candidate project identification.

2.2.3 Programmatic Indicators

Programmatic indicators will be used by the County to help evaluate watershed management needs. These indicators illustrate the extent and location of existing and past management efforts. The following types of management in the watershed were inventoried during plan development:

- Detention Facilities
- Stream Restoration
- Riparian Buffer Restoration
- BMP Facilities
- Low Impact Development
- Inspection and Maintenance of Stormwater Management Facilities
- Inspection and Repair of Stormwater Infrastructure and Outfalls
- Dumpsite Removal
- Regional Ponds
- Volunteer Monitoring
- Subarea Treatment (used in watershed modeling studies)

Information for these indicators will be considered to identify and evaluate watershed management needs for individual watersheds and for the County as a whole.

2.2.4 Composite Scores

After metric values were translated into scores, objective, composite and overall composite scores were calculated for use in subwatershed ranking. Weighting factors were used when calculating composite scores to give more importance to certain indicators and objectives. First, watershed impact indicators were grouped by objective. Each metric score was multiplied by a predetermined weighting factor specific to that indicator, and the products were summed within objectives to generate an objective composite score for each objective. Each objective composite score was then multiplied by a predetermined weighting factor specific to that objective, and the products were summed to generate an overall composite score. A similar process was used for source indicators, but without an objective composite score (since source indicators are not directly linked to objectives).

2.3 Subwatershed Ranking

The composite scores calculated under the methods previously described were used to identify problem areas in the watershed and rank subwatersheds for management priority. Subwatersheds were further categorized based on which management opportunities were most likely to restore functions to the problem areas identified. The resulting data were then utilized to identify key issues and select projects that would achieve the watershed planning goals and objectives.

The subwatershed ranking procedure involved reviewing watershed impact objective, composite, overall composite and source indicator scores. Since some of the indicators are predictive, i.e. based on modeling, it was possible to pose "what if?" questions and test future scenarios with and without management actions. Existing management facilities and programs which were inventoried for programmatic indicators and data collected during field reconnaissance were also considered. The ranking process consisted of the following steps:

1. Used the watershed impact overall composite scores and identified subwatersheds that were potential problem areas under existing and future conditions.
2. Used the watershed impact objective composite scores and identified subwatersheds that were potential problem areas under existing and future conditions for each objective.
3. Reviewed source indicator composite scores and identified additional problem areas.
4. Used individual source indicator scores to identify potential sources of impacts in downstream problem areas.
5. In combination with the above data, used the programmatic indicator data inventory to identify subwatersheds where management was most needed.
6. Consulted available field reconnaissance data throughout the above steps to confirm that results reflected conditions in the field.

All this information was combined to rank subwatersheds in order from the most problematic (higher priority for management actions) to the least problematic (lower priority for management actions). Subwatershed ranking provided guidance as to where management was most needed and could be applied successfully, but the final determination was ultimately based on best professional judgment.

2.4 Stormwater Modeling

Storm events are classified by the amount of rainfall, in inches, that occurs over the duration of a storm. The amount of rainfall depends on how frequently the storm will statistically occur and how long the storm lasts. Based on many years of rainfall data collected, storms of varying strength have been established based on the duration and probability of that event occurring within any given year. In general, smaller storms occur more frequently than larger storms of equal duration. Hence, a 2-year, 24hr storm (having a 50 percent chance of happening in a given year) has less rainfall than a 10-year, 24hr storm (having a 10 percent chance of happening in a given year). Stormwater runoff (which is related to the strength of the storm) is surplus rainfall that does not soak into the ground. This surplus rainfall flows (or ‘runs off’) from roof tops, parking lots and other impervious surfaces and is ultimately received by storm drainage systems, culverts and streams.

Modeling is a way to mathematically predict and spatially represent what will occur with a given rainfall event. There are two primary types of models that are used to achieve this goal; hydrologic and hydraulic:

- *Hydrologic models* take into account several factors; the particular rainfall event of interest, the physical nature of the land area where the rainfall occurs and how quickly the resulting stormwater runoff drains this given land area. Hydrologic models can describe both the quantity of stormwater runoff and resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that are transported by the runoff.

- *Hydraulic models* represent the effect the stormwater runoff from a particular rainfall event has on both man-made and natural systems. These models can both predict the ability man-made culverts/channels have in conveying stormwater runoff and the spatial extent of potential flooding.

Table 2.3 shows three storm events and the rationale for being modeled:

Table 2.3
Modeling Rationale

Storm Event	Modeling Rationale
2-year, 24hr	Represents the amount of runoff that defines the shape of the receiving streams.
10-year, 24hr	Used to determine which road culverts will have adequate capacity to convey this storm without overtopping the road.
100-year, 24hr	Used to define the limits of flood inundation zones

2.4.1 Hydrologic Model (SWMM)

The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) was first developed in the early 1970s. Over the past 30 years, the model has been updated and refined and is now used throughout the country as a design and planning tool for stormwater runoff. Specifically, SWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas.

The runoff component of SWMM operates on a collection of subwatershed areas where rain falls and runoff is generated. The routing (or hydraulic) portion of SWMM transports this runoff through a conveyance system of pipes, channels and storage/treatment devices. SWMM tracks the quantity and quality of runoff generated within each subwatershed, and the flow rate and depth of water in the conveyance system during a simulation period.

2.4.2 Pollution Model (STEPL)

While the SWMM model can calculate pollutant loads, the Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to determine pollutant loads for the watershed planning effort. Also developed by EPA, STEPL employs simple algorithms to calculate surface runoff. This includes nutrient loads, such as nitrogen and phosphorus, and sediment loads from various land uses. STEPL also calculates load reductions that would result from the implementation of various Best Management Practices (BMPs). The nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff as influenced by factors such as land use distribution and management practices. Sediment loads are calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using known BMP efficiencies.

2.4.3 Hydraulic Model (HEC-RAS)

The Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic model was initially developed by the U.S. Army Corps of Engineers (USACE) in the early 1990s as a tool to manage the rivers and harbors in their jurisdiction. HEC-RAS has found wide acceptance as the standard for simulating the hydraulics of water flow through natural and/or manmade channels and rivers. HEC-RAS is commonly used for modeling water flowing through a system of open channels with the objective of computing water surface elevations.

The geographic input data for the HEC-RAS model was extracted using HEC-GeoRAS. HEC-GeoRAS is a tool that processes the geospatial data within the County's Geographic Information System, specifically as it pertains to physical features such as stream geometry and flow path so that these features can be represented in the model.

Using available County or Virginia Department of Transportation (VDOT) engineering data, bridge and culvert crossings were coded into the model to simulate the effect these facilities have on the water surface elevations or profile. Where data were not available, field reconnaissance was performed to obtain the crossing elevation data. This crossing data was determined relative to a point where the elevation could be estimated accurately from the County's topographic data. Manning's 'n' values, which represent surface roughness, were assigned to the channel and overbank portions of the studied streams based on field visits and aerial photographs.

The hydrologic flow input data and the locations where the flows change were extracted from SWMM. The 2-yr, 10-yr and 100-yr storm flow outputs were determined at several locations in order to provide a detailed flow profile for input into the HEC-RAS hydraulic model.

As stated previously, the 2-year storm discharge is regarded as the channel-forming or dominant discharge that transports the majority of a stream's sediment load and therefore actively forms and maintains the channel. A comparison of stream dynamics and channel geometry for the 2-year discharge provides insight regarding the relative stability of the system and helps to identify areas in need of restoration.

The 10-year storm discharge was included to analyze the level of service of bridge and culvert stream crossings. Occurring less frequently than the 2-year storm, the flood stage associated with this storm can result in more significant safety hazards to residents. All stream crossings (bridges and culverts) were analyzed against this storm to see if they performed at safe levels.

The 100-year storm discharge is used by the Federal Emergency Management Agency (FEMA) to delineate floodplain inundation zones in order to establish a Flood Insurance Rate Map (FIRM) for a given area. The 100-yr HEC-RAS models were built in compliance with FEMA standards and were included to map the limits of these floodplain inundation zones. This mapping provided a means to assess which properties are at risk to flooding by the 100-yr storm event.

2.5 Public Involvement Plan

A consistent approach for public involvement was important to enable comparisons among planning processes and final watershed management plans. Conversely, as each watershed has unique characteristics, the strategies employed must also address the diverse needs, interests and conditions of the watershed and its community. The principal goals for public involvement were:

- Increase community awareness and understanding of stormwater management
- Provide meaningful participation options for a diversity of stakeholders
- Incorporate community ideas into the scope of the watershed plans
- Strive for community support for the final plans

Recognizing the need for public acceptance of the final plans, County staff created a public involvement process with multiple feedback loops to facilitate informed participation by the public and key stakeholder groups at all development stages. The first step of the public involvement process was to host an Introductory and Issues Scoping forum that was open to all residents. The primary purpose of this forum was to solicit informed input on the development of the watershed management plan. Other objectives were to explain the planning process to the community and develop an initial list of watershed issues and concerns.

After the forum, stakeholder groups were invited to be part of a Watershed Advisory Group (WAG) for each plan. These were comprised of local stakeholders who represented various interests (HOA representatives, environmental groups, etc) and advised County staff about community outreach opportunities and key issues affecting their watershed and potential projects. They also were invited to comment on draft and final versions of the watershed management plan. Each WAG met with County staff five to six times throughout the plan development in order to provide guidance and comments at critical junctures of the process.

The WAG also provided support at the second public forum, the Draft Plan Review Workshop. The workshop provided the extended community with an opportunity to review the first draft of the watershed plan and provide input. Comments were collected at the end of a 30-day period and addressed as appropriate. The final plan was then adopted by the Board of Supervisors.

More information on the public involvement process including WAG meeting minutes, public forum meeting minutes and public comments and responses can be found in Volume 2, Appendix C.

3.0 Summary of Watershed Conditions

Section 3.0 is a summary of the watershed conditions found in the Sugarland Run and Horsepen Creek watersheds. Detailed information regarding watershed conditions in the Sugarland Run watershed and the Horsepen Creek watershed can be found in the Draft Sugarland Run and Horsepen Creek Watershed Workbook, dated October 2008, located in Appendix A.

The Sugarland Run and Horsepen Creek watersheds are located in the northwestern portion of Fairfax County. Fairfax County is broken into 30 watersheds. Each watershed is defined by the topography of the area and does not follow county, state or national boundaries. The watersheds within Fairfax County are part of the larger Potomac River Basin. The Potomac River, in turn, is part of the even larger Chesapeake Bay Watershed, which drains 64,000 square miles and extends from New York through Pennsylvania, Delaware, West Virginia, Maryland, Virginia, and the District of Columbia. For management and planning purposes, watersheds are broken down into watershed management areas (WMAs) and subwatersheds. A WMA is generally four square miles (2,560 acres) in size and is the contributing drainage area to a major tributary or a group of subwatersheds with similar characteristics. A subwatershed ranges in size from 100 to 300 acres.

Table 3.1 identifies the total area, area within Fairfax County, perennial stream miles and perennial stream miles within Fairfax County for each watershed and each watershed management area that comprise Sugarland Run and Horsepen Creek watersheds

Table 3.1
Summary of Watershed Management Areas

Watershed Management Area	Total Acres	Total Sq-mi	Sq-mi in Fairfax County	% Land Area in Fairfax County	Total Perennial Stream Miles	Perennial Stream Miles in Fairfax County	% Perennial Stream Miles in Fairfax County
Folly Lick	1,814	2.8	2.7	94%	5.3	5.2	99%
Sugarland Headwaters	928	1.5	1.5	100%	1.4	1.4	100%
Lower Sugarland	3,743	5.9	1.1	18%	13.8	2.6	19%
Lower Middle Sugarland	3,503	5.5	3.1	57%	14.8	11.4	77%
Potomac	1,053	1.7	0.1	7%	3.0	0.1	2%
Upper Sugarland	1,391	2.2	2.2	100%	3.5	3.5	100%
Upper Middle Sugarland	1,975	3.1	3.1	100%	6.8	6.8	100%
Sugarland Total	14,407	22.5	13.7	61%	48.6	31.0	64%
Cedar	782	1.2	1.2	100%	2.4	2.4	100%
Frying Pan	1,130	1.8	1.8	100%	3.6	3.6	100%
Indian	2,066	3.2	0.0	0%	4.5	0.0	0%
Lower Horsepen	3,190	5.0	0.0	1%	7.0	0.0	0%

Table 3.1 Summary of Watershed Management Areas							
Watershed Management Area	**Total Acres**	**Total Sq-mi**	**Sq-mi in Fairfax County**	**% Land Area in Fairfax County**	**Total Perennial Stream Miles**	**Perennial Stream Miles in Fairfax County**	**% Perennial Stream Miles in Fairfax County**
Lower Middle Horsepen	1,186	1.9	1.0	55%	3.4	1.5	43%
Merrybrook	967	1.5	1.4	94%	2.0	1.7	84%
Middle Horsepen	953	1.5	1.3	87%	2.9	2.9	100%
Stallion	2,394	3.7	0.0	0%	3.2	0.0	0%
Upper Horsepen	1,929	3.0	3.0	100%	7.3	7.3	100%
Horsepen Total	14,597	22.8	9.8	43%	36.3	19.4	53%
Sugarland & Horsepen Total	29,004	45.3	23.5	52%	84.9	50.3	59%

The Fairfax County Stormwater Planning Division has created standard land use categories to unify watershed management planning throughout the county. The categories are assigned a code for easy identification. The Fairfax County land use categories are presented in Table 3.2.

Table 3.2 Generalized Land Use Categories		
Land Use	**Code**	**Description**
Open Space	OS	Open space, parkland, or vacant land
Estate Residential	ESR	Single-family detached greater than 2 acres per residence
Low Density Residential	LDR	Single-family detached 0.5-2 acres per residence
Medium Density Residential	MDR	Single-family detached less than 0.5 acres per residence and multifamily residential less than 8 dwelling units per acre
High Density Residential	HDR	All residential less than 0.125 acre per residence (8 or greater dwelling units per acre)
Institutional	INT	School or institutions, originally considered LIC
Low Intensity Commercial	LIC	Commercial uses including low rise and limited offices and neighborhood retail
High Intensity Commercial	HIC	Commercial uses including high density offices and highway retail
Industrial	IND	Industrial uses
Golf Course	GC	Golf courses, originally considered open space
Water	WATER	Perennial streams buffered 10’
Transportation	TRANS	Transportation, areas not represented by parcels

3.1 Sugarland Run Watershed

The Sugarland Run watershed is made up of Sugarland Run, Offuts Branch, Folly Lick Branch, and Rosiers Branch. The portion of the Sugarland Run watershed that lies within Fairfax County has a drainage area of approximately 15.3 square miles and has 31.1 miles of perennial streams. The Sugarland Run watershed consists of seven WMAs including Folly Lick, Headwaters, Lower Sugarland, Lower Middle Sugarland, Potomac, Upper Sugarland, and Upper Middle Sugarland as shown in Figure 3.1.

Assessments were made of each WMA based on information supplied by the County and from field reconnaissance. Each WMA was assessed for factors such as drainage complaints, proposed county projects, existing stormwater management facilities, on-site septic systems, Neighborhood Source Assessments (NSA), Hot Spot Investigations (HIS) and Stream Physical Assessments (SPA).

The water quality and quantity was modeled for each WMA by assessing land uses, impervious coverage, topography, vegetative cover, the health of streams, and stormwater management. Each WMA was evaluated using STEPL Modeling and HEC-RAS Modeling to determine the WMA subwatershed ranking of watershed impacts. Each WMA was also evaluated using source indicators to identify potential WMA stressors or pollutant sources. For more detailed information, see the Sugarland Run and Horsepen Creek Watersheds Draft Watershed Workbook, dated October 2008, located in Appendix A.

Overall, Sugarland Run watershed streams range in quality from poor to good. Poor reaches are concentrated around the upstream area and good reaches are generally located in the tributaries draining into the downstream area. The upstream area is located partly within the Town of Herndon and is characterized by urban residential, commercial, and industrial development. The northern tributaries drain lower density residential areas before crossing into Loudoun County and emptying into the main stem of Sugarland Run.

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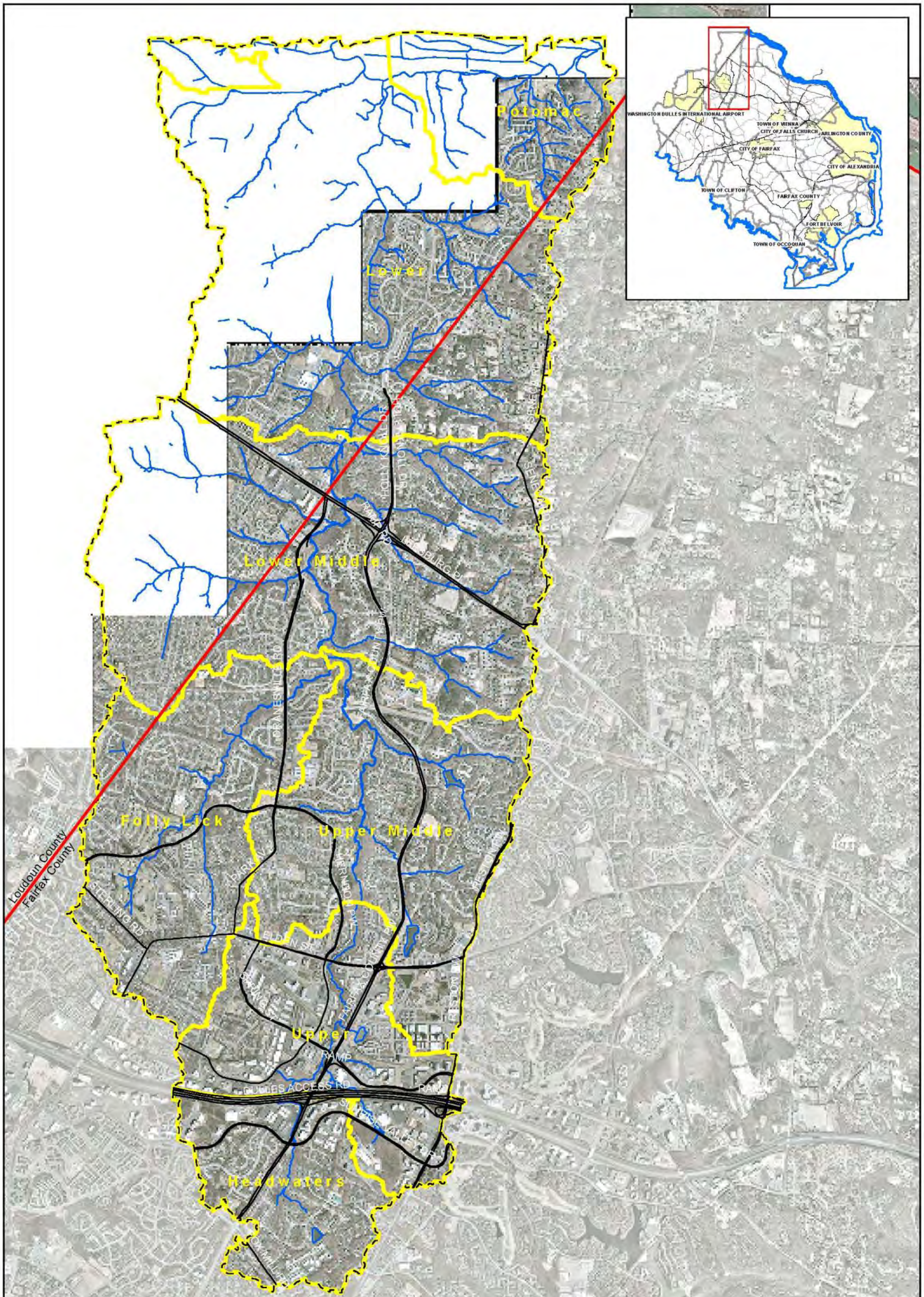

N

0 0.25 0.5 Miles

Roads
Perennial Streams
WMA Boundary
Sugarland Run Watershed Boundary
County Boundary

Map 3.1
Sugarland Run
Watershed Management Area
Map

3.1.1 Folly Lick WMA

The Folly Lick WMA is located in the western portion of the Sugarland Run Watershed. The WMA is comprised of 1,813 acres (2.83 square miles). Approximately 5.3 miles of perennial streams are located within the Folly Lick WMA, and flow northeast toward the confluence with Sugarland Run. The streams range from poor to fair condition in the Herndon section to good condition in the northern section. The WMA consists primarily of medium density residential land use with a golf course and high density residential in the central portion, as shown in Map 3.2. According to the HEC-RAS modeling, one bridge does not carry the 2, 10 or 100-year stormflow, and will overtop the roadway. Also, one culvert does not carry the 100-year stormflow and may increase flooding upstream.

None of the subwatersheds within the Folly Lick WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, most of the northern portion of the WMA is in good condition, but the conditions deteriorate when traveling south toward the headwaters of Folly Lick Branch.

One of the subwatersheds within the Folly Lick WMA has been identified as a potential problem area in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. Most of the WMA shows high levels of stressors and pollutant sources.

3.1.2 Headwaters WMA

The Headwaters WMA is located in the southern portion of the Sugarland Run Watershed. The WMA is comprised of 929 acres (1.45 square miles). Approximately 1.4 miles of perennial streams exist within the Headwaters WMA, and flow north toward the confluence with the main stem of Sugarland Run. The majority of these streams range from poor to fair condition. The WMA consists primarily of medium density residential land use in the south and commercial and industrial land uses in the north, as shown in Map 3.2. According to the HEC-RAS modeling, two culverts do not carry the 100-year stormflow, causing water to overtop the roadways and may increase flooding upstream.

One of the subwatersheds within the Headwaters WMA has been identified as a potential problem area in the subwatershed ranking of watershed impacts. Based upon existing conditions, all of the WMA is in very poor condition. One of the subwatersheds within the Headwaters WMA has been identified as an additional potential problem area in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. Most of the WMA shows high levels of stressors and pollutant sources.

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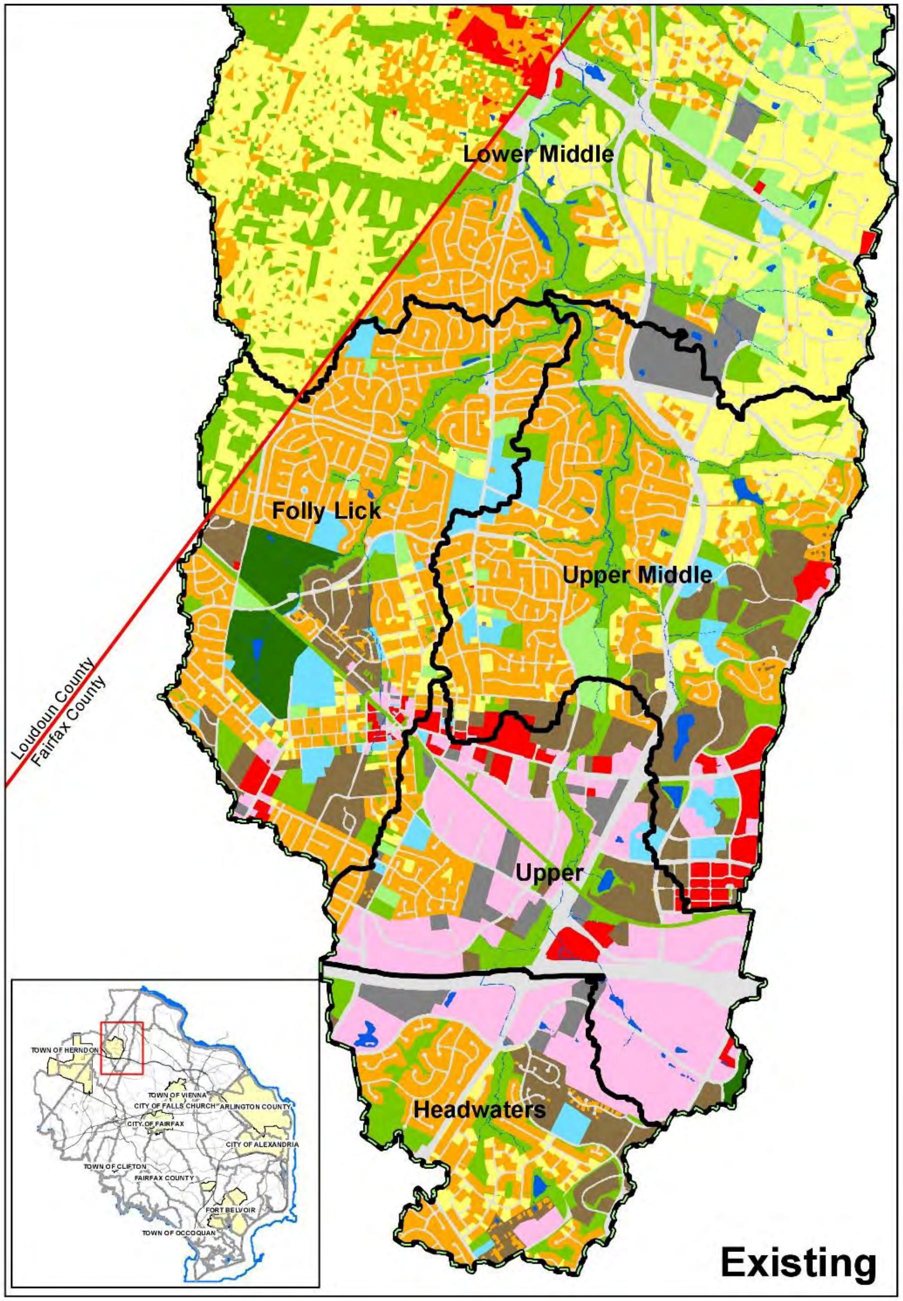
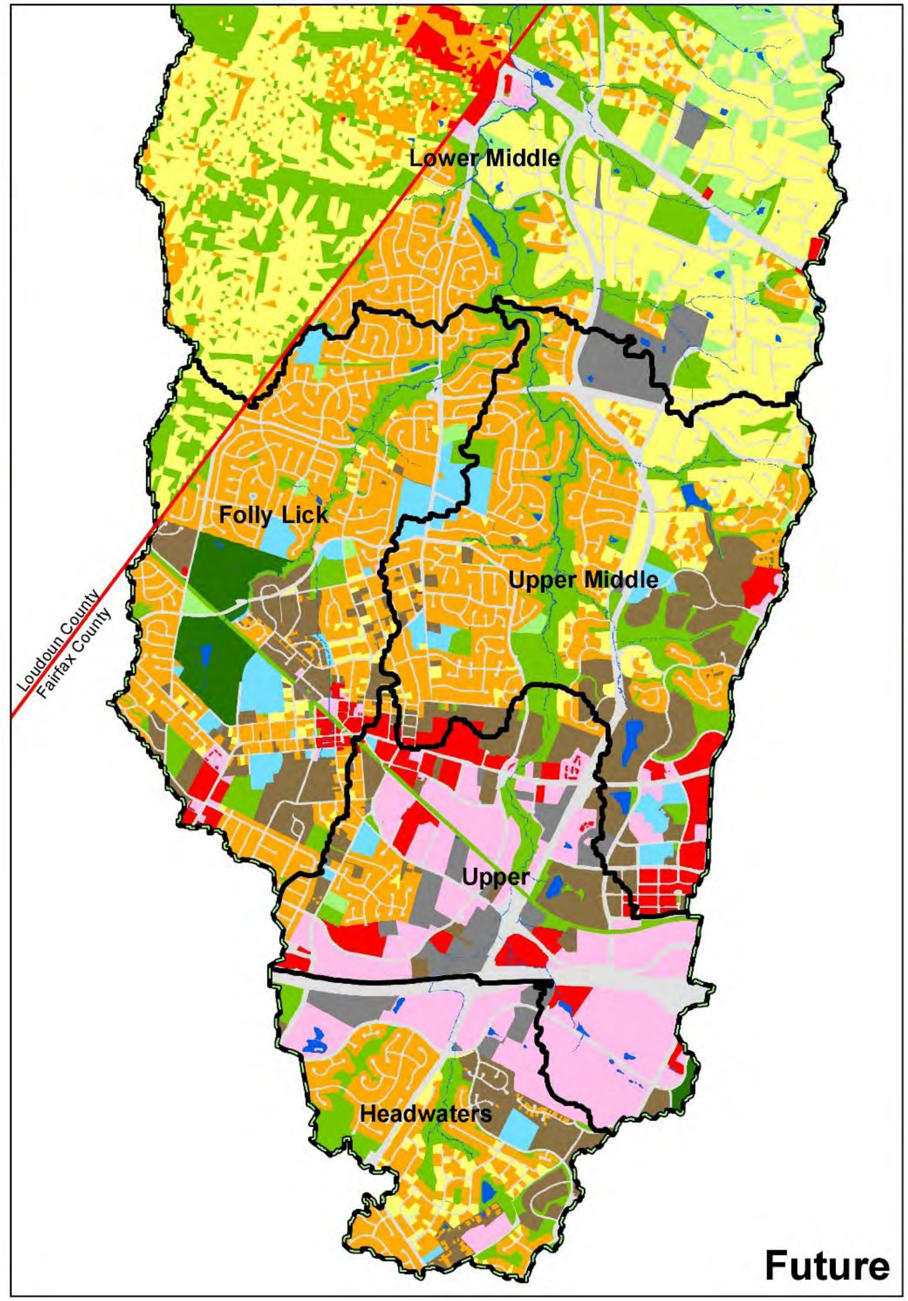
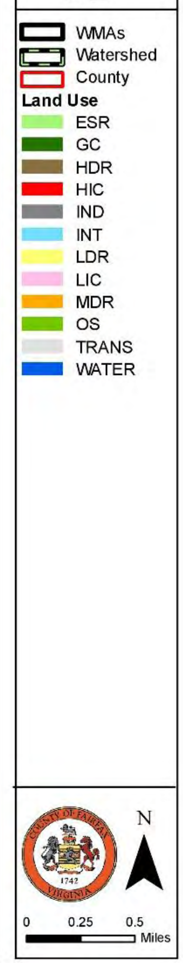
Map 3.2
Existing and Future Land Use Map for Upper Sugarland Run Watershed







3.1.3 Lower Middle Sugarland WMA

The Lower Middle Sugarland WMA is located in the northern portion of the Sugarland Run Watershed. The WMA is comprised of 3,590 acres (5.61 square miles). The portion that lies within Fairfax County is comprised of 2,012 acres (3.14 square miles). Approximately 14.8 miles of perennial streams exist within the Lower Middle Sugarland WMA, and flow west into Loudoun County. These streams range from fair to good condition. The WMA consists primarily of low and medium density residential land uses with open space along stream corridors, as shown in Map 3.3. According to the HEC-RAS modeling, one bridge does not carry the 100-year stormflow, and the 100-year stormflow will overtop the roadway. Also, one culvert does not carry the 100-year stormflow and may increase flooding upstream.

None of the subwatersheds within the Lower Middle Sugarland WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the majority of the WMA is in good condition. The exception was one subwatershed that scored fair.

One of the subwatersheds within the Lower Middle Sugarland WMA has been identified as an additional potential problem area in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The rest of the WMA ranked as low to moderate levels of stressors and pollutant sources.

3.1.4 Lower Sugarland WMA

The Lower Sugarland WMA is located in the northern portion of the Sugarland Run Watershed. The WMA is comprised of 3,742 acres (5.85 square miles). The portion that lies within Fairfax County is comprised of 691 acres (1.08 square miles). Approximately 13.8 miles of perennial streams exist within the Lower Sugarland WMA, and flow west into Loudoun County. These streams range from fair to good condition. The WMA consists primarily of open space in the north and along stream corridors with low and medium density residential land uses throughout the east and west, as shown in Map 3.3.

None of the subwatersheds within the Lower Sugarland WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. The subwatershed areas of the Lower Sugarland WMA that lie outside of Fairfax County were not scored. Based upon existing conditions, all of the scored WMA is in good condition.

None of the subwatersheds within the Lower Sugarland WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. Most of the WMA shows low levels of stressors and pollutant sources.

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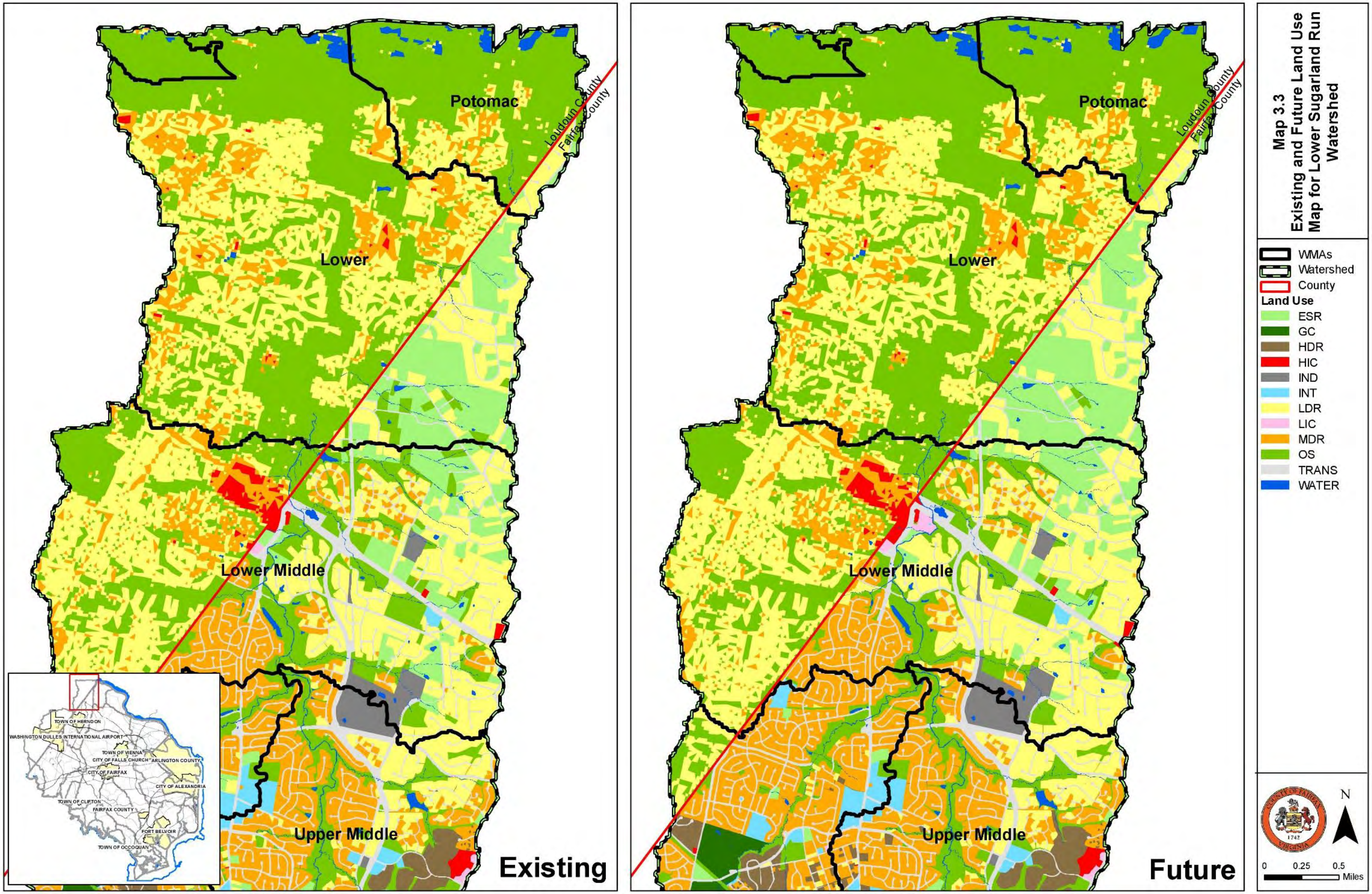


Map 3.3
Existing and Future Land Use Map for Lower Sugarland Run Watershed

3.1.5 Potomac WMA

The Potomac WMA is located at the northern tip of the Sugarland Run Watershed. The WMA is comprised of 1,053 acres (1.64 square miles). The portion that lies within Fairfax County is comprised of 70 acres (0.1 square miles). Approximately 3.0 miles of perennial streams exist within the Potomac WMA in Fairfax County, and flow west into Loudoun County. These streams range from fair to good condition. The WMA consists primarily of open space in the north and low and medium density residential land uses in the south, as shown in Map 3.3.

None of the subwatersheds within the Potomac WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. The subwatershed areas of the Potomac WMA that lie outside of Fairfax County were not scored. Based upon existing conditions, the majority of the scored WMA is in good condition.

None of the subwatersheds within the Potomac WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The WMA was ranked as having low levels of stressors and pollutant sources.

3.1.6 Upper Middle Sugarland WMA

The Upper Middle Sugarland WMA is located in the middle of the Sugarland Run Watershed. The WMA is comprised of 1,975 acres (3.09 square miles). Approximately 6.8 miles of perennial streams exist within the Upper Middle Sugarland WMA, and flow north and northwest through the watershed. Most of these streams are in good condition, with only one small tributary in poor condition. The WMA consists primarily of medium density residential land use in the west, low density residential in the northeast, high density residential to the east, and high intensity commercial land uses to the southeast, as shown in Map 3.2. According to the HEC-RAS modeling, two culverts do not carry the 100-year stormflow and may increase flooding upstream.

None of the subwatersheds within the Upper Middle Sugarland WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in good condition.

One of the subwatersheds within the Upper Middle Sugarland WMA has been identified as a potential problem area in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The remainder of the WMA was ranked as having moderate levels of stressors and pollutant sources.

3.1.7 Upper Sugarland WMA

The Upper Sugarland WMA is located in the southern portion of the Sugarland Run Watershed. The WMA is comprised of 1,391 acres (2.71 square miles). Approximately 3.5 miles of perennial streams exist within the Upper Sugarland WMA, and flow north through the watershed. These streams range from poor to good condition. The WMA consists primarily of low intensity commercial land uses and transportation networks, as shown in Map 3.2. According to the HEC-

RAS modeling, five culverts do not carry the 100-year stormflow and may increase flooding upstream. The 100-year stormflow from two of these culverts will overtop the roadway.

Three of the subwatersheds within the Upper Sugarland WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the entire WMA is in moderate condition.

Three of the subwatersheds within the Upper Sugarland WMA have been identified as additional potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The WMA was ranked as having moderate to high levels of stressors and pollutant sources.

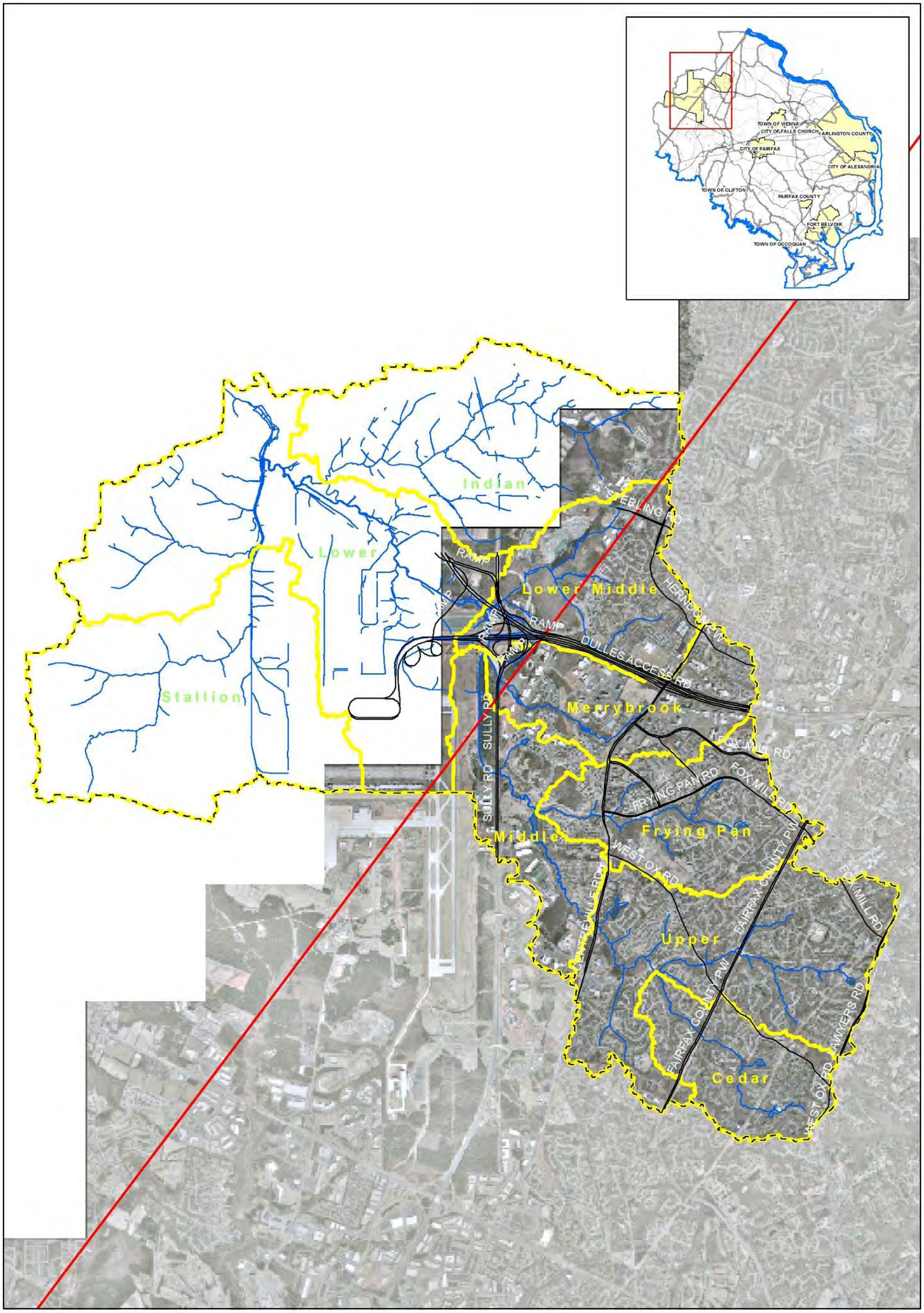
3.2 Horsepen Creek Watershed

The Horsepen Creek watershed is comprised of Horsepen Run, Frying Pan Branch, Cedar Run, and Merrybrook Run. The portion of Horsepen Creek Watershed that lies within Fairfax County has a drainage area of approximately 9.6 miles and 19.4 miles of perennial streams. The Horsepen Creek Watershed consists of nine watershed management areas (WMAs) including Cedar Run, Frying Pan, Indian, Lower Horsepen, Lower Middle Horsepen, Merrybrook, Middle Horsepen, Stallion, and Upper Horsepen as shown in Map 3.4.

Assessments were made of each WMA based on information supplied by the County and field reconnaissance. Each WMA was assessed for factors such as drainage complaints, proposed county projects, existing stormwater management facilities, on-site septic systems, Neighborhood Source Assessment (NSA), Hot Spot Investigation (HIS) and Stream Physical Assessment (SPA).

The water quality and quantity was modeled for each WMA by assessing land uses, impervious coverage, topography, vegetative cover, the health of streams, and stormwater management. Each WMA was evaluated using STEPL Modeling and HEC-RAS Modeling to determine the WMA subwatershed ranking of watershed impacts. Each WMA was also evaluated using source indicators to identify potential WMA stressors or pollutant sources. For more detailed information, see the Sugarland Run and Horsepen Creek Watersheds Draft Watershed Workbook, dated October 2008, located in Appendix A.

Overall, Horsepen Creek watershed streams range in quality from very poor to good. Poor and very poor reaches are concentrated around the western, downstream area and good reaches are generally located in the eastern, upstream area. The downstream area borders Loudoun County and is located partly within the Town of Herndon. This area is characterized by urban residential, commercial, and industrial development. The eastern, upstream area drains primarily low and medium density residential areas.



N

0 0.2 0.4 0.8 Miles

Roads
Perennial Streams
WMA Boundary
Horsepen Creek Watershed Boundary
County Boundary

Map 3.4
Horsepen Creek
Watershed Management Area
Map

3.2.1 Cedar Run WMA

The Cedar Run WMA is located in the southern tip of the Horsepen Creek Watershed. The WMA is comprised of 783 acres (1.2 square miles). Approximately 2.4 miles of perennial streams exist within the Cedar Run WMA, and flow in a northwest direction toward the confluence with Horsepen Creek. Most of these streams are in good to fair condition. The WMA consists primarily of medium density residential land use with open space along stream corridors, as shown in Map 3.5. According to the HEC-RAS modeling, one culvert does not carry the 100-year stormflow and may increase flooding upstream.

One of the subwatersheds within the Cedar Run WMA has been identified as a potential problem area in the subwatershed ranking of watershed impacts. Based upon existing conditions, the remainder of the WMA is in moderate condition.

Two of the subwatersheds within the Cedar Run WMA have been identified as additional potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The remainder of the WMA was ranked as having moderate levels of stressors and pollutant sources.

3.2.2 Frying Pan WMA

The Frying Pan WMA is located in the central portion of the Horsepen Creek Watershed, and is bordered on the east by the Sugarland Run Watershed. The WMA is comprised of 1,131 acres (1.8 square miles). Approximately 3.6 miles of perennial streams exist within the Frying Pan WMA, and flow in a western direction toward the confluence with Horsepen Creek. Most of these streams are in poor condition. The WMA consists primarily of high density residential land use in the northwest, medium density residential in the northeast and open space along stream corridors, as shown in Map 3.5. According to the HEC-RAS modeling, one culvert does not carry the 100-year stormflow and may increase flooding upstream.

None of the subwatersheds within the Frying Pan WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in fair to moderate condition.

One of the subwatersheds within the Frying Pan WMA has been identified as an additional potential problem area in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The remainder of the WMA was ranked as having moderate levels of stressors and pollutant sources.

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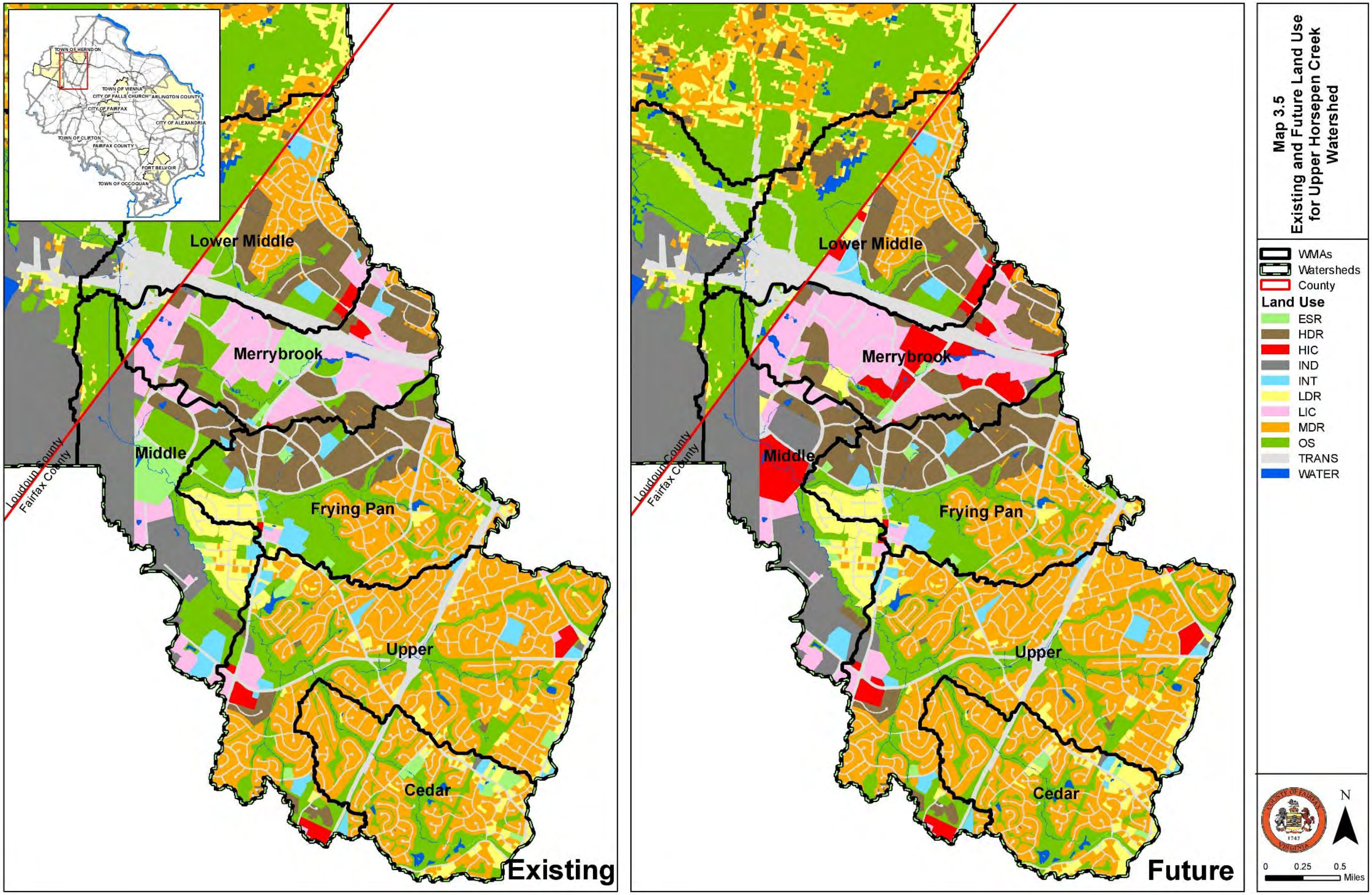

Map 3.5
Existing and Future Land Use for Upper Horsepen Creek Watershed

3.2.3 Indian WMA

The Indian WMA is located on the northern border of the Horsepen Creek Watershed, and is located almost entirely within Loudoun County. The WMA is comprised of 2,066 acres (3.2 square miles). The portion that lies within Fairfax County is comprised of 5.3 acres (0.01 square miles). Approximately 4.5 miles of perennial streams exist within the Indian WMA, and flow in a western direction toward the confluence with Horsepen Creek. The WMA primarily consists of open space and low and medium density residential land uses, as shown in Map 3.6.

None of the subwatersheds within the Indian WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Only two subwatersheds within the Fairfax County portion of the Indian WMA were scored. Based upon existing conditions, the WMA is in fair condition.

None of the subwatersheds within the Indian WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The WMA was ranked as having low levels of stressors and pollutant sources.

3.2.4 Lower Horsepen WMA

The Lower Horsepen WMA is located in the northwestern portion of the Horsepen Creek Watershed. The WMA is comprised of 3,189 acres (5.0 square miles). The portion that lies within Fairfax County is comprised of 20.6 acres (0.03 square miles). Approximately 7.0 miles of perennial streams exist within the Lower Horsepen WMA, and flow north and northwest toward the confluence with Horsepen Creek. The WMA consists primarily of open space to the west and industrial land uses containing the Dulles International Airport to the east, as shown in Map 3.6.

None of the subwatersheds within the Lower Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Only one subwatershed within the Fairfax County portion of the Lower Horsepen WMA was scored. Based upon existing conditions, the WMA is in moderate condition.

None of the subwatersheds within the Lower Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. Only one subwatershed within the Fairfax County portion of the Lower Horsepen WMA was scored.

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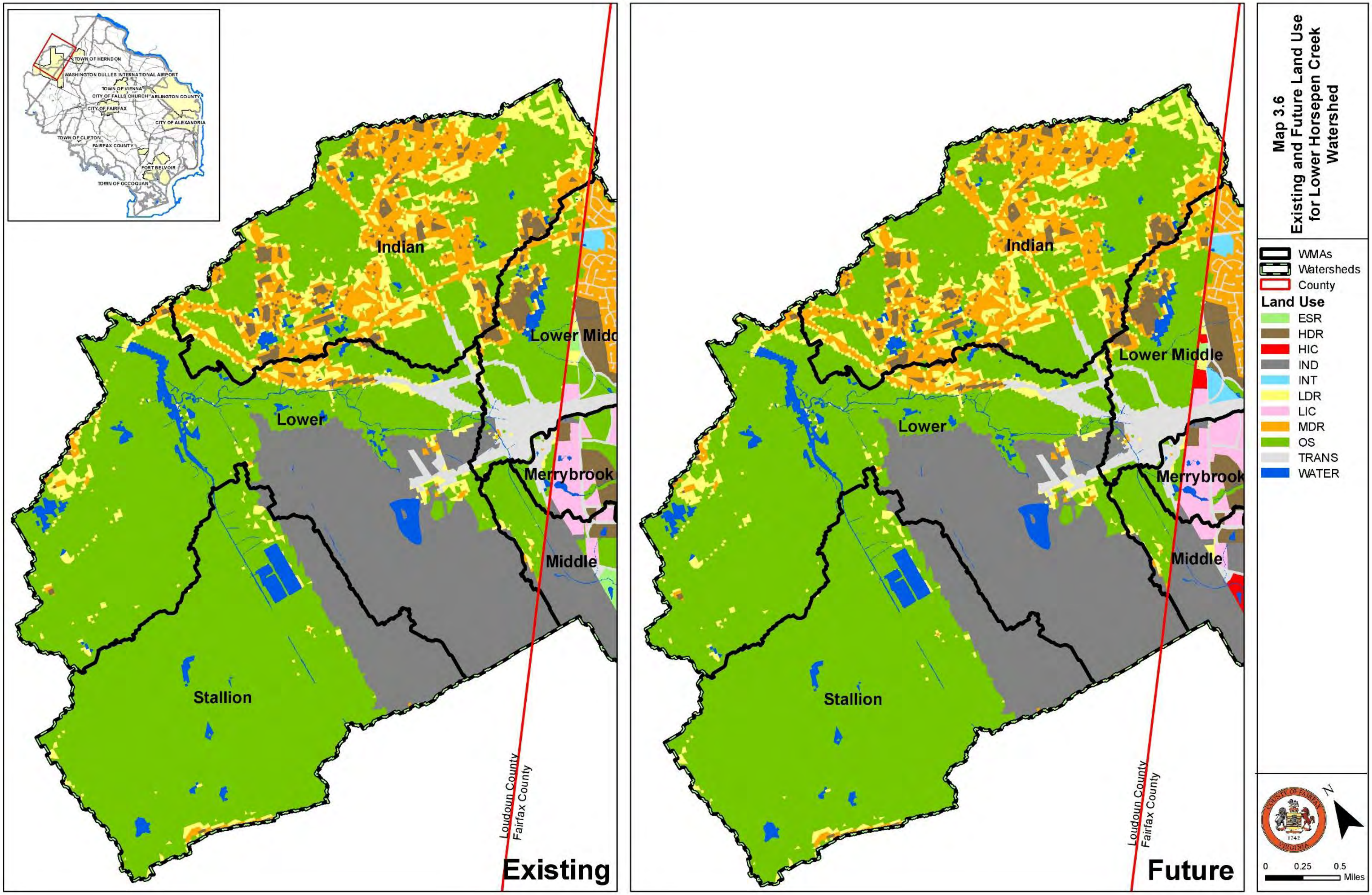

**Map 3.6
Existing and Future Land Use
for Lower Horsepen Creek
Watershed**

3.2.5 Lower Middle Horsepen WMA

The Lower Middle Horsepen WMA is located in the central portion of the Horsepen Creek Watershed, and is bordered on the east by the Sugarland Run Watershed. The WMA is comprised of 1,188 acres (1.9 square miles). Approximately one half of this WMA is located in Fairfax County and the other half is located in Loudoun County. Approximately 3.4 miles of perennial streams exist within the WMA, and flow in a western direction toward the confluence with Horsepen Creek. The WMA consists primarily of open space to the west and medium and high density residential land uses to the east, as shown in Map 3.5.

None of the subwatersheds within the Lower Middle Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in moderate condition.

None of the subwatersheds within the Lower Middle Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The WMA was ranked as having low to moderate levels of stressors and pollutant sources.

3.2.6 Merrybrook WMA

The Merrybrook WMA is located in the central portion of the Horsepen Creek Watershed, and is bordered on the east by the Sugarland Run Watershed. The WMA is comprised of 967 acres (1.5 square miles). A small portion on the western side of the WMA lies within Loudoun County. Approximately 2.0 miles of perennial streams exist within the Merrybrook WMA, and flow in a western direction into Loudoun County before flowing into the main stem of Horsepen Creek. The WMA consists primarily of commercial and high density residential land uses with open space along stream corridors, as shown in Map 3.5.

None of the subwatersheds within the Merrybrook WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in fair condition.

None of the subwatersheds within the Merrybrook WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The WMA was ranked as having moderate levels of stressors and pollutant sources.

3.2.7 Middle Horsepen WMA

The Middle Horsepen WMA is located in the central portion of the Horsepen Creek Watershed. The WMA is comprised of 953 acres (1.5 square miles). A small portion of the northern tip lies within Loudoun County. Approximately 2.9 miles of perennial streams exist within the Middle Horsepen WMA, and flow in a northern direction into Loudoun County. The streams in the upper portion of the WMA are in good to fair condition, and streams in the lower portion of the WMA are in poor to very poor condition. The WMA consists primarily of commercial and industrial land uses to the west with open space and low density residential land uses to the east, as shown in Map 3.5. According to the HEC-RAS modeling, one bridge and one culvert do not carry the 100-year stormflow, and will overtop the roadways.

Two of the subwatersheds within the Middle Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in poor to very poor condition.

None of the subwatersheds within the Middle Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The southern portion of the WMA was ranked as having moderate levels of stressors and pollutant sources. The northern portion of the WMA was ranked as having low to moderate levels of stressors and pollutant sources.

3.2.8 Stallion WMA

The Stallion WMA is located in the western portion of the Horsepen Creek Watershed. The WMA lies entirely within Loudoun County. The WMA is comprised of 2,394 acres (3.7 square miles). Approximately 3.2 miles of perennial streams exist within the Stallion WMA, and flow in a northern direction into the Lower Horsepen WMA. The WMA consists primarily of open space with industrial land uses to the northeast, as shown in Map 3.6.

No subwatershed ranking was completed for the Stallion WMA since it is located completely in Loudoun County.

3.2.9 Upper Horsepen WMA

The Upper Horsepen WMA is located in the southern tip of the Horsepen Creek Watershed. The WMA is comprised of 1,929 acres (3.0 square miles). Approximately 7.3 miles of perennial streams exist within the Upper Horsepen WMA, and flow in a northwest direction into the Middle Horsepen WMA. The majority of streams are in good to fair condition, although there are some small portions in poor to very poor condition. The WMA consists primarily of medium density residential land uses with open space along stream corridors, as shown in Map 3.5.

Two of the subwatersheds within the Upper Horsepen WMA have been identified as potential problem areas in the subwatershed ranking of watershed impacts. Based upon existing conditions, the WMA is in moderate condition.

Two additional subwatersheds within the Upper Horsepen WMA have been identified as additional potential problem areas in the subwatershed ranking of source indicators to identify potential stressors or pollutant sources. The remainder of the WMA was ranked as having moderate to high levels of stressors and pollutant sources.

4.0 Summary of Watershed Restoration Strategies

Watershed restoration strategies to address stormwater problems and to improve water quality were developed for the Sugarland Run and Horsepen Creek watersheds. The strategies recommended in this plan were developed by identifying priority subwatersheds and then identifying candidate restoration projects within them. The top 70 projects were selected for implementation within the next 10 years, and an additional 50 projects were selected for implementation within the next 25 years. A brief description of the methodology used to select priority subwatersheds and candidate restoration projects and the actual prioritization process is provided in this section. Detailed information on this process is provided in Technical Memos 3.2 and 3.4/3.5 found in Appendix B.

This section also includes a description of watershed restoration strategies, along with several examples of the types of projects that have been proposed. The end result of this work can be found in the list of 10-year and 25-year projects provided at the conclusion of this section.

4.1 Priority Subwatershed Identification

Priority subwatersheds and candidate restoration areas were identified based on the results of final subwatershed ranking, priority restoration elements from the Stream Physical Assessment (SPA), problem areas identified during subwatershed characterization and field reconnaissance, and input from the Watershed Advisory Group (WAG). These areas were targeted for implementation of structural Best Management Practices (BMPs), or restoration strategies.

There are also areas within the Sugarland Run and Horsepen Creek watersheds that would benefit from preservation strategies rather than solely restorative strategies. Preservation strategies target the less impacted subwatersheds and key areas such as headwaters to prevent future degradation of the subwatershed and downstream areas. By evaluating subwatershed ranking, results of the pollutant loading model STEPL, and the total impervious area of the subwatershed, priority areas for preservation strategies were identified. These areas were targeted for the implementation of non-structural BMPs.

4.2 Description of Prioritization Process

The prioritization process that was used to select priority subwatersheds, identify candidate restoration projects, and determine final restoration projects consisted of four steps as outlined below. Detailed information and data regarding the prioritization process can be found in Technical Memos 3.4 and 3.5 located in Appendix B.

Step 1: The potential "universe" of structural projects was narrowed down by identifying priority subwatersheds, evaluating candidate restoration projects, soliciting comments from the WAG and determining which projects were viable.

Step 2: The watershed management plan prioritization scheme was used to perform the initial project ranking using the Spreadsheet Tool for Estimating Pollutant Load (STEPL) and watershed indicators for all structural candidate projects within the 0-25-year implementation time frame.

STEPL is a spreadsheet tool that uses simple algorithms to calculate nutrient and sediment loads from various land uses and determines the pollutant load reductions that would occur from implementing various BMPs.

Structural candidate projects were scored from 1 to 5 points, with 5 points representing the highest priority and 1 point representing the lowest priority. The five factors included:

- **Effect on watershed impact indicators (30%)** – Watershed impact indicators provide an overall picture of the condition of the watershed using a variety of quantitative indicators. Candidate projects that have a greater positive effect on the watershed impact indicators are likely to have a greater benefit than projects with a lesser or neutral effect.
- **Effect on source indicators (30%)** – Source indicators provide an overall picture of the stressors within a watershed using a variety of quantitative indicators. Candidate projects that have a greater positive effect on the source indicators are likely to have a greater benefit than projects with a lesser or neutral effect.
- **Location within priority subwatersheds (10%)** – Candidate projects located within poor quality subwatersheds have the potential to provide a greater overall impact than a project located within a high quality subwatershed. Therefore, projects located in poor quality subwatershed received a higher priority and a higher score than projects located in a high quality subwatershed.
- **Sequencing (20%)** – Projects upstream relative to other projects should be completed prior to projects located downstream. Upstream projects will provide protection for future downstream projects and also mitigate sources and stressors that cause cumulative impacts downstream. Therefore, projects in headwater areas were considered the highest priority and received a higher project score.
- **Implementability (10%)** – Less complex projects and projects without land acquisition requirements will be easier to implement and are given higher scores accordingly. Projects that were located on County property or retrofits of County-maintained stormwater facilities were scored higher than projects on private parcels and those with multiple landowners.

Step 3: The proposed 10-year implementation projects were further analyzed and evaluated using both the Storm Water Management Model (SWMM) and the HEC-RAS model. SWMM is a rainfall-runoff simulation model that estimates the quantity and quality of runoff. HEC-RAS is a computer program that models the hydraulics of water flow through watercourses. By utilizing these tools, a determination was made on which projects should be included in the 10-year implementation plan and how they were ranked within it.

Step 4: The final set of recommended projects and final ranking of all projects was determined through close collaboration with the WAG. Project ranking was also adjusted and finalized based on estimated costs and projected benefits of the projects. Projects that had greater projected benefits relative to estimated costs were prioritized. Finally, the ranked structural projects were grouped into the two implementation timeframes - the priority projects within 10 years and the long-term projects within 25 years. Detailed project fact sheets were created for the priority projects and can be found in Section 5.

4.3 Summary of Subwatershed Strategies

Once priority subwatersheds were identified and impairments for each subwatershed were determined, improvement goals and strategies were developed for each priority subwatershed based on the sources of subwatershed impairments. In order to achieve these goals, both structural projects and non-structural practices were developed.

All subwatersheds draining to a planned, un-built regional pond were evaluated for potential restoration alternatives, and the alternatives were categorized as **regional pond alternative strategies**. **Subwatershed improvement strategies** are intended to reduce stormwater impacts for subwatersheds that do not drain to a planned, un-built regional pond. **Stream restoration strategie**s are targeted to improve habitat, to promote stable stream geomorphology, and to reduce in-stream pollutants due to erosion. **Non-structural measures and preservation strategies** can provide significant benefits by improving the water quality of stormwater runoff, by reducing the quantity of stormwater runoff, by improving stream and riparian habitat, and by mitigating the potential impacts of future development. Table 4.1 shows the relationship between the County goals and objectives and the restoration strategies.

Table 4.1
Relationship between County Objectives and Restoration Strategies

	Restoration Strategies			
County Goals & Objectives	**Regional Pond Alternatives**	**Subwatershed Improvements**	**Stream Restoration**	**Non-Structural & Preservation**
Minimize impacts of stormwater runoff on stream hydrology to promote stable stream morphology, protect habitat, and support biota	✘	✘	✘	✘
Minimize flooding to protect property, human health, and safety	✘	✘		
Provide for healthy habitat through protecting, restoring, and maintaining riparian buffers, wetlands, and in stream habitat	✘	✘	✘	✘
Improve and maintain diversity of native plants and animals in the County	✘	✘	✘	✘
Minimize impacts to stream water quality from pollutants in stormwater runoff	✘	✘		✘
Minimize impacts to drinking water sources from pathogens, nutrients, and toxics in stormwater runoff	✘	✘		✘
Minimize impacts to drinking water storage capacity from sediment in stormwater runoff	✘	✘	✘	✘
Encourage the public to participate in watershed stewardship	✘	✘	✘	✘
Coordinate with regional jurisdictions on watershed management and restoration efforts such as Chesapeake Bay initiatives	✘	✘	✘	✘
Improve watershed aesthetics in Fairfax County	✘	✘	✘	✘

The following table includes a summary of project types that may be included for the various improvement goals and strategies.

Table 4.2
Summary of Subwatershed Strategies & Project Types

Strategies	Project Types
Regional Pond Alternatives	Stormwater Pond Retrofits New Stormwater Ponds Low Impact Development Retrofits Culvert Retrofits, including Road Crossing Improvements Outfall Improvements Area-wide Drainage Improvements
Subwatershed Improvements	Stormwater Pond Retrofits New Stormwater Ponds Low Impact Development Retrofits Culvert Retrofits, including Road Crossing Improvements Outfall Improvements Area-wide Drainage Improvements
Stream Restoration	Streambank Stabilization Natural Channel Restoration
Non-Structural Measures and Preservation Strategies	Buffer restoration Rain barrel programs Dumpsite/Obstruction removal Community outreach/Public education Conservation acquisition/easements Street sweeping Storm drain stenciling

Each of the subwatershed strategies are briefly described below along with information on sample project types.

4.3.1 Regional Pond Alternative Strategies

Regional stormwater ponds, which may be very large, can be considered as a watershed management tool. Based on *The Role of Regional Ponds in Fairfax County Stormwater Management (Fairfax County 2003)*, a number of smaller on-site stormwater facilities that perform a similar function to larger regional pond facilities are the preferred approach. All subwatersheds containing a planned, un-built regional pond or draining to a planned, un-built regional pond were evaluated for potential alternatives. Regional pond alternative strategies include:

- Retrofits to existing stormwater ponds
- New stormwater ponds
- Low impact development projects,
- Culvert retrofits
- Outfall improvements
- Area-wide drainage improvements

When more than one project is proposed for a regional pond drainage area, the project group will be considered as a single project in order to emphasize the necessity of implementing the entire group of projects to replace the function of the large regional pond.

The Regional Stormwater Management Plan created by Camp, Dresser and McKee in 1989 proposed a total of 12 regional ponds for Sugarland Run and Horsepen Creek watersheds; five regional ponds were proposed for Sugarland Run and seven regional ponds were proposed for Horsepen Creek. In addition to the 12 regional ponds proposed in the 1989 Regional Stormwater Management Plan, four additional regional ponds were proposed for Sugarland Run and Horsepen Creek Watersheds, three in Sugarland Run and one in Horsepen Creek, for a total of 16 regional ponds proposed for the two watersheds.

Of the eight regional ponds proposed for Sugarland Run watershed, only four have been fully constructed, two are partially funded and unconstructed, and two are not actively funded and not slated for construction. The four unconstructed regional ponds proposed for Sugarland Run (S-01, S-02, S-05, and S-07) were evaluated as described above. Alternative projects are proposed for three out of the four unconstructed regional ponds (S-02, S-05, and S-07). For regional pond S-01, alternatives were considered but no projects were deemed viable due to the lack of good locations for alternative projects. It is proposed that regional pond S-01 be implemented with a limited scope. Detailed descriptions for these projects can be found in Section 5.

Of the eight regional ponds proposed for Horsepen Creek watershed, four have been fully constructed, two are partially funded and unconstructed, and two are inactive, unfunded and unconstructed. The four regional ponds proposed for Horsepen Creek that have not been constructed (H-02, H-07, H-13, and H-16) were evaluated as described above. No alternative projects are proposed for regional pond H-02, because all existing development in the drainage area receives treatment on-site and any future development would also be treated on-site. Implementation of the regional pond was also determined to be undesirable because areas draining to the proposed regional pond are adequately treated and implementation of the regional pond would require a large disturbance to wooded areas and riparian buffers. The best option for the area of this regional pond is to implement non-structural practices that would preserve and protect the forested riparian buffer and ensure that all new development have adequate stormwater controls. Alternative projects are proposed for regional pond H-07 but adequate quantity control could not be obtained through the alternative projects alone. It is proposed that the alternative projects for regional pond H-07 be combined with the construction of a pond at the location of the proposed regional pond that would have a more limited scope. Alternative projects are proposed for proposed regional pond H-13. Proposed regional pond H-16 drains a single 89 acre subwatershed that was determined to be low priority due to good site conditions. An existing wet pond, WP0354, is also located upstream of the proposed location for regional pond H-16 and would treat most of the drainage area to the regional pond. It is proposed that regional pond H-16 remain unconstructed as there is no need for a regional pond at this location. Detailed descriptions of these projects can be found in Section 5.

4.3.2 Subwatershed Improvement Strategies

Subwatershed improvement strategies are intended to reduce stormwater impacts for subwatersheds that do not drain to a planned, un-built regional pond. Project types for subwatershed improvement strategies are the same types of projects recommended for the planned, un-built regional pond drainage areas. However, each individual project will be given its own project identification number and will not be considered as a combined group of projects.

Low impact development (LID) projects may be incorporated into Regional Pond Alternative Strategies and Subwatershed Improvement Strategies. LID projects are Best Management Practices (BMPs) designed to provide water quality and quantity benefits for stormwater management on the site where stormwater is generated. Possible LID projects include:

- Sand Filters and Sand/Peat Filters
- Rain Gardens/Bioretention
- Infiltration Basins/Trenches
- Vegetated Rooftops
- Porous/Permeable Paving
- Underground or Rooftop Storage

4.3.3 Stream Restoration Strategies

Stream restoration strategies are targeted at improving stream and riparian buffer habitat, promoting stable stream geomorphology, and reducing in-stream pollutants due to erosion. Regional pond alternative strategies and subwatershed improvement strategies are critical to the success of stream restoration strategies by improving drainage and reducing peak flows. A major component of stream restoration strategies is identifying and addressing the source of the impairments.

Stream restoration can be accomplished by installing streambank stabilization measures, installing and/or maintaining riparian buffers, or implementing natural channel restoration measures. Structural streambank stabilization measures include riprap or other “hard” engineering stabilization measures such as concrete, sheet piling or gabions. Non-structural streambank stabilization measures, which are preferred, can include the following:

- Cedar tree revetments
- Root wad revetments
- Rock toe revetments
- Live crib walls
- Natural fiber rolls
- Live fascines
- Brush mattresses
- Live stakes

Streambank stabilization projects can be expensive and are more likely to succeed when upstream stormwater problems are addressed prior to the installation of streambank stabilization measures.

4.3.4 Non-Structural Measures and Preservation Strategies

Non-structural projects do not require traditional construction measures to be implemented and may be programmatic in nature. These projects include but are not limited to the following practices:

- Buffer restorations
- Rain barrel programs
- Dumpsite and obstruction removals
- Community outreach and public education
- Land conservation coordination projects
- Inspection and enforcement projects
- Street sweeping programs
- Recommendation of additional studies, surveys and assessments

These projects, in concert with the structural projects, represent a holistic approach to watershed management. Since much of the land area in Fairfax County is privately owned, there is a strong need to work with local communities to promote environmental awareness and recommend projects that can be implemented by residents and other groups.

The fundamental difference between structural and non-structural projects is the ability to predict the result of the project implementation through models. For example, the nitrogen removal of a wet pond may be calculated; however, there is no way to predict the reduction in nitrogen from an outreach campaign on proper fertilizer use. Additionally, these projects and programs should not be confined to any single watershed but could be implemented throughout the County as opportunities occur. Because of these differences, non-structural projects were evaluated and will be implemented using a different process than the structural projects.

There are many advantages of non-structural projects. Some of the key advantages to this projects type are:

- Less costly
- Less disruptive
- Promotes public and community awareness

In general, non-structural projects represent opportunities to proactively pursue stormwater issues that more traditional structural practices cannot address. The use of non-structural practices fulfills Fairfax County's MS4 permit requirements and environmental initiatives. The full potential of these projects will be realized through partnerships with County agencies, residents and other interested parties.

4.4 Project Type Descriptions

A detailed description of the project types included in the WMP and their benefits are provided below.

<u>New Stormwater Ponds and Stormwater Pond Retrofits</u>

<u>Extended Detention (ED) Basin</u>

An extended detention basin is a stormwater management facility that temporarily stores stormwater runoff and discharges it at a slower rate through a hydraulic outlet structure. It is typically dry during non-rainfall periods. The purpose of this BMP is to enhance water quality and decrease downstream flooding and channel erosion. Water quality is enhanced through gravitational settling, though settled pollutants may become re-suspended with frequent high inflow velocities.

Photo 4.1 Extended Detention Basin Full of Stormwater
Source: Virginia Stormwater Management Handbook

Photo 4.1 shows an extended detention basin full of stormwater runoff. The circuitous path slows stormwater and allows for the settling of sediments.

Figure 4.1 shows a typical plan view of an extended detention basin.

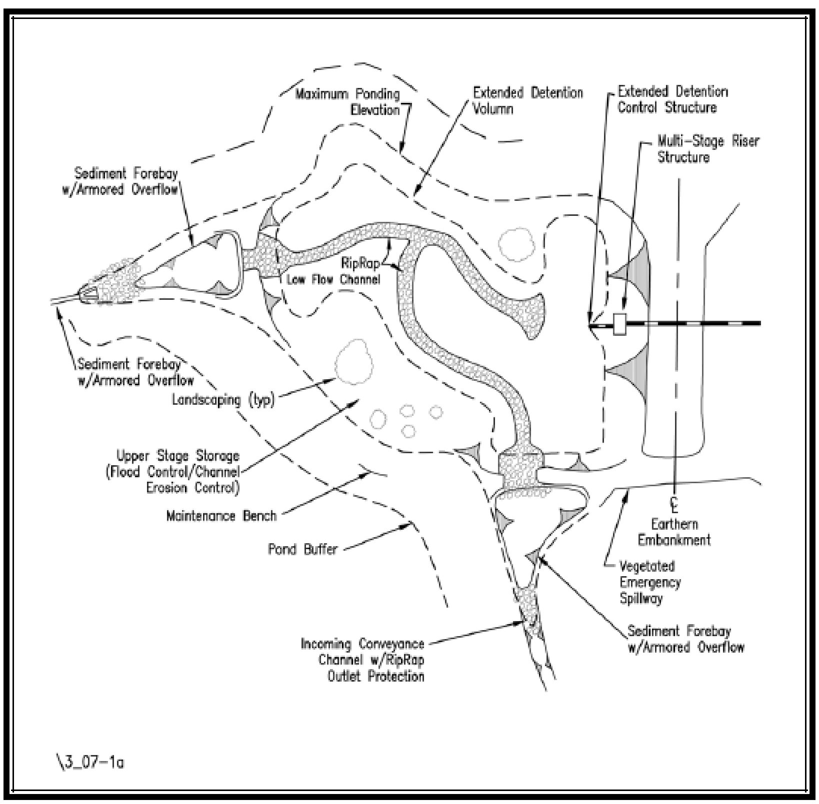

Figure 4.1 Plan View of Extended Detention Basin
Source: Virginia Stormwater Management Handbook

Enhanced Extended Detention (EED) Basin

An enhanced extended detention basin has a similar design to an extended detention basin, though it incorporates a shallow marsh along the bottom. The shallow marsh improves water quality through wetland plant uptake, absorption, physical filtration, and decomposition. Wetland vegetation also traps settled pollutants, reducing the re-suspension that can be found in extended detention basins. The purpose of this BMP is to enhance water quality and decrease downstream flooding and channel erosion.

Photo 4.2 Enhanced Extended Detention Basin Full of Stormwater
Source: Virginia Stormwater Management Handbook

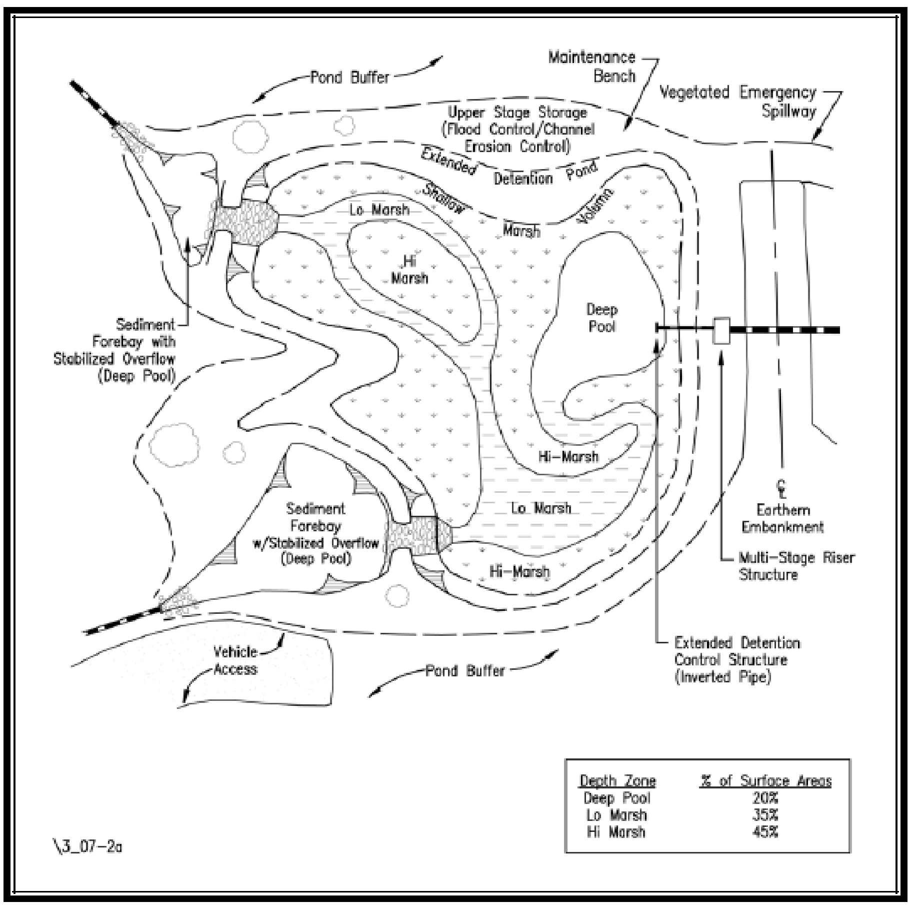

Figure 4.2 Plan view of Enhanced Extended Detention Basin
Source: Virginia Stormwater Management Handbook

Photo 4.2 shows a multi-stage weir principal spillway and deep water pool (18”-48” depth) in an enhanced extended detention basin.

Figure 4.2 shows a plan view of an enhanced extended detention basin.

Retention Basin (Wet Pond)

A retention basin (wet pond) is a stormwater facility that has a permanent pool of water, which means it is normally wet all the time. The purpose of this BMP is to provide storage for stormwater runoff, to alleviate downstream flooding and channel erosion, and to improve water quality. A retention basin may be used to temporarily store stormwater runoff above the permanent pool elevation and release it at lower rates. Water quality can be improved through gravitational settling, biological uptake and decomposition.

Photo 4.3 Retention Basin
Source: Virginia Stormwater Management Handbook

Photo 4.3 shows a typical stormwater retention basin in a residential community. The aquatic bench is important for public safety, the biological health of the facility, and is aesthetically pleasing.

Figure 4.3 shows a typical plan view and section of a retention basin.

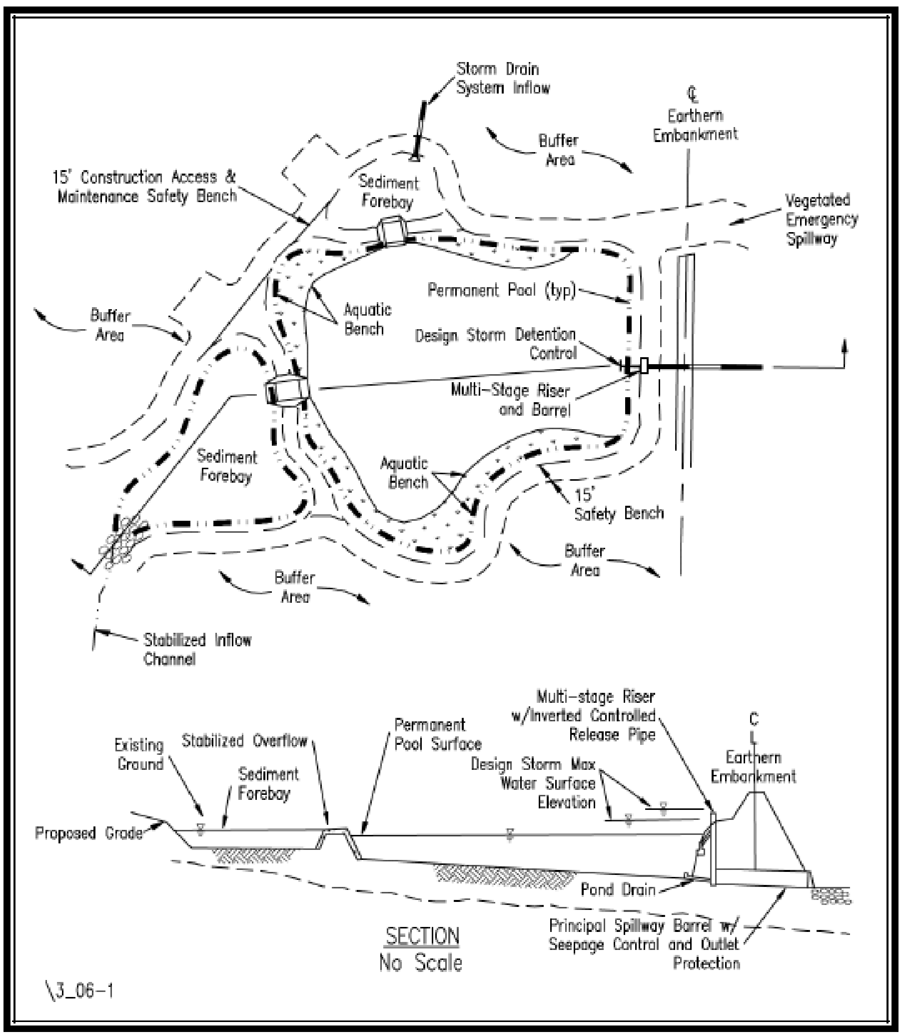

Figure 4.3 Retention Basin – Plan and Section
Source: Virginia Stormwater Management Handbook

Constructed Stormwater Wetlands

Constructed stormwater wetlands are shallow pools that are created to provide growing conditions suitable for both emergent and aquatic vegetation. They are constructed to replicate natural wetland ecosystems. Constructed wetlands are installed to enhance the water quality of stormwater runoff through gravitational settling, nutrient uptake by wetland vegetation, absorption, physical filtration, and biological decomposition.

Photo 4.4 Constructed Stormwater Wetlands
Source: Virginia Stormwater Management Handbook

Photo 4.4 shows a constructed stormwater wetland. The vegetation is protected from waterfowl by a netting system. Figure 4.4 shows a plan view of constructed stormwater wetlands.

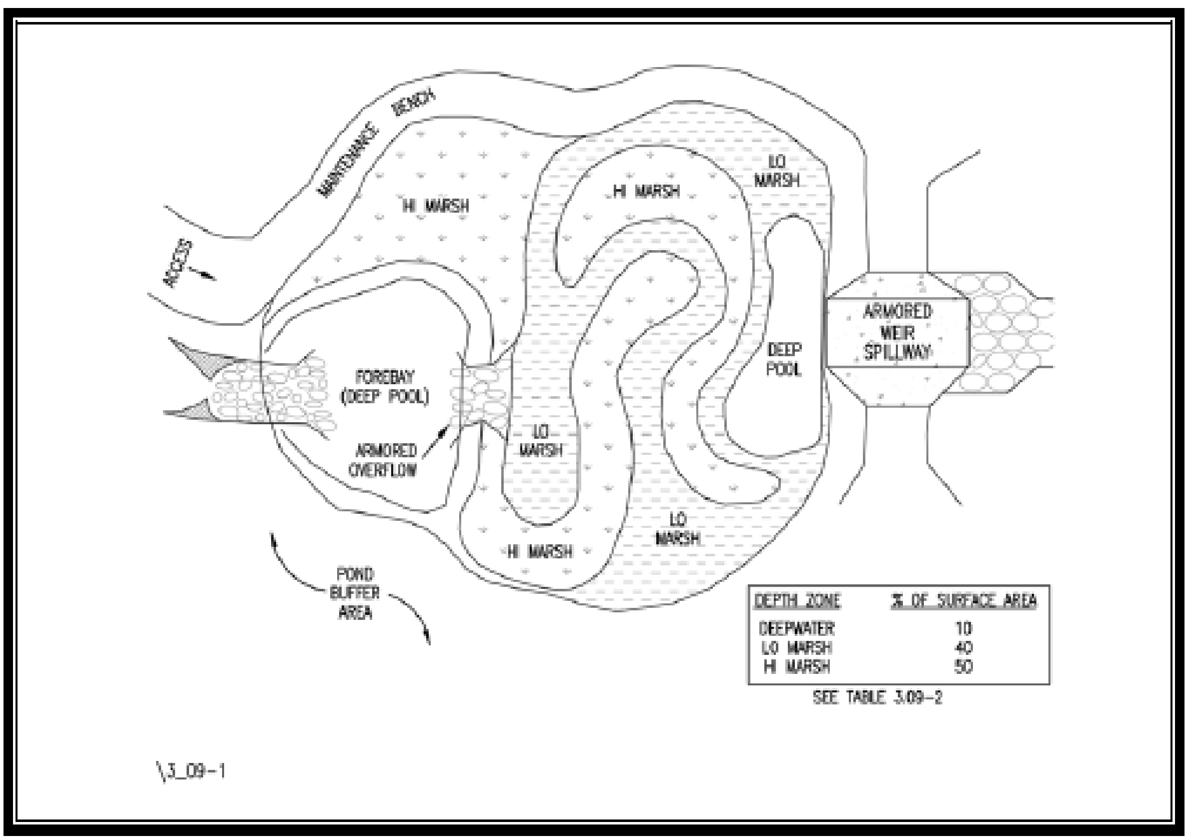

Figure 4.4 Constructed Stormwater Wetlands – Plan
Source: Virginia Stormwater Management Handbook

Culvert Retrofits

A culvert is a conduit through which surface water can flow under or across a road, railway, trail, or embankment. A culvert retrofit involves the replacement or modification of an existing culvert. This can be necessary due to many factors such as a culvert being undersized for the amount of stormwater it carries or if the culvert has been damaged.

Culvert Retrofits with Micro-pools

Culvert retrofits with micro-pools involve the measures stated above plus the addition of shallow depressions that hold stormwater, known as micro-pools. The purpose of this BMP is to slow down stormwater in order to enhance water quality through infiltration, sedimentation, and filtration and to decrease downstream flooding and erosion. Stormwater runoff volumes are decreased through infiltration and by uptake of the plant material. Culvert retrofits with micro-pools improve water quality, reduce stormwater runoffs and peak volumes, increase groundwater recharge, provide wildlife habitat, and are aesthetically pleasing. Figure 4.5 shows a typical plan and profile of a crossing retrofit showing a secondary embankment.

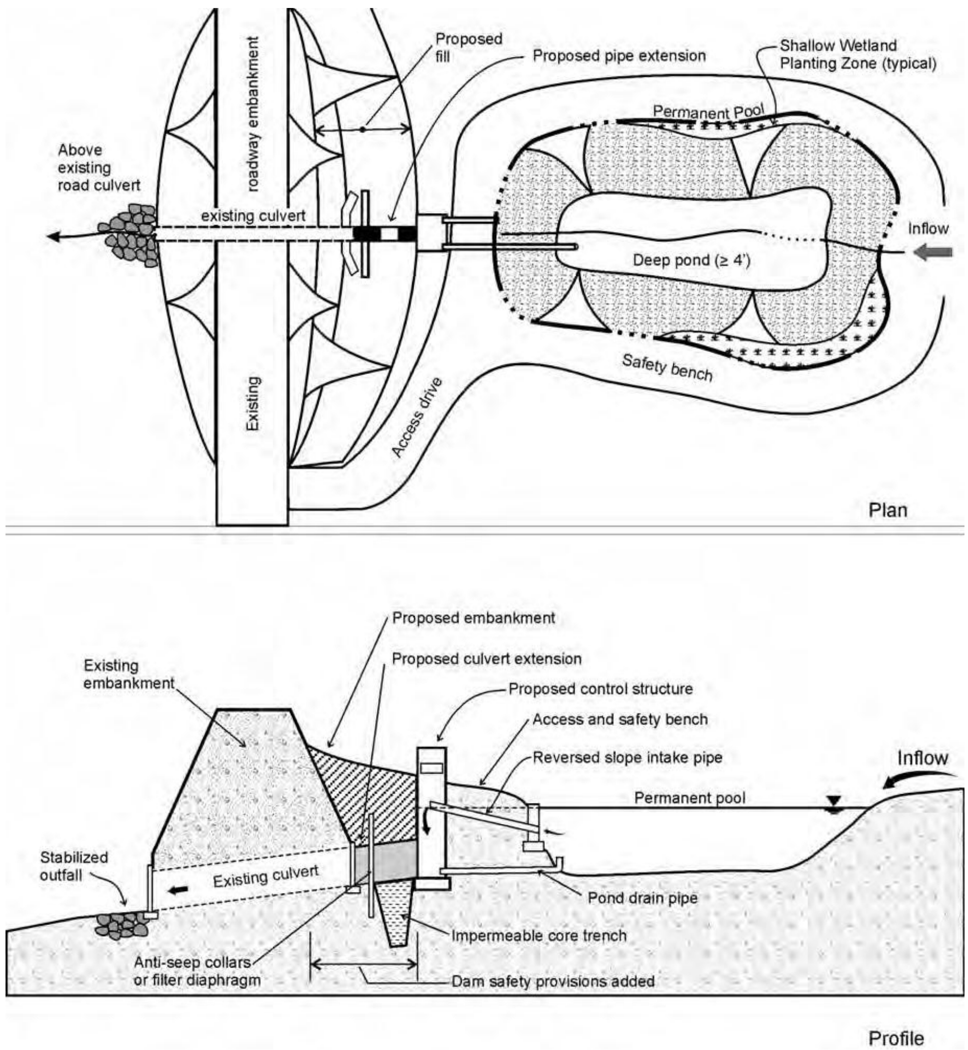

Figure 4.5 Typical Culvert Retrofit with Micro-pool Configuration
Source: Center for Watershed Protection

<u>Best Management Practices/Low Impact Development Retrofits (BMPs/LIDs)</u>

<u>Rain Garden (Bioretention Basin)</u>

Photo 4.5 Rain Garden
Source: Virginia Stormwater Management Handbook

A rain garden (bioretention basin) is a shallow surface depression planted with native vegetation to capture and treat stormwater runoff. The purpose of this BMP is to capture, treat, and infiltrate stormwater. Rain gardens store and infiltrate stormwater runoff, which increases groundwater recharge and may decrease downstream erosion and flooding. Stormwater runoff water quality is improved by filtration through the soil media and biological and biochemical reactions with the soil and around the root zones of plants. Rain gardens improve water quality, reduce stormwater runoff and peak volumes, increase groundwater recharge, provide wildlife habitat and are aesthetically pleasing.

Photo 4.5 shows the application of a rain garden in a multifamily residential area.

Figure 4.6 shows a plan view of a rain garden at the edge of a parking lot with curbing.

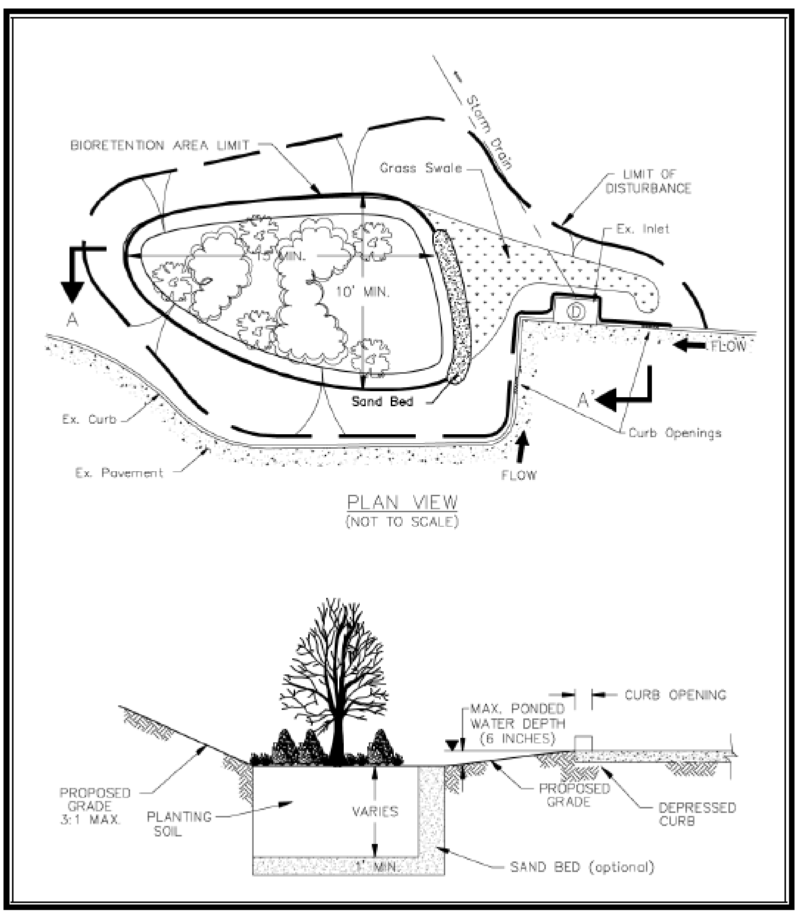

Figure 4.6 Rain Garden at Edge of Parking Lot, Plan View (Source: Virginia Stormwater Management Handbook)

Vegetated/Grassed Swale

A vegetated/grassed swale is a broad and shallow channel vegetated with erosion resistant and flood-tolerant grasses and/or herbaceous vegetation. Sometimes, check dams are placed within the swale to encourage ponding behind them. The purpose of this BMP is to convey and slow down stormwater in order to enhance water quality through sedimentation and filtration. Check dams slow the flow rate and create small, temporary ponding areas. Stormwater runoff volumes may be decreased through infiltration and/or evapo-transpiration and water quality is improved by nutrient uptake of the plant material and settling of soil particles.

Photo 4.6 Grassed Swale with Check Dams
Source: Virginia Stormwater Management Handbook

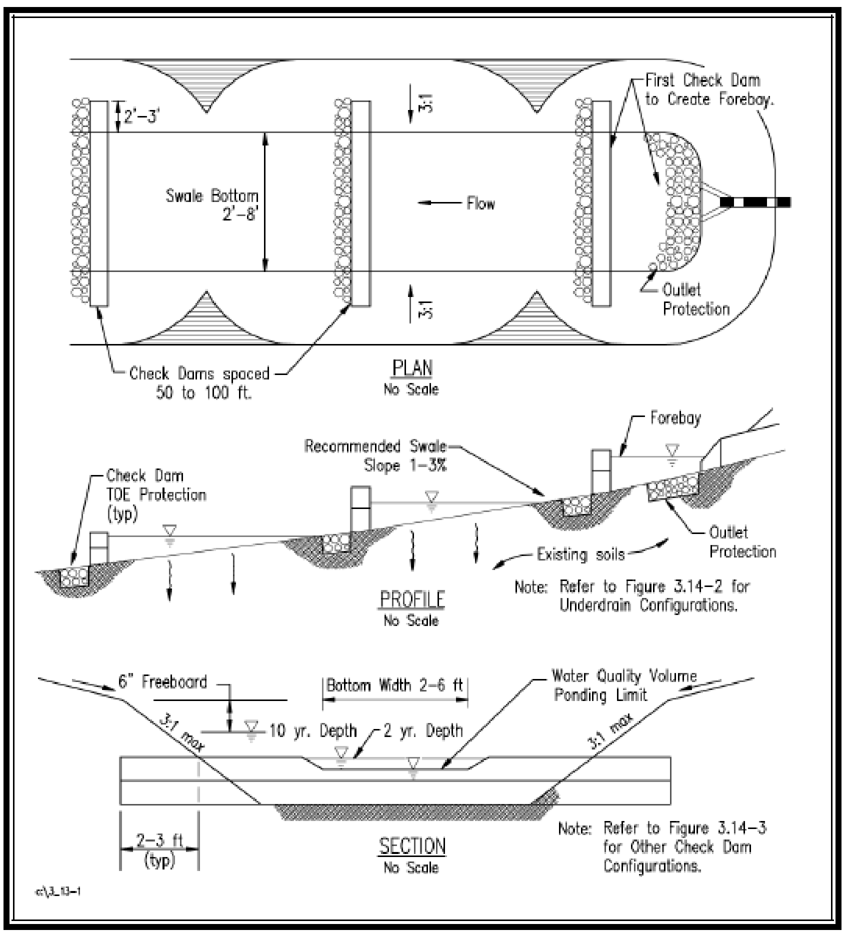

Figure 4.7 Typical Vegetated Swale Configuration
Source: Virginia Stormwater Management Handbook

Photo 4.6 shows a grassed swale with check dams. The area behind the check dams is used for storage of stormwater runoff. The notched center of the check dams allows for safe overflow of stormwater without scouring the sides of the channel.

Figure 4.7 shows a typical vegetated swale configuration.

<u>Water Quality Swale/ Infiltration Trench</u>

A water quality swale is a vegetated/grassed swale that is underlain by an engineered soil mixture designed to promote infiltration. The purpose of this BMP is to convey and slow down stormwater in order to enhance water quality through infiltration, sedimentation, and filtration. Stormwater runoff volumes are decreased through infiltration and water quality is improved by nutrient uptake of the plant material and settling of soil particles. Infiltration trenches may also be designed with a gravel surface.

Photo 4.7 Vegetated Water Quality Swale
Source: F. X. Browne, Inc.

Photo 4.7 shows a vegetated swale connecting a drainage outlet and a stormwater basin. The swale was planted with a combination of native trees, shrubs and herbaceous plants that provide nutrient uptake, habitat for organisms like birds and butterflies, and are aesthetically pleasing.

Figure 4.8 shows a typical water quality swale configuration.

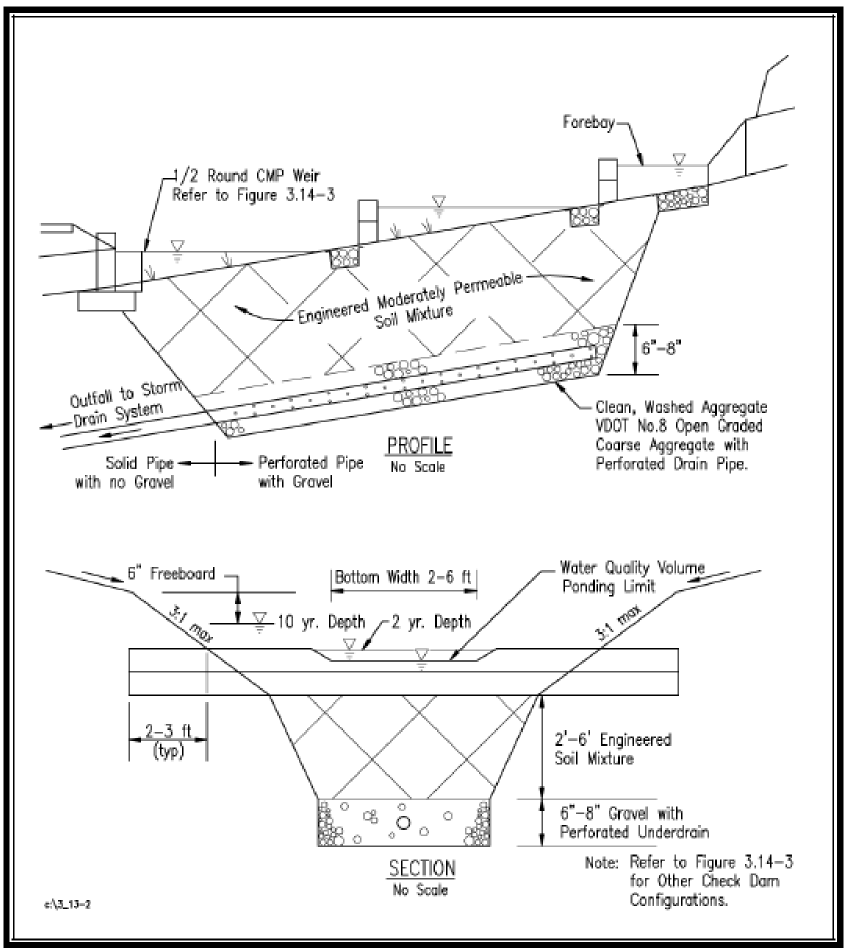

Figure 4.8 Typical Water Quality Swale Configuration
Source: Virginia Stormwater Management Handbook

Green Roof

A green roof is a roof that is covered or partially covered with a waterproof layer, soil media, and vegetation. Extensive green roofs have low-growing, drought-tolerant vegetation (typically sedum species) planted in shallow soil. Intensive green roofs have a thicker layer of soil and can support a wider variety of plant material, including trees. The purpose of a green roof is to reduce stormwater runoff volumes and peak flows, improve water quality, improve air quality, provide insulation for the building, provide habitat for wildlife, and to decrease urban air temperatures. Intensive green roofs typically encourage public access for recreational and aesthetic uses. Figure 4.9 shows a green roof cross section.

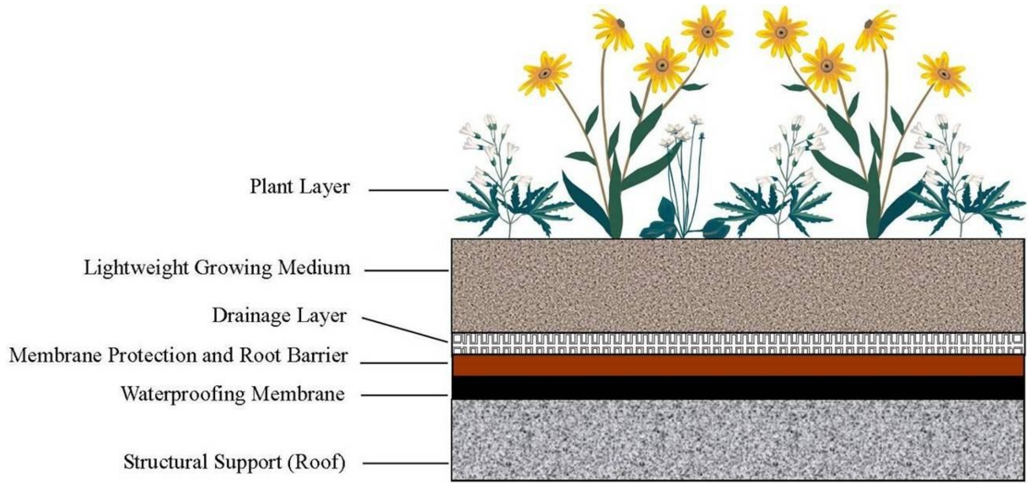

Figure 4.9 Green Roof Cross Section
Source: Virginia Stormwater Management Handbook

Photo 4.8 Before Green Roof

Photo 4.9 After Green Roof

Source: Fairfax County, VA

The photos below show a before and after shot of the Herrity Building parking garage at the Government Center complex in Fairfax County.

The Herrity Building green roof is open to the public and provides an aesthetic green space for workers and those who visit.

Stream Restoration

Photo 4.10 Restored Channel in Snakeden Watershed, Reston, Virginia
Source: Reston Association

A healthy stream is one that is in its natural condition, does not have a disproportionate amount of stormwater runoff contributing to the stream flows, meanders, has a healthy riparian buffer with native vegetation and supports aquatic life. Straightened streams with smoothed channels, typically man-made or altered, have increased velocities which can cause substantial erosion and flooding to downstream areas. The purpose of a stream restoration is to return the stream to its healthy, natural condition. Stream restoration includes many types of improvements such as re-grading stream banks to enhance the floodplain, re-grading the stream to create a meander or step pool system, stabilizing stream banks with "soft" measures, stabilizing stream banks with "hard" measures and building in-stream structures to protect the stream banks and streambed.

Figure 4.10 Comprehensive Stream Restoration Project
Source: F. X. Browne, Inc.

Stabilizing stream banks with "soft" measures such as vegetation, brush layering and fascines protect stream banks from scour and erosion caused by large velocities. Healthy vegetation will also slow velocities, decrease flows, and provide wildlife habitat. Building in-stream structures such as rock cross vanes and step pools and stabilizing stream banks with "hard" measures like boulder revetments also protect the stream banks from scour and erosion caused by large velocities. Restored streams have reduced soil erosion, reduced stormwater runoffs and peak volumes, provide aquatic habitat, provide recreational activities and are aesthetically pleasing.

In some cases, localized streambank stabilization measures are not sufficient to restore stream channel structure and functions. For severely impaired streams, a more comprehensive restoration project may be warranted that involves reconstructing the channel and/or floodplain. Re-grading of the stream banks or streambed is done to mimic the natural shape and direction of a healthy stream. Re-grading stream banks to connect with the floodplain allows large flows access over the floodplain, which can decrease velocities and volumes. Creating a meander in the stream can slow flows to reduce downstream flooding.

Step Pools

Step pools are rock grade control structures that recreate the natural step-pool channel morphology and gradually lower the elevation of a stream in a series of steps. They are constructed in steeper channels where a fixed bed elevation is required, and are typically used in streams with a slope greater than three percent. They are built in the stream channel and allow for "stepping down" the channel over a series of drops. As water flows over the step, energy is dissipated into the plunge pool. Step pools can connect reaches of different elevations, dissipate the energy of high-velocity flows, and improve aquatic habitat.

Photo 4.11 Step Pool Channel
Source: Arlingtonians for a Clean Environment

Photo 4.11 shoes a close-up of step pools in Donaldson Run in Arlington, VA. Figure 4.11 shows a typical plan and profile for step pool structures.

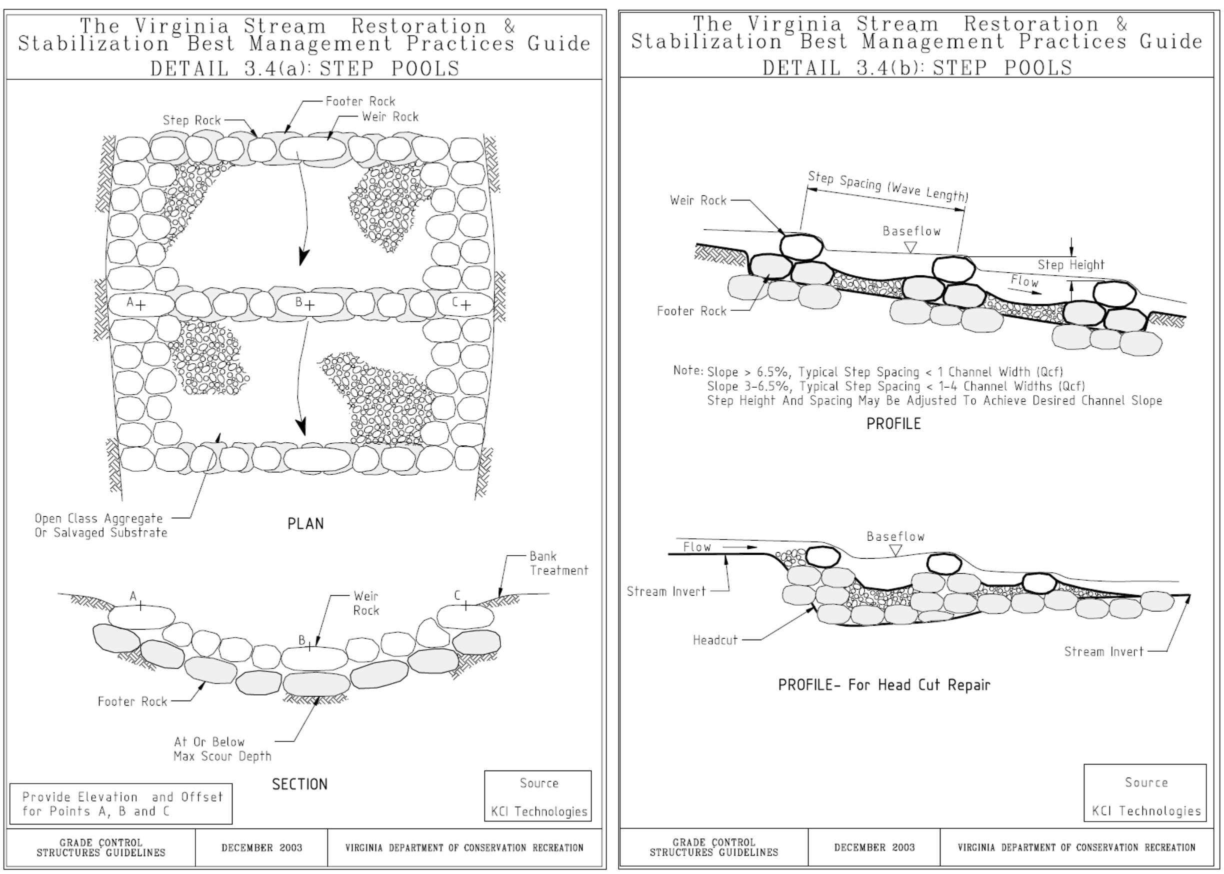

Figure 4.11 Step Pool Plan and Profile
Source: Virginia Stormwater Management Handbook

Rock Vanes

A rock cross vane is an in-stream stone structure that provides grade control and reduces streambank erosion. Rock cross vanes are placed at an angle to direct flow to the center of the stream over the cross vane, capture sediment, and create a scour pool downstream of the structure. They are used to direct flows toward the center of the channel which decreases stress on the stream banks and reduces bank erosion. The narrower flow path and decreased stress on stream banks is also beneficial for protecting bridges and maintaining streambed elevation.

Photo 4.12 Rock Vane in Completed Stream Restoration in Reston, Virginia

Source: Reston Association

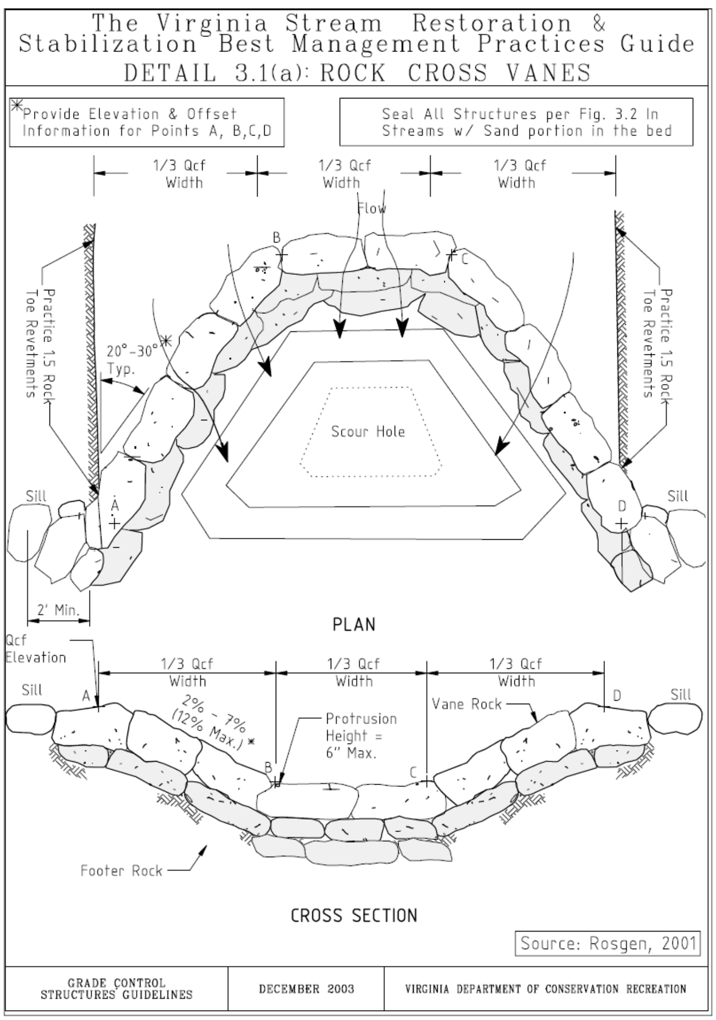

Figure 4.12 Detail Plan Rock Vane

Rock vanes also increase the flow depth downstream from the structure which enhances fish habitat.

Photo 4.12 shows a rock vane structure in a completed stream restoration in the Snakeden Watershed in Reston, Virginia. Figure 4.12 shows a detailed sketch for a typical rock vane.

Boulder Revetments/Boulder Toe

Boulder revetments, also called boulder toe, consists of placing a boulder or boulders in the toe of a streambank to provide rigid toe protection. The "toe" lies at the bottom of the slope and supports the weight of the streambank. Rigid toe protection is used where the lower streambank and toe are subject to erosion and require permanent protection. They can be placed at near vertical slopes, and are a good option for areas that have limited horizontal space. Boulder revetments protect stream banks from heavy flows and prevent erosion at the base of the streambank.

Photo 4.13 Boulder Revetment
Source: Center for Watershed Protection

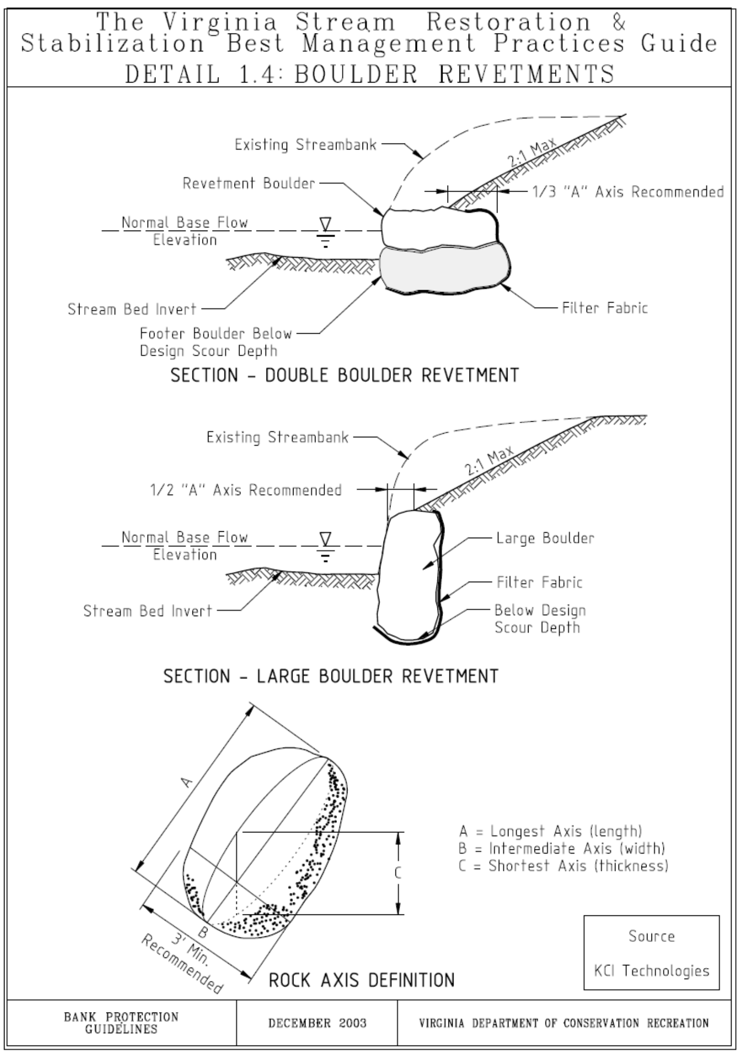

Figure 4.13 Detail Plan Boulder Revetment

Photo 4.13 shows a boulder revetment in a completed stream restoration. Figure 4.13 shows a detailed sketch for a typical boulder revetment.

Non-Structural

Riparian Buffer Restoration

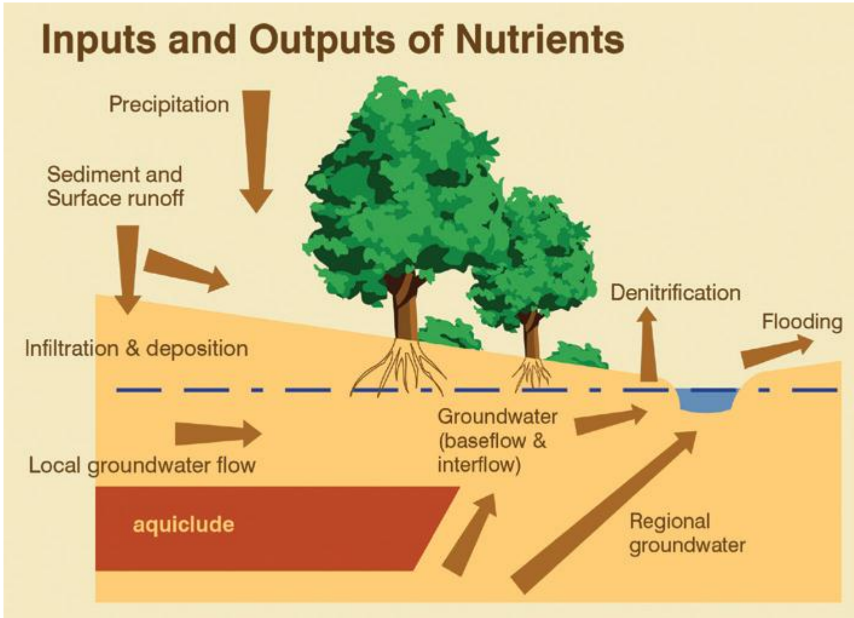

Figure 4.14 Riparian Buffer Nutrient Inputs and Outputs
Source: Virginia Department of Forestry

A riparian buffer is the area adjacent to streams, lakes, ponds and wetlands. This area is extremely important to the health of a water body, as it intercepts, slows, and filters stormwater before it reaches the water. A wooded riparian buffer with a shrub and herbaceous layer is the most effective riparian buffer, while the least effective riparian buffer consists of mowed grass or no vegetation. The wider a riparian buffer is, the better it is for the health of a stream.

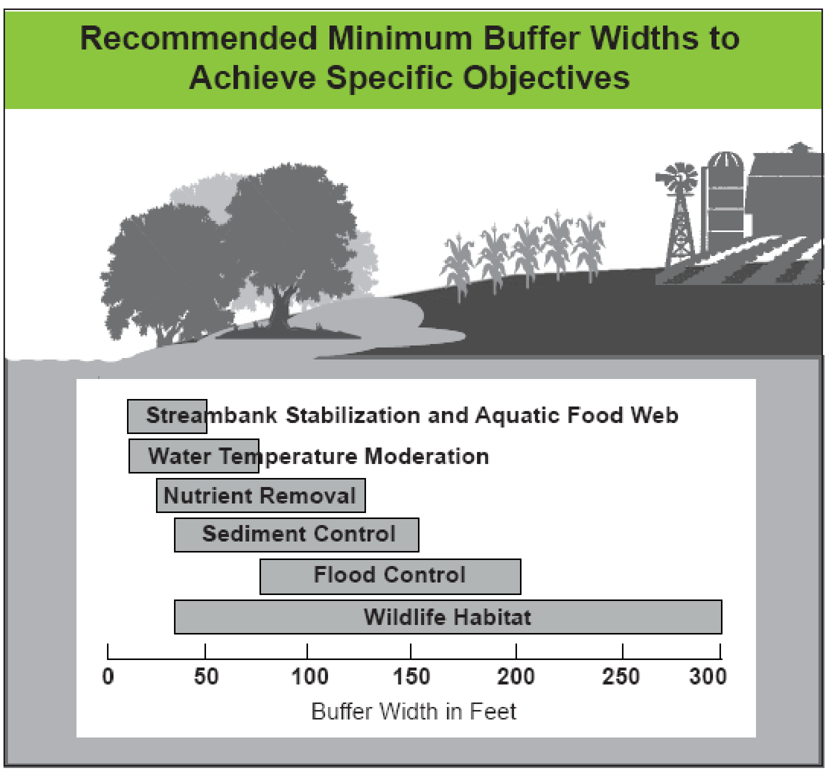

Figure 4.15 Buffer Widths and Objectives
Source: Virginia Department of Forestry

Riparian buffer restoration consists of removing invasive species and/or undesirable vegetation and replanting with native trees, shrubs, and herbaceous species. Among the benefits of these buffers is improved water quality, reduced soil erosion and stormwater runoff and improved wildlife habitat.

Figure 4.14 illustrates the inputs and outputs of nutrients in a riparian buffer.

Figure 4.15 describes the recommended minimum buffer widths to achieve specific objectives.

Targeted Rain Barrel Program

Rain barrels are tanks/containers that collect and store stormwater runoff from a roof by connecting to rain gutters/downspouts. The purpose of a rain barrel is to slow down and capture stormwater runoff to reduce stormwater runoff volumes and peak rates and to decrease flooding and erosion. Utilizing the rainwater for irrigation improves water quality by filtration through the soil and increases groundwater recharge. Utilizing rainwater also reduces the need to use well water or municipal water.

Photo 4.14 shows a typical rain barrel that can be assembled at home or bought from a retail center.

Photo 4.14 Typical Rain Barrel
Source: Northern Virginia Soil and Water Conservation District, Fairfax County, VA

4.5 Overall List of Projects

Map 4.1 shows all structural and non-structural project locations throughout Sugarland Run and Horsepen Creek watersheds as they are distributed within the Dranesville, Hunter Mill and Sully supervisor districts.

Table 4.3 is the Master Project List, which contains all projects, organized by implementation plan and project number. The 10-year implementation projects have associated project fact sheets that are located in Section 5.

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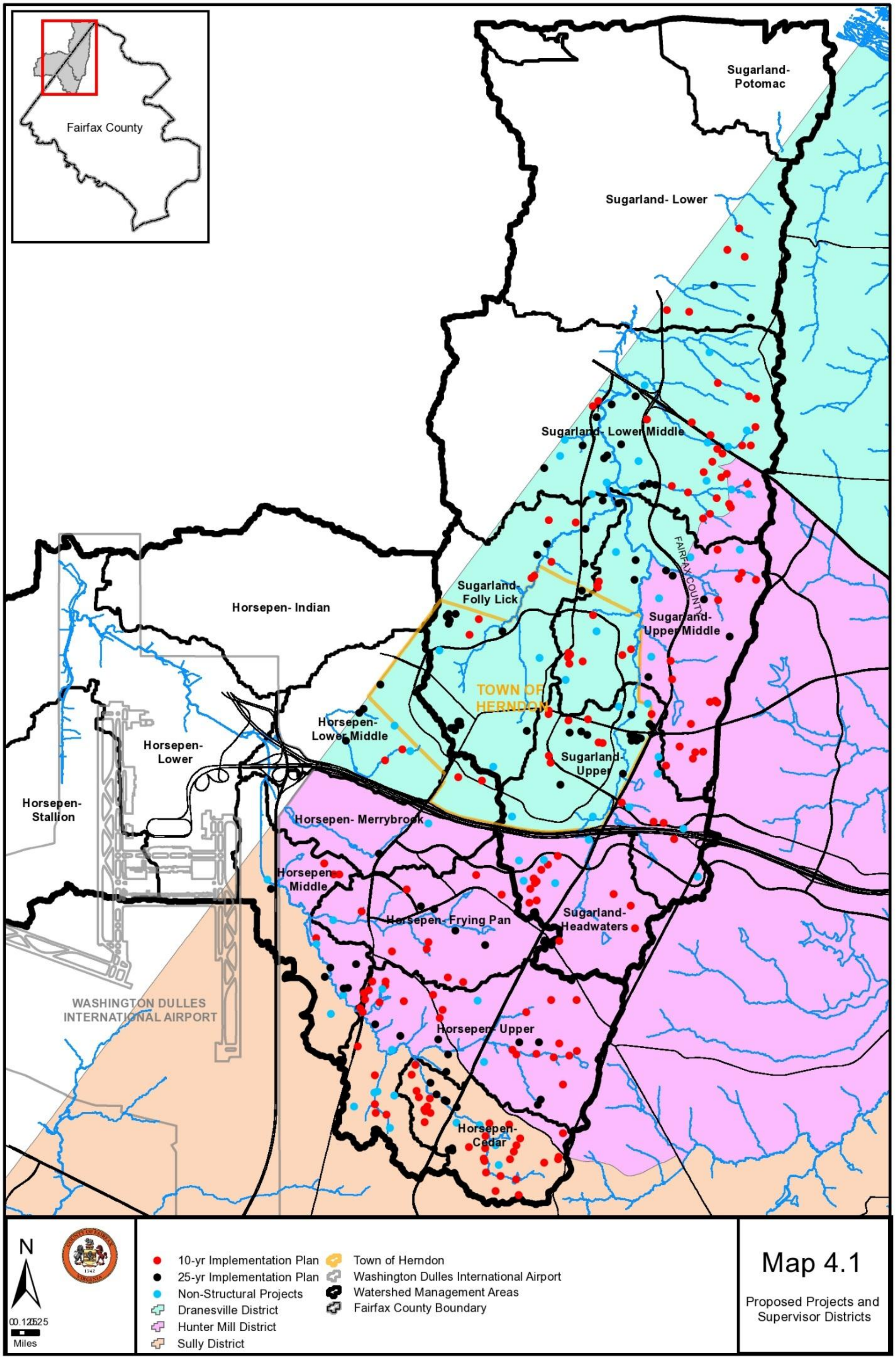

Map 4.1

Proposed Projects and Supervisor Districts

Table 4.3 Master Project List						
Priority Structural Projects (10 Year Implementation Plan)						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
HC9007	Regional Pond Alternative Suite	Horsepen - Cedar	Between Ladybank Lane & Mother Well Court	Quality/ Quantity	Park/Private	$790,000
HC9013	Regional Pond Alternative Suite	Horsepen - Cedar	Between Franklin Farm Rd, West Ox Rd & Ashburton Ave	Quality/ Quantity	County/Private	$1,970,000
HC9102	New Stormwater Pond	Horsepen - Middle	Legacy Circle & Sunrise Valley Drive	Quality/ Quantity	Private	$150,000
HC9106	Stormwater Pond Retrofit	Horsepen - Frying Pan	Frying Pan Road & Centreville Road	Quality/ Quantity	State/County/ Private	$310,000
HC9107	New Stormwater Pond	Horsepen - Merrybrook	Palmer Drive & Dogwood Court	Quality/ Quantity	Local	$210,000
HC9108	Stormwater Pond Retrofit	Horsepen - Middle	Near Copper Creek Road & Copper Creek Court	Quantity/ Quality	County/Park	$190,000
HC9109	Stormwater Pond Retrofit	Horsepen - Frying Pan	Between Coppermine Rd, Thomas Jefferson Dr & Masons Ferry Dr	Quality/ Quantity	Private	$400,000
HC9110	New Stormwater Pond	Horsepen - Merrybrook	Herndon Parkway & Campbell Way	Quality/ Quantity	Private	$160,000
HC9114	Stormwater Pond Retrofit	Horsepen - Frying Pan	Fox Mill Road & Cabin Creek Road	Quality/ Quantity	Private	$340,000
HC9116	New Stormwater Pond	Horsepen - Frying Pan	Near Halterbreak Court & Curved Iron Road culs-de sac	Quality	Park	$220,000
HC9118	Stormwater Pond Retrofit	Horsepen - Upper	Between Floris Lane & Merricourt Lane culs-de-sac	Quality/ Quantity	Private	$120,000
HC9119	Stormwater Pond Retrofit	Horsepen - Frying Pan	Colts Brook Drive & Fox Mill Road	Quality/ Quantity	County	$450,000
HC9121	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	Centreville Road & Lake Shore Drive	Quality/ Quantity	State/Park/ Private	$590,000
HC9122	Stormwater Pond Retrofit	Horsepen - Upper	Lake Shore Drive & Running Pump Lane	Quality/ Quantity	Private	$70,000
HC9123	Stormwater Pond Retrofit	Horsepen - Upper	Near Point Rider Lane & Equus Court	Quality/ Quantity	County	$150,000
HC9126	Stormwater Pond Retrofit	Horsepen - Upper	Monterey Estates Drive & West Ox Road	Quality/ Quantity	County	$180,000

Table 4.3 Master Project List						
Priority Structural Projects (10 Year Implementation Plan)						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
HC9127	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Medow Hall Drive & New Carson Drive	Quality/ Quantity	County/Private	$180,000
HC9128	Stormwater Pond Retrofit	Horsepen - Upper	Korean Orthodox Presbyterian Church, McLearen Road & Centreville Road	Quality/ Quantity	Private	$430,000
HC9129	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	West Ox Road & New Parkland Drive	Quality/ Quantity	County/State	$490,000
HC9132	Stormwater Pond Retrofit	Horsepen - Upper	Highland Mews Subdivision, Hutumn Court & Highland Mews Court	Quality/ Quantity	Private	$210,000
HC9133	Stormwater Pond Retrofit, BMP/LID, Stream Restoration	Horsepen - Cedar	Near Glen Taylor Lane & Mother Well Court	Quantity/ Quality	Park/Private	$310,000
HC9134	Stormwater Pond Retrofit, BMP/LID	Horsepen - Upper	Kinross Circle & Scotsmore Way	Quality/ Quantity	Private	$310,000
HC9136	Stormwater Pond Retrofit	Horsepen - Upper	Near Viking Drive & Pinecrest Road	Quality/ Quantity	Private	$150,000
HC9137	Stream Restoration, New Stormwater Pond	Horsepen - Upper	Between Tewksbury Drive & Kettering Drive	Quality	Private	$430,000
HC9140	Stormwater Pond Retrofit	Horsepen - Upper	Huntington Drive cul-de-sac	Quality/ Quantity	Private	$370,000
HC9142	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Upper	Quincy Adams Drive & Quincy Adams Court	Quality/ Quantity	Private	$220,000
HC9143	Stormwater Pond Retrofit	Horsepen - Cedar	Off of Ashburton Avenue, near Thistlethorn Drive & Saffron Drive	Quantity/ Quality	County	$310,000
HC9149	New Stormwater Pond	Horsepen - Upper	Chasbarb Terrace & Chasbarb Court	Quality	Private	$270,000
HC9200	Culvert Retrofit, Stream Restoration	Horsepen - Lower Middle	Near Parcher Avenue & Monaghan Drive, next to the Reflection Lake pool	Quality	Private	$1,070,000
HC9201	Stream Restoration	Horsepen - Upper	Between Claxton Drive & Conquest Place culs-de-sac	Quality	Private	$230,000

Table 4.3 Master Project List						
Priority Structural Projects (10 Year Implementation Plan)						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
HC9202	Stream Restoration	Horsepen - Upper	Between Quincy Adams Court, Viking Court & Prince Harold Court culs-de-sac	Quality	Private	$950,000
HC9500	BMP/LID	Horsepen - Middle	Wellesley Subdivision, Stratford Glen Place	Quality	Private	$250,000
HC9503	BMP/LID	Horsepen - Frying Pan	Frying Pan Park/Kidwell Farm	Quality	Park	$90,000
SU9002	Regional Pond Alternative Suite	Sugarland - Upper Middle	Near Wheile Ave, between Pellow Circle Terrace & Reston Ave	Quality/ Quantity	County/Private	$860,000
SU9005	Regional Pond Alternative Suite	Sugarland - Lower Middle	Near Leesburg Pike, between Rolling Holly Drive & Sugarland Road	Quality	County/ Private	$780,000
SU9007	Regional Pond Alternative Suite	Sugarland - Lower Middle	Between Leesburg Pike, Fairfax County Parkway & Wiehle Avenue	Quality/ Quantity	State/County/ Park/Private	$1,010,000
SU9100	Stormwater Pond Retrofit	Sugarland - Lower	Jackson Tavern Way cul-de-sac	Quality/ Quantity	County	$170,000
SU9101	Stormwater Pond Retrofit	Sugarland - Lower	Near Great Falls Way & Jackson Tavern Way	Quality/ Quantity	County/Private	$390,000
SU9103	Stormwater Pond Retrofit	Sugarland - Lower	Thomas Run Drive	Quality/ Quantity	County/Private	$210,000
SU9106	Stormwater Pond Retrofit, BMP/LID	Sugarland - Lower Middle	Near Tralee Drive & Old Holly Drive	Quality/ Quantity	Private	$400,000
SU9108	Stormwater Pond Retrofit	Sugarland - Lower Middle	Dranesville Road & Woodson Drive	Quality/ Quantity	Private	$210,000
SU9110	Stormwater Pond Retrofit	Sugarland - Lower Middle	Methven Court cul-de-sac	Quality/ Quantity	County	$130,000
SU9117	Stormwater Pond Retrofit	Sugarland - Folly Lick	Dranesville Road & Hiddenbrook Drive	Quality/ Quantity	County/Private	$500,000
SU9123	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near Philmont Drive & Judd Court	Quality/ Quantity	Private	$310,000
SU9129	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Quail Ridge Court cul-de-sac	Quality	Private	$190,000

Table 4.3 Master Project List						
Priority Structural Projects (10 Year Implementation Plan)						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
SU9130	New Stormwater Pond	Sugarland - Upper Middle	Near Jenny Ann Court cul-de-sac	Quality/ Quantity	Private	$150,000
SU9135	Stormwater Pond Retrofit, BMP/LID	Sugarland - Upper Middle	Trinity Presbyterian Church	Quality/ Quantity	Private	$320,000
SU9136	New Stormwater Pond	Sugarland - Upper Middle	Near Queens Row Street & Herndon Parkway	Quality/ Quantity	Private	$110,000
SU9139	Stormwater Pond Retrofit	Sugarland - Upper	Towns at Stuart Pointe Subdivision, Stuart Pointe Lane	Quality/ Quantity	County	$70,000
SU9143	Stormwater Pond Retrofit	Sugarland - Upper	Near Grove Street & Herndon Parkway	Quality/ Quantity	Private	$140,000
SU9144	New Stormwater Pond, BMP/LID	Sugarland - Upper Middle	Bowman Towne Drive & Fountain Drive	Quality/ Quantity	Park/Private	$200,000
SU9146	Stormwater Pond Retrofit, New Stormwater Pond	Sugarland - Upper	Next to St. Timothy's Episcopal Church, Spring Street	Quality/ Quantity	County/Private	$130,000
SU9147	Stormwater Pond Retrofit	Sugarland - Upper	Near Edmund Halley Drive & Sunrise Valley Drive	Quality/ Quantity	Private	$140,000
SU9149	New Stormwater Pond, Stream Restoration, Stormwater Pond Retrofit	Sugarland - Headwaters	Polo Fields Subdivision	Quality/ Quantity	Private	$1,930,000
SU9150	New Stormwater Pond	Sugarland - Headwaters	Near Nutmeg Lane cul-de-sac	Quality/ Quantity	Private	$250,000
SU9201	New Stormwater Pond, Stream Restoration	Sugarland - Folly Lick	Folly Lick stream corridor between Fantasia Drive & Monroe Street	Quality/ Quantity	Park/Private	$910,000
SU9203	Stream Restoration	Sugarland - Upper Middle	Hunters Creek HOA and Runnymede Park	Quality/ Quantity	Local/Private	$290,000
SU9204	Stream Restoration	Sugarland - Folly Lick	Herndon Centennial Park golf course	Quality/ Quantity	Local	$1,880,000
SU9205	Stream Restoration	Sugarland - Upper Middle	Fairfax County Parkway & Walnut Branch Road	Quality/ Quantity	State/Private	$810,000
SU9208	Stream Restoration	Sugarland - Headwaters	Near Sanibel Drive & Tigers Eye Court culs-de-sac	Quality	Private	$1,170,000
SU9209	Stream Restoration	Sugarland - Headwaters	Pinecrest Road & Glade Drive	Quality	State/Private	$290,000
SU9210	Stream Restoration	Sugarland - Headwaters	Fox Mill Road & Keele Drive	Quality	Private	$80,000

Table 4.3 Master Project List						
Priority Structural Projects (10 Year Implementation Plan)						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
SU9500	BMP/LID	Sugarland - Upper Middle	Herndon High School	Quality	County	$850,000
SU9502	BMP/LID	Sugarland - Upper Middle	Herndon Elementary School	Quality/ Quantity	County	$580,000
SU9504	BMP/LID	Sugarland - Upper Middle	Reston North Park	Quality/ Quantity	Park	$130,000
SU9505	BMP/LID	Sugarland - Upper	Near Elden Street & Van Buren Street	Quality/ Quantity	Private	$380,000
SU9509	BMP/LID	Sugarland - Upper Middle	Trader Joe's	Quality	County/Private	$330,000
SU9512	BMP/LID	Sugarland - Upper Middle	Reston Hospital	Quality	Private	$200,000
SU9514	BMP/LID	Sugarland - Upper	Sunset Hills Road & Fairfax County Parkway	Quality	State/Private	$290,000
SU9515	BMP/LID	Sugarland - Upper	Sunset Hills Road & Town Center Parkway	Quality	Private	$200,000
					Total Cost:	***$29,560,000***

Table 4.3 Master Project List					
Long-term Structural Projects (25 Year Implementation Plan)					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
HC9100	Stormwater Pond Retrofit	Horsepen - Lower Middle	Rock Hill Road & Turquoise Lane	Quantity/ Quality	Private
HC9101	Stormwater Pond Retrofit	Horsepen - Lower Middle	Near Spring Knoll Drive & Summerset Place	Quantity/ Quality	Private
HC9103	Stormwater Pond Retrofit	Horsepen - Middle	Dulles Int'l Airport, near Sully Rd & electric substation	Quantity/ Quality	Federal
HC9104	New Stormwater Pond	Horsepen - Merrybrook	Centreville Road & McNair Farms Drive	Quality	Private
HC9111	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Frying Pan Road & Coppermine Road	Quantity/ Quality	County/Park
HC9113	Stormwater Pond Retrofit	Horsepen - Middle	Towerview Road cul-de-sac	Quantity/ Quality	Private
HC9115	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Middle	Near Mustang Drive & Maverick Lane	Quantity/ Quality	County/Private
HC9117	Stormwater Pond Retrofit	Horsepen - Frying Pan	Monroe Manor Drive cul-de-sac	Quantity/ Quality	County
HC9124	Stormwater Pond Retrofit	Horsepen - Frying Pan	Near Locksley Court cul-de-sac	Quantity/ Quality	County

Table 4.3 Master Project List					
Long-term Structural Projects (25 Year Implementation Plan)					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
HC9125	New Stormwater Pond	Horsepen - Upper	Near Spring Chapel Court cul-de-sac	Quality	Park
HC9130	Stormwater Pond Retrofit	Horsepen - Upper	Middleton Farm Subdivision, between Middleton Farm Lane & Blue Holly Lane culs-de-sac	Quality/ Quantity	Park
HC9131	Stormwater Pond Retrofit, Culvert Retrofit	Horsepen - Upper	Near West Ox Road & McLearen Road	Quantity/ Quality	County/Private
HC9135	Stormwater Pond Retrofit	Horsepen - Cedar	Near Emerald Chase Drive & Rover Glen Court	Quantity/ Quality	Private
HC9138	New Stormwater Pond	Horsepen - Cedar	Near Emerald Chase Drive & Ruby Lace Court	Quality	Park
HC9139	New Stormwater Pond	Horsepen - Upper	Near Bradwell Road & Litchfield Drive	Quality	County
HC9146	Stormwater Pond Retrofit, BMP/LID	Horsepen - Cedar	Near Ashburton Avenue & Wheeler Way	Quantity/ Quality	County/Private
HC9148	Stormwater Pond Retrofit, New Stormwater Pond	Horsepen - Upper	Near Glenbrooke Woods Drive cul-de-sac	Quality	Private
HC9302	Area-wide Drainage Improvement	Horsepen - Cedar	Burchlawn Street cul-de-sac	Quality	N/A
HC9400	Culvert Retrofit	Horsepen - Lower Middle	Near Rock Hill Road & Innovation Avenue	Quality	State/Private
HC9401	Culvert Retrofit	Horsepen - Lower Middle	Near Rock Hill Road & Innovation Avenue	Quantity	State
HC9501	BMP/LID	Horsepen - Middle	Along stream corridor between Floris Street & Mountainview Court	Quality	Private
HC9502	BMP/LID	Horsepen - Middle	Floris Elementary School	Quality	Park
HC9505	BMP/LID	Horsepen - Upper	Near Emerald Chase Drive & Lazy Glen Court	Quality	County
SU9001	Regional Pond Alternative Suite	Sugarland - Lower Middle	Near Rowland Drive & Heather Way	Quality	Park/Private
SU9105	Stormwater Pond Retrofit	Sugarland - Lower	Air View Lane	Quantity/ Quality	Private
SU9107	Stormwater Pond Retrofit	Sugarland - Lower Middle	Near Leesburg Pike & Fairfax County Parkway	Quantity/ Quality	County
SU9111	Stormwater Pond Retrofit	Sugarland - Lower Middle	Dranesville Road & Woodson Drive	Quality	State/Park
SU9112	Stormwater Pond Retrofit	Sugarland - Lower Middle	East of Dranesville Road & Butter Churn Drive	Quantity/ Quality	Park
SU9115	Stormwater Pond Retrofit	Sugarland - Lower Middle	Hastings Hunt Section 6 and Jenkins Ridge Subdivisions	Quantity/ Quality	County/Private

Table 4.3 Master Project List					
Long-term Structural Projects (25 Year Implementation Plan)					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
SU9118	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near stream corridor in Dranesville Estate Section 1 and 2	Quantity/ Quality	County/Park
SU9120	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Eddyspark Drive & Kingsvale Circle	Quality/ Quantity	County/Private
SU9121	Stormwater Pond Retrofit, New Stormwater Pond	Sugarland - Folly Lick	East of Millikens Bend Road near Millbank Way & Westlodge Court	Quantity/ Quality	Park
SU9122	Stormwater Pond Retrofit	Sugarland - Folly Lick	Baptist Temple of Herndon	Quantity/ Quality	Private
SU9124	Stormwater Pond Retrofit	Sugarland - Upper Middle	Near Rosiers Branch Drive & Heather Down Drive	Quantity/ Quality	County
SU9127	Stormwater Pond Retrofit	Sugarland - Folly Lick	Herndon United Methodist Church	Quantity/ Quality	Private
SU9128	Stormwater Pond Retrofit	Sugarland - Upper Middle	Between the Fawn Ridge Lane culs-de-sac	Quantity/ Quality	County/Private
SU9133	New Stormwater Pond, BMP/LID	Sugarland - Folly Lick	Near Crestview Drive & Bond Street	Quantity/ Quality	Private
SU9137	New Stormwater Pond	Sugarland - Upper Middle	Walnut Branch Road & Purple Sage Court	Quantity/ Quality	Private
SU9140	New Stormwater Pond, Stormwater Pond Retrofit	Sugarland - Upper	Safeway; corner of Post Drive & Grove Street	Quantity/ Quality	Private
SU9141	Stormwater Pond Retrofit	Sugarland - Upper	Substation near Grove Street & Grant Street	Quality/ Quantity	Private
SU9142	Stormwater Pond Retrofit	Sugarland - Folly Lick	Near Spring Street & Wood Street	Quantity/ Quality	Private
SU9200	Stream Restoration	Sugarland - Lower Middle	Near Dranesville Road & Woodson Drive	Quality	State/Park/ Private
SU9202	Stream Restoration	Sugarland - Folly Lick	Near Herndon Parkway & Stevenson Court	Quality	Private
SU9206	Stream Restoration	Sugarland - Upper	Near Herndon Parkway & Tamarack Way	Quality	Private
SU9207	Stream Restoration	Sugarland - Upper	Near Fairfax County Parkway & New Dominion Parkway	Quality	Private
SU9400	Culvert Retrofit	Sugarland - Lower	Near Kentland Drive & Parrish Farm Lane	Quantity/ Quality	State/Private
SU9501	BMP/LID	Sugarland - Upper Middle	Lake Newport Road & North Point Drive	Quality	County/Private
SU9510	BMP/LID	Sugarland - Upper	Near Elden Street & Fairfax County Parkway	Quality	State/Private
SU9511	BMP/LID	Sugarland - Folly Lick	Dulles Park Court & Alabama Drive	Quality	Private
SU9513	BMP/LID	Sugarland - Upper	Near Old Dominion Avenue & Aspen Drive	Quality	Private

Table 4.3
Master Project List
Non-Structural Projects

Project #	Project Type	WMA	Location	Watershed Benefit	Land Owner
HC9901	Buffer Restoration, Rain Barrel Programs	Horsepen - Cedar	Near Ashburton Avenue & Thistlethorn Drive	Quality/ Quantity	Park/Private
HC9902	Buffer Restoration	Horsepen - Frying Pan	Stream corridors near Copper Bed Road & Copper Hill Road	Quality	County/Park
HC9903	Buffer Restoration, Rain Barrel Programs	Horsepen - Lower Middle	Reflection Lake HOA & Four Season HOA (Herndon)	Quality/ Quantity	Private
HC9904	Conservation Acquisition Project/ Land Conservation Coordination Project	Horsepen - Middle	Stream corridors near Sully Road & Park Center Road	Quality	Federal/County/ Park/Private
HC9905	Conservation Acquisition Project/ Land Conservation Coordination Project, Dumpsite/ Obstruction Removal, Buffer Restoration	Horsepen - Upper	Stream corridors near McLearen Road & Cobra Drive	Quality	County/Park/ Private
HC9906	Rain Barrel Programs	Horsepen - Upper	Chantilly Highlands	Quantity	Private
HC9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	Horsepen - Merrybrook	Centreville Road & Woodland Park Road	Quality	County/Private
SU9900	Rain Barrel Programs	Sugarland - Folly Lick	Westfield, Fortnightly Square, Haloyon of Herndon Sect 5, Van Vlecks, Ballou, Saubers, Herndon Station, Herndon Park Station, and Chandon Subdivisions	Quantity	Private
SU9901	Buffer Restoration	Sugarland - Lower Middle	Near Leesburg Pike & Rolling Holly Drive	Quality	State/Park/ Private
SU9902	Rain Barrel Programs	Sugarland - Lower Middle	Sugar Creek Sec. 1, Stuart Hills, Cedar Chase, Oak Creek Estates, Forest Heights Estates, Stoney Creek Woods, Hastings Hunt sec. 6, portion of Jenkins Ridge, Holly Knoll, and Crestbrook Subdivisions	Quantity	Private
SU9903	Conservation Acquisition Project/ Land Conservation Coordination Project	Sugarland - Lower Middle	Stream corridor near Leesburg Pike & Holly Knoll Drive	Quality	County/Private

Table 4.3 Master Project List					
Non-Structural Projects					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
SU9904	Community Outreach/ Public Education	Sugarland - Lower Middle	Near Heather Way cul-de-sac	N/A	Private
SU9905	Rain Barrel Programs	Sugarland - Upper	Crestview Sec. 1, Runnymede Manor, Stuart Woods, Reston Sec. 49, and Towns at Stuart Pointe Subdivisions	Quantity	Private
SU9906	Buffer Restoration	Sugarland - Upper	Near Fairfax County Parkway & Sunset Hills Road	Quality	County/Private
SU9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	Sugarland - Upper	Stream corridors near Herndon Parkway & Fairbrook Drive	Quality	Private
SU9908	Rain Barrel Programs	Sugarland - Upper Middle	Stuart Ridge, Shaker Woods, Shaker Grove, Kingstream, Hunters Creek, Potomac Fairways, Iron Ridge Sec. 2, Graymoor, Chestnut Grove, Old Drainsville Hunt Club, Jeneba Woods, Reston Sec. 49, and Sugar Land Heights Subdivisions	Quantity	Private
SU9909	Rain Barrel Programs	Sugarland - Headwaters	Polo Fields Subdivision	Quantity	Private
SU9910	Buffer Restoration	Sugarland - Headwaters	Fairfax County Parkway & Dulles Access Road	Quality	Private
SU9911	Conservation Acquisition Project/ Land Conservation Coordination Project	Sugarland - Headwaters	Sunrise Valley Wetland Park	Quality	Private

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5.0 WMA Area Restoration Strategies for Sugarland Run Watershed and Horsepen Creek Watershed

Section 5.0 provides descriptions of the restoration strategies proposed for the Sugarland Run and Horsepen Creek watersheds. Restoration strategies were chosen based on needs of each WMA.

A large portion of the Sugarland Run watershed is urbanized. The majority of open space is located along the stream corridors and along the northern edge of the watershed. The southern portion of the watershed contains mostly medium and high density residential and industrial land uses. The northern portion of the watershed contains mostly low density and estate residential land uses. The expected changes in land use within Fairfax County show decreases in lower density land uses and increases in urban land uses.

There are 157 existing stormwater facilities located in the Sugarland Run watershed within Fairfax County. Approximately 74 percent of the portion of Sugarland Run watershed within Fairfax County is not treated by an existing stormwater facility. This large area of the Sugarland Run watershed that lacks existing stormwater controls is significantly affecting flooding and water quality; therefore, there is a definite need for new stormwater projects in this area.

A large portion of the Horsepen Creek watershed is also urbanized. The majority of open space is located along stream corridors and along the western edge of the watershed. The eastern portion of the watershed contains mostly medium density residential land uses. The central portion of the watershed contains mostly high density residential and industrial uses. The western portion of the watershed, which is located in Loudoun County, contains a mixture of low and medium density residential, industrial and open space land uses. As with Sugarland Run, the expected changes in land use within Fairfax County show decreases in lower density land uses and increases in urban land uses.

There are 147 existing stormwater facilities located in the Horsepen Creek watershed within Fairfax County. Approximately 69 percent of the portion of Horsepen Creek watershed located within Fairfax County is not treated by an existing stormwater facility. This large area of the Horsepen Creek watershed that lacks existing stormwater controls indicates the need for new watershed management projects.

5.1 Sugarland Run Watershed WMAs

Each subsection of Section 5.1 includes a description of key WMA conditions, a description of proposed structural and non-structural 10-year projects in the WMA, a listing of 10-year and 25-year projects for the WMA, and a map showing the types and locations of all 10-year and 25-year projects within the WMA. Each WMA in the Sugarland Run watershed is described separately. Additional project details, benefits, and design considerations for the projects in the 10-year implementation plan are included on the project fact sheets located in Section 5.3.

5.1.1 Folly Lick WMA

Description of Key WMA Conditions

Approximately 78 percent of the Folly Lick WMA is urbanized. The expected changes in land use show an increase in higher density urban areas and decreases in lower density and rural areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Folly Lick WMA contains 22 existing stormwater facilities. Approximately 80 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Folly Lick WMA contributes approximately 16 percent of the total suspended solids, 17 percent of the total nitrogen, and 17 percent of the total phosphorus annual loads to the Sugarland Watershed.

Folly Lick WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Folly Lick WMA.

SU9117 Retrofit existing dry pond (0827DP) to extended detention dry basin and adjacent, existing dry ponds (0637DP and 0934DP) to a single enhanced extended detention dry basin with marsh areas. Remove trickle ditches, install forebay and install/retrofit outlet structure.

SU9123 Improve existing regional dry pond S-04 (1440DP) to enhanced extended detention dry basin with marsh areas. Remove concrete trickle ditch and retrofit outlet structure.

SU9201 The community around Fantasia Drive does not have existing stormwater controls and significant stream erosion is occurring downstream. Construct an extended detention dry pond, improve the outfall and repair stream erosion impacts.

SU9204 The streams in the golf course have been straightened and lack sufficient buffer. Create meander and add structures to channel to slow flow. Install riparian buffer planting as allowed by height restrictions. Stabilize right bank at lower extent of reach.

Folly Lick WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Folly Lick WMA.

SU9118 Existing dry ponds (0784DP, 0573DP and 0227DP) in Dranesville Estates Sections 1 and 2 provide minimal quantity-only stormwater treatment. Retrofit all to enhanced extended detention dry basins with marsh areas and remove concrete trickle ditches.

SU9121 Hiddenbrook subdivision does not have existing stormwater controls. Retrofit dry pond (0260DP) to enhanced extended detention dry basin, with proper outlet structure and wetland vegetation; remove concrete trickle ditch. Install a second, similar enhanced extended detention dry basin.

SU9122 Existing dry pond (0283DP) provides stormwater treatment for church along Dranesville Road. Improve pond efficiency by removing concrete trickle ditch, planting quality vegetation for improved nutrient uptake, and provide energy dissipation at outfall.

SU9127 The United Methodist Church has minimal existing stormwater treatment. Retrofit existing dry pond to enhanced extended detention dry basin with improved outlet structure, minor grading to eliminate short-circuit and marsh areas for improved water quality and quantity controls.

SU9133 The Tralee subdivision does not have existing stormwater treatment. Construct two new enhanced extended detention dry basins with marsh areas and three rain gardens/bioretention areas throughout the area to provide both water quality and water quantity controls.

SU9142 The high density residential development around Pride Avenue has limited existing stormwater controls. Retrofit existing dry pond to enhanced extended detention dry basin with improved outlet structure, quality vegetation, and removal of concrete trickle ditch.

SU9202 Daylight stream below Herndon Parkway and restore to natural channel with sufficient energy dissipation and restore riparian buffer between apartment buildings.

SU9511 This community does not have existing stormwater controls. Install seven rain gardens around existing storm sewer inlets and within existing swale.

Folly Lick WMA 25-Year Projects

The following non-structural project is designed to reduce stormwater flow volume and decrease peak flows in areas with no existing stormwater management and no opportunity for new structural stormwater controls.

SU9900 Targeted rain barrel program at Westfile, Chandon, Fortnightly Square, Haloyon of Herndon Section 5, Van Vlecks, Ballou, Saubers, Herndon Station, and Herndon Park Station subdivisions.

10-Year and 25-Year Project Information Tables for Folly Lick WMA

Table 5.1 lists all structural and non-structural projects proposed in the Folly Lick WMA. Project locations for all structural and non-structural projects are shown on Map 5.1.

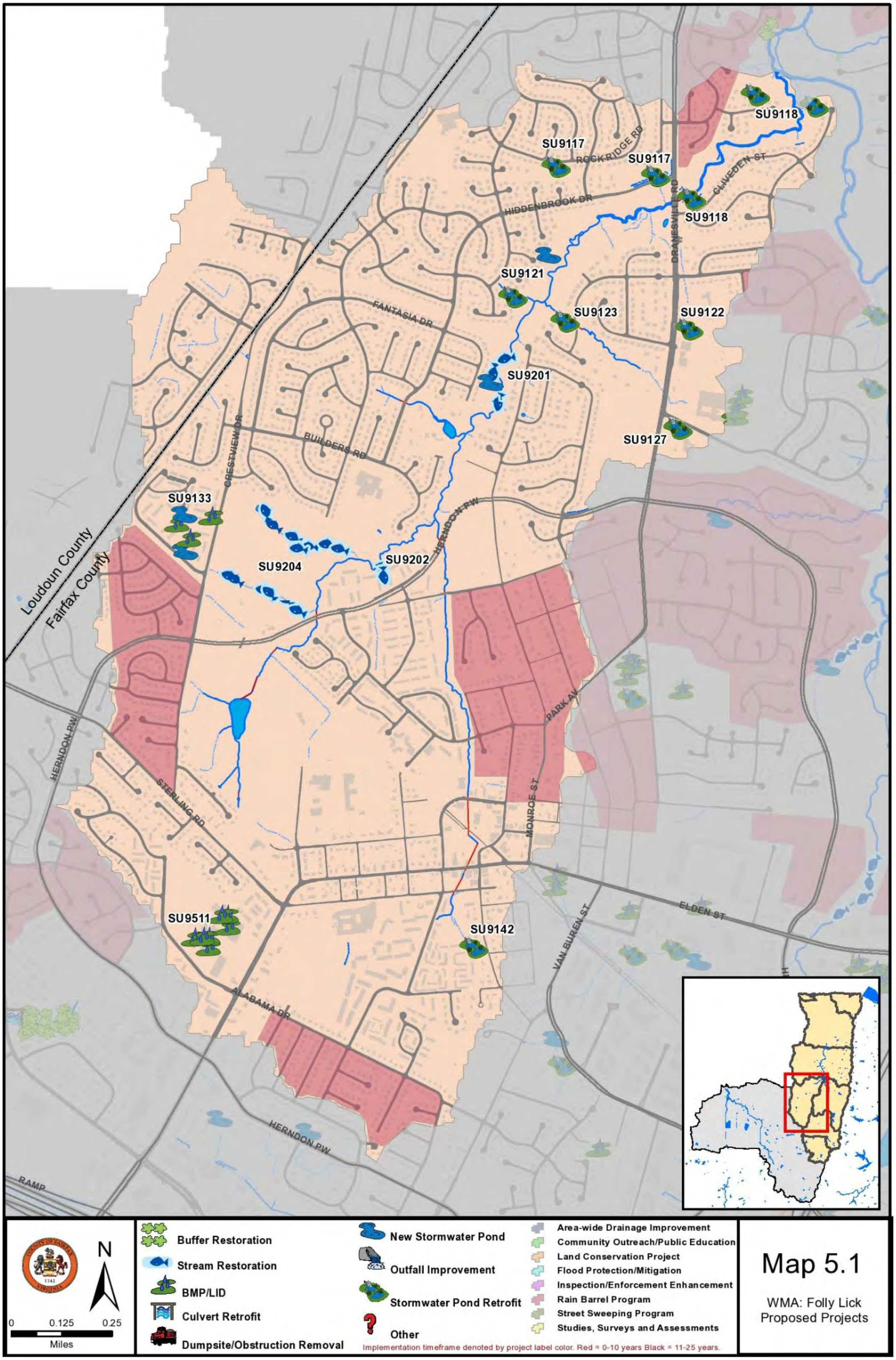
Table 5.1
Project List – Folly Lick WMA

Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
SU9117	Stormwater Pond Retrofit	SU-FL-0002	Dranesville Road & Hiddenbrook Drive	Quality/ Quantity	County/ Private	0 - 10
SU9123	Stormwater Pond Retrofit	SU-FL-0003	Near Philmont Drive & Judd Court	Quality/ Quantity	Private	0 - 10
SU9201	New Stormwater Pond, Stream Restoration	SU-FL-0004	Folly Lick stream corridor between Fantasia Drive & Monroe Street	Quality/ Quantity	Park/ Private	0 - 10
SU9204	Stream Restoration	SU-FL-0006	Herndon Centennial Park golf course	Quality/ Quantity	Local	0 - 10
SU9118	Stormwater Pond Retrofit	SU-FL-0001	Near stream corridor in Dranesville Estate Section 1 and 2	Quantity/ Quality	County/ Park	11 - 25
SU9121	Stormwater Pond Retrofit, New Stormwater Pond	SU-FL-0002	East of Millikens Bend Road near Millbank Way & Westlodge Court	Quantity/ Quality	Park	11 - 25
SU9122	Stormwater Pond Retrofit	SU-FL-0002	Baptist Temple of Herndon	Quantity/ Quality	Private	11 - 25
SU9127	Stormwater Pond Retrofit	SU-FL-0003	Herndon United Methodist Church	Quantity/ Quality	Private	11 - 25
SU9133	New Stormwater Pond, BMP/LID	SU-FL-0006	Near Crestview Drive & Bond Street	Quantity/ Quality	Private	11 - 25
SU9142	Stormwater Pond Retrofit	SU-FL-0009	Near Spring Street & Wood Street	Quantity/ Quality	Private	11 - 25
SU9202	Stream Restoration	SU-FL-0006	Near Herndon Parkway & Stevenson Court	Quality	Private	11 - 25
SU9511	BMP/LID	SU-FL-0007	Dulles Park Court & Alabama Drive	Quality	Private	11 - 25

Non-Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner
SU9900	Rain Barrel Programs	SU-FL-0002	Westfield, Fortnightly Square, Haloyon of Herndon Sect 5, Van Vlecks, Ballou, Saubers, Herndon Station, Herndon Park Station, and Chandon Subdivisions	Quantity	Private



Map 5.1

WMA: Folly Lick
Proposed Projects

5.1.2 Headwaters WMA

Description of Key WMA Conditions

Approximately 85 percent of the Headwaters WMA is urbanized. The expected changes in land use show an increase in medium density residential areas and decreases in low intensity commercial and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Headwaters WMA contains 17 existing stormwater facilities. Approximately 76 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Headwaters WMA contributes approximately nine percent of the total suspended solids, 10 percent of the total nitrogen, and 10 percent of the total phosphorus annual loads to the Sugarland Watershed.

Headwaters WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Headwaters WMA.

SU9149 Headwaters of Sugarland Run race through a network of concrete channels at high flows. Remove concrete channel and replace with a natural stream channel; include cross vanes for energy dissipation and stormwater controls at each incoming tributary.

SU9150 This area does not have existing stormwater controls. Install new extended detention dry basin behind apartments and school. Capture drainage from outfall and drainage channel.

SU9208 The stream channel is a steep concrete channel with no energy dissipation. Restore naturalized stream channel with step pool features, restore/repair two foot bridges, install energy dissipation to incoming storm drain and install educational signage.

SU9209 This stream is eroding below the outfall and also creating overland drainage channels due to lack of energy dissipating structures and vegetation. Repair head cuts, install check dams/energy dissipation, vegetate understory and remove invasive plants.

SU9210 The stream banks in this stream are eroding and the concrete channel provides no energy dissipation. Break up concrete channel and add rock for energy dissipation, re-plant riparian understory and educate homeowners about proper yard waste disposal.

Headwaters WMA 25-Year Projects

There are no 11-25 year projects proposed for Sugarland Headwaters WMA.

Headwaters WMA Non-Structural Projects

The following non-structural projects are designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Water quality and wildlife habitat will also be improved with project implementation.

SU9909 Targeted Rain Barrel Program at Polo Fields Home Owners Association.

SU9910 Naturalize existing County dry pond (DP0164) with native vegetation.

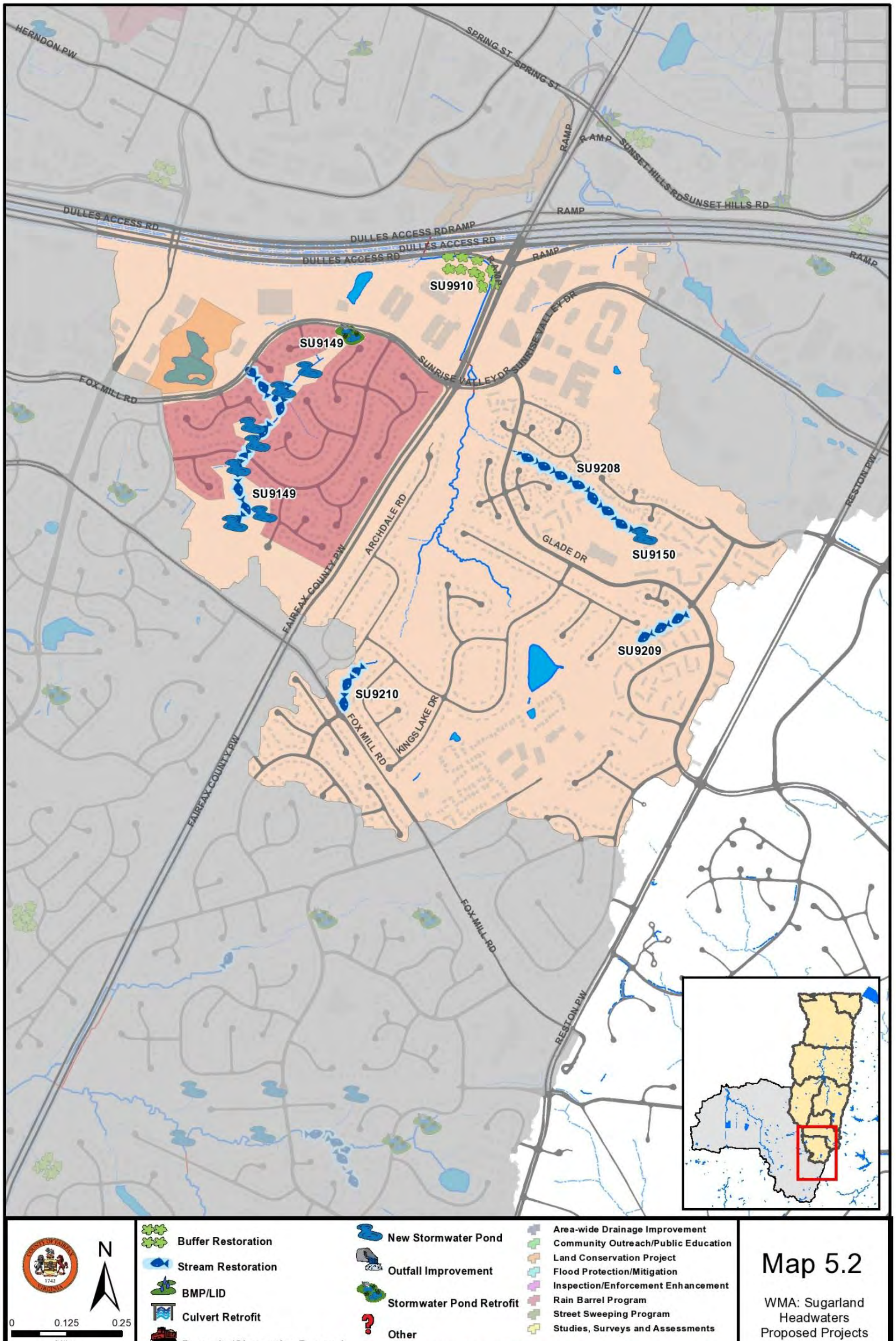
SU9911 Preserve Sunrise Valley Wetland Park as a natural wetland area and naturalize adjacent dry pond (No StormNet ID).

10-Year and 25-Year Project Information Tables for Headwaters WMA

Table 5.2 lists all structural and non-structural projects proposed in the Headwaters WMA. Project locations for all structural and non-structural projects are shown on Map 5.2.

Table 5.2
Project List – Headwaters WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
SU9149	New Stormwater Pond, Stream Restoration, Stormwater Pond Retrofit	SU-SU-0047	Polo Fields Subdivision	Quality/ Quantity	Private	0 - 10
SU9150	New Stormwater Pond	SU-SU-0049	Near Nutmeg Lane cul-de-sac	Quality/ Quantity	Private	0 - 10
SU9208	Stream Restoration	SU-SU-0049	Near Sanibel Drive & Tigers Eye Court culs-de-sac	Quality	Private	0 - 10
SU9209	Stream Restoration	SU-SU-0051	Pinecrest Road & Glade Drive	Quality	State/ Private	0 - 10
SU9210	Stream Restoration	SU-SU-0050	Fox Mill Road & Keele Drive	Quality	Private	0 - 10
Non-Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	
SU9909	Rain Barrel Programs	SU-SU-0047	Polo Fields Subdivision	Quantity	Private	
SU9910	Buffer Restoration	SU-SU-0048	Fairfax County Parkway & Dulles Access Road	Quality	Private	
SU9911	Conservation Acquisition Project/ Land Conservation Coordination Project	SU-SU-0047	Sunrise Valley Wetland Park	Quality	Private	



Map 5.2

WMA: Sugarland Headwaters Proposed Projects

5.1.3 Lower Middle Sugarland WMA

Description of Key WMA Conditions

Approximately 65 percent of the Lower Middle Sugarland WMA is urbanized. The expected changes in land use show increases in low and medium density residential and commercial areas and decreases in estate residential and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Lower Middle Sugarland WMA contains 37 existing stormwater facilities. Approximately 83 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Lower Middle Sugarland WMA contributes approximately 23 percent of the total suspended solids, 22 percent of the total nitrogen, and 23 percent of the total phosphorus annual loads to the Sugarland Watershed.

Lower Middle Sugarland WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Middle Sugarland WMA.

SU9005 Subbasins SU-SU-0026 and SU-SU-0027 have minimal stormwater controls. Install infiltration trench/vegetated swales, rain gardens, and include educational signage. Retrofit dry ponds (DP0562, 0570DP, and 1332DP) to enhanced extended detention dry basins and remove trickle ditches. Retrofit existing farm pond to a stormwater wet pond with vegetated pond edges and proper outlet structure.

SU9007 Subbasins SU-FF-0002, 0003 and 0004 have minimal stormwater controls. A combination of twelve basin retrofits, wetlands, culvert retrofits and a new basin will provide stormwater controls for nearly two-thirds of the subbasins' 457 acres.

SU9106 Retrofit existing dry ponds (1382DP and 1454DP) to extended detention dry basins for improved quality and quantity control. Remove trickle ditches, retrofit outlet structures, and naturalize. Install a rain garden around an existing inlet.

SU9108 Retrofit Bowl America dry pond to extended detention dry basin and Sugarland Hill dry pond (0570DP) to enhanced extended detention dry basin with marsh areas for improved quality and quantity controls. Install educational signage.

SU9110 Existing dry pond in Laing at Sugarland subdivision will be enlarged and retrofitted to extended detention basin to provide additional quantity and quality control. Remove concrete trickle ditch and install proper outlet structure.

Lower Middle Sugarland WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Middle Sugarland WMA.

SU9001 A portion of Shaker Woods subdivision does not have existing stormwater treatment. Install bioswales, remove riprap and allow existing drainage channels to naturalize, install stormwater facility at toe of slope to provide some water quality and quantity treatment.

SU9107 Existing dry pond (1034DP) treating Grand Hamptons II shows evidence of improper function and clogging of the outlet structure. Raise the low flow outlet structure and construct a micro-pool above the outlet to reduce clogging and improve pond function.

SU9111 Existing pond along Dranesville Road does not have a proper outlet structure. Improve pond to a properly functioning enhanced extended detention pond by installing a proper outlet structure, sediment forebay, and low marsh areas for improved quality and quantity control.

SU9112 Existing dry pond (0074DP) provides only water quantity control. Retrofit to enhanced extended detention dry basin and install stilling pond below outlet. Retrofit nearby existing farm pond to a stormwater wet pond with proper outlet structure and vegetated pond edges.

SU9115 Existing dry ponds (0828DP and 0308DP) in Hastings Hunt and Jenkins Ridge provide only water quantity control. Retrofit ponds to enhanced extended detention dry basins with proper outlet structures and wetland vegetation, and install educational signage.

SU9200 Repair eroded Sugarland Run streambanks upstream of Leesburg Pike (SPA reach SUSU1-2-E4) and reconnect stream with floodplain. Improve stream channel (re-grade banks) and outfall at incoming tributary (SPA ditch SUSU1-2-D9). Clear obstructions upstream.

Lower Middle Sugarland WMA Non-Structural Projects

The following non-structural projects are designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

SU9901 Restore riparian buffers in five locations: downstream of Stuart Hills Way crossing, northwest corner of Lessburg Pi and Holly Knoll Dr, along Leesburg Pike at the driving range, downstream across the street from the driving range, and south of Yellow Tavern Court in the Crestbrook Subdivision.

SU9902 Targeted rain barrel program at Sugar Creek Sec. 1, Stuart Hills, Cedar Chase, Oak Creek Estates, Forest Heights, Stoney Creek Woods, Hastings Hunt Sec. 9, a portion of Jenkins Ridge, Holly Knoll, and Crestbrook subdivisions.

SU9903 Obtain conservation easements to preserve riparian buffer and habitat along several headwater streams to Sugarland Run upstream of Holly Knoll Drive and the riparian buffer along a reach of Muddy Branch near the Fairfax County boundary.

SU9904 Educate homeowners near the Heather Way cul-de-sac on erosion control BMPs and yard waste as an improper control measure.

10-Year and 25-Year Project Information Tables for Lower Middle Sugarland WMA

Table 5.3 lists all structural and non-structural projects proposed in the Lower Middle Sugarland WMA. Project locations for all structural and non-structural projects are shown on Map 5.3.

Table 5.3
Project List – Lower Middle Sugarland WMA

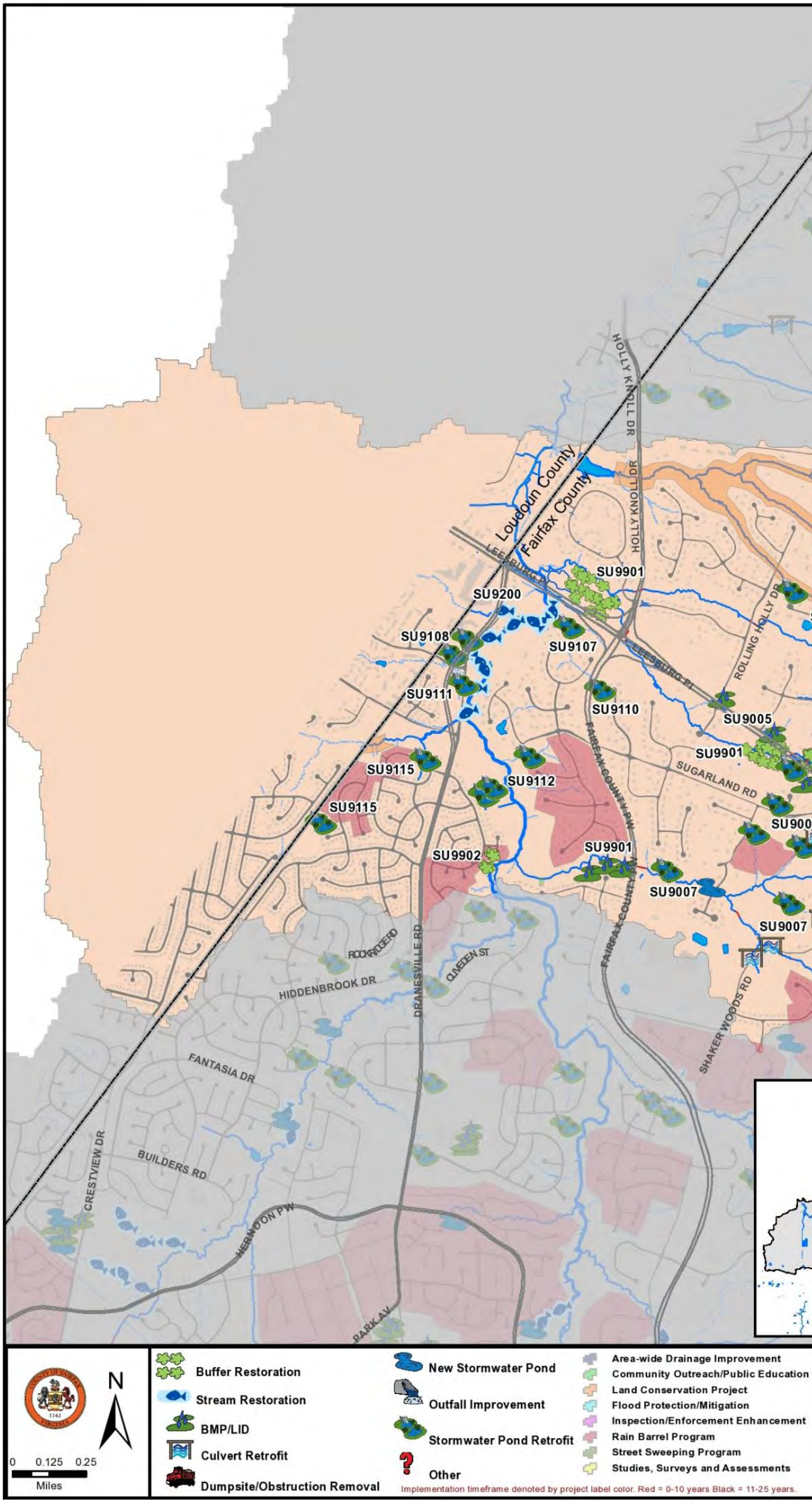
Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
SU9005	Regional Pond Alternative Suite	SU-SU-0026/27	Near Leesburg Pike, between Rolling Holly Drive & Sugarland Road	Quality	County/ Private	0 - 10
SU9007	Regional Pond Alternative Suite	SU-FF-0002/03/04	Between Leesburg Pike, Fairfax County Parkway & Wiehle Avenue	Quality/ Quantity	State/ County/ Park/ Private	0 - 10
SU9106	Stormwater Pond Retrofit, BMP/LID	SU-SU-0021	Near Tralee Drive & Old Holly Drive	Quality/ Quantity	Private	0 - 10
SU9108	Stormwater Pond Retrofit	SU-SU-0028	Dranesville Road & Woodson Drive	Quality/ Quantity	Private	0 - 10
SU9110	Stormwater Pond Retrofit	SU-SU-0028	Methven Court cul-de-sac	Quality/ Quantity	County	0 - 10
SU9001	Regional Pond Alternative Suite	SU-FF-0001	Near Rowland Drive & Heather Way	Quality	Park/ Private	11 - 25
SU9107	Stormwater Pond Retrofit	SU-SU-0028	Near Leesburg Pike & Fairfax County Parkway	Quantity/ Quality	County	11 - 25
SU9111	Stormwater Pond Retrofit	SU-SU-0029	Dranesville Road & Woodson Drive	Quality	State/Park	11 - 25
SU9112	Stormwater Pond Retrofit	SU-SU-0030	East of Dranesville Road & Butter Churn Drive	Quantity/ Quality	Park	11 - 25
SU9115	Stormwater Pond Retrofit	SU-MB-0001	Hastings Hunt Section 6 and Jenkins Ridge Subdivisions	Quantity/ Quality	County/ Private	11 - 25
SU9200	Stream Restoration	SU-SU-0028	Near Dranesville Road & Woodson Drive	Quality	State/ Park/ Private	11 - 25

Non-Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner
SU9901	Buffer Restoration	SU-FF-0001	Near Leesburg Pike & Rolling Holly Drive	Quality	State/ Park/ Private
SU9902	Rain Barrel Programs	SU-FF-0001	Sugar Creek Sec. 1, Stuart Hills, Cedar Chase, Oak Creek Estates, Forest Heights Estates, Stoney Creek Woods, Hastings Hunt sec. 6, portion of Jenkins Ridge, Holly Knoll, and Crestbrook Subdivisions	Quantity	Private

Table 5.3 Project List – Lower Middle Sugarland WMA					
Non-Structural Projects					
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**
SU9903	Conservation Acquisition Project/ Land Conservation Coordination Project	SU-FF-0001	Stream corridor near Leesburg Pike & Holly Knoll Drive	Quality	County/ Private
SU9904	Community Outreach/ Public Education	SU-FF-0001	Near Heather Way cul-de-sac	N/A	Private



Map 5.3

WMA: Sugarland Lower Middle Proposed Projects

5.1.4 Lower Sugarland WMA

Description of Key WMA Conditions

Only 18 percent of this WMA is located within Fairfax County, and contains mostly low density and estate residential land uses. Approximately 50 percent of the Lower Sugarland WMA is urbanized. The expected changes in land use show an increase in estate residential areas and a decrease in open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions. The Lower Sugarland WMA contains four existing stormwater facilities within Fairfax County.

Lower Sugarland WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Sugarland WMA.

SU9100 The Great Falls West basin provides only water quantity control. Retrofit existing dry pond (1445DP) to enhanced extended detention dry basin with marsh areas, including installation of proper outlet structure and clearing of blocked culvert pipe.

SU9101 The Great Falls West basins provide only water quantity control. Retrofit existing dry ponds (1447DP and 1446DP) to enhanced extended detention dry basin with marsh areas, remove trickle ditches, install proper outlet structures and increase spillway elevation.

SU9103 Kentland Farms and Thomas Avenue have few stormwater controls. Retrofit existing dry pond to an enhanced extended detention dry basin with marsh areas and micro-pool, remove trickle ditch. Drain near-by farm pond to create a new constructed wetland.

Lower Sugarland WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Sugarland WMA.

SU9105 A headwaters area around Seneca Ridge subdivision does not have existing stormwater controls. Retrofit existing farm pond to a stormwater wet pond with proper outlet structure and slightly lowered water level for additional capacity.

SU9400 Replace the culvert at Kentland Drive, construct aquatic bench and micro-pool upstream and stabilize streambank erosion above and below culvert.

Lower Sugarland WMA Non-Structural Projects

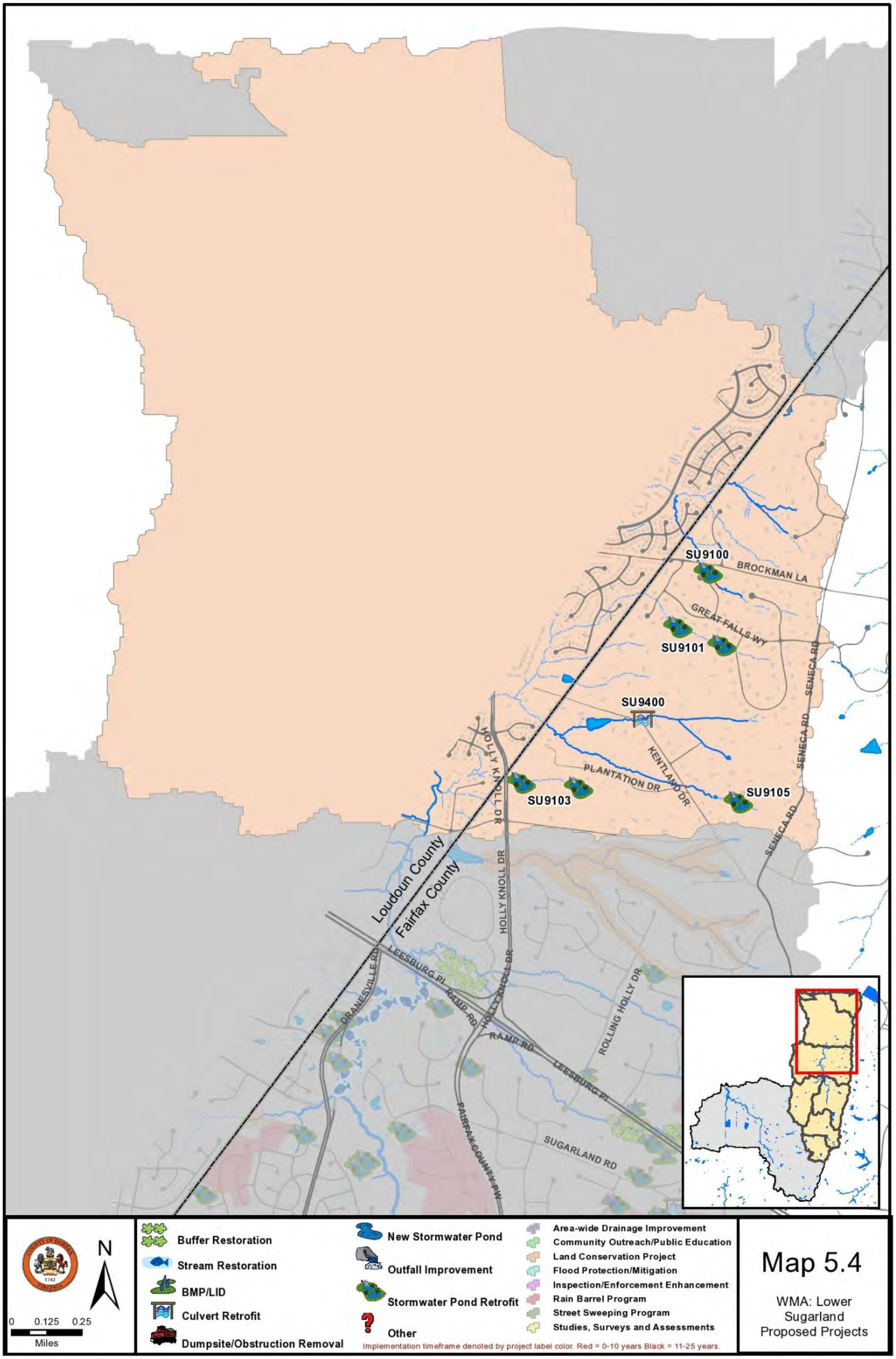
There are no non-structural projects proposed for Lower Sugarland WMA.

10-Year and 25-Year Project Information Tables for Lower Sugarland WMA

Table 5.4 lists all structural and non-structural projects proposed in the Lower Sugarland WMA. Project locations for all structural and non-structural projects are shown on Map 5.4.

Table 5.4
Project List – Lower Sugarland WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
SU9100	Stormwater Pond Retrofit	SU-SU-0008	Jackson Tavern Way cul-de-sac	Quality/ Quantity	County	0 - 10
SU9101	Stormwater Pond Retrofit	SU-SU-0012	Near Great Falls Way & Jackson Tavern Way	Quality/ Quantity	County/ Private	0 - 10
SU9103	Stormwater Pond Retrofit	SU-SU-0018	Thomas Run Drive	Quality/ Quantity	County/ Private	0 - 10
SU9105	Stormwater Pond Retrofit	SU-SU-0013	Air View Lane	Quantity/ Quality	Private	11 - 25
SU9400	Culvert Retrofit	SU-SU-0013	Near Kentland Drive & Parrish Farm Lane	Quantity/ Quality	State/ Private	11 - 25


SU9100
BROCKMAN LA
GREAT FALLS WY
SU9101
SENECA RD
SU9400
KENTLAND DR
PLANTATION DR
SU9105
SU9103
HOLLY KNOLL DR
Loudoun County
Fairfax County
DRANESVILLE RD
LEESBURG PI
RAMP RD
ROLLING HOLLY DR
FAIRFAX COUNTY PW
SUGARLAND RD
N
0 0.125 0.25
Miles
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
Map 5.4
WMA: Lower Sugarland Proposed Projects

5.1.5 Potomac WMA

Description of Key WMA Conditions
The portion of this WMA that is located within Fairfax County consists of only 70 acres and is comprised of mostly low density residential land use. Approximately 22 percent of the Potomac WMA is urbanized. The expected changes in land use show no changes to this WMA. Limiting new development will protect the watershed by conserving natural resources and limiting new pollution and stormwater runoff sources. The Potomac WMA contains one existing stormwater facility within Fairfax County.

Potomac WMA Projects
Because only 70 acres of the Potomac WMA are located in Fairfax County, there are no projects proposed in the Potomac WMA.

5.1.6 Upper Middle Sugarland WMA

Description of Key WMA Conditions
Approximately 82 percent of the Upper Middle Sugarland WMA is urbanized. The expected changes in land use show increases in higher density residential, industrial, and open space areas and decreases in lower density residential and institutional areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Upper Middle Sugarland WMA contains 38 existing stormwater facilities. Approximately 76 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Upper Middle Sugarland WMA contributes approximately 20 percent of the total suspended solids, 20 percent of the total nitrogen, and 20 percent of the total phosphorus annual loads to the Sugarland Watershed.

Upper Middle Sugarland 10-Year Projects
The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Middle Sugarland WMA.

SU9002 Improve existing dry pond (0337DP) to an enhanced extended detention dry basin with marsh area (SU9002C). Install new enhanced extended detention dry pond (SU9002A). Install new rain garden with educational signage (SU9002B). Repair eroded streambanks and culvert and install micro-pool (SU9002D). Larger projects are discussed below.

SU9129 The outlet structure for existing dry pond (0336DP) is frequently clogged, reducing the functionality of the pond. Install a micro-pool with wetland vegetation above outlet structure to reduce clogging. Vegetate the pond bottom and replace concrete channel upstream with vegetated swale with check dams for energy dissipation.

SU9130 Iron Ridge Section 2, Potomac Fairways, Van Vlecks, Chestnut Grove, and Graymor subdivisions do not have existing stormwater controls. Install new extended detention dry basin and install vegetated swale behind homes/along Herndon Parkway to direct runoff to new facility.

SU9135 Retrofit existing dry pond to enhanced extended detention dry basin with marsh areas to improve water quality and quantity treatment. Remove concrete trickle ditch, retrofit outlet structure. Install infiltration trenches in parking lot islands for additional quality control.

SU9136 Hunter's Creek and Hunter's Creek Section 2, Ashburn, The Villages, Runnymede Manor Chelmstord, Cassa Goettling, Sugar Land Heights, Yount, and Madison Forest subdivisions have no existing stormwater controls and the receiving stream is deteriorating due to high storm flows. Install a new extended detention dry basin just downstream of Runnymede Park on Hunter's Creek Pool property.

SU9144 Some of this area does not have existing stormwater treatment. Install three new extended detention dry basins. Daylight stormwater runoff from storm sewers into basin. Install rain garden around existing depressed inlet.

SU9203 Tributary to Sugarland Run is eroding. Remove multiflora rose obstruction below Hunter's Creek Pool parking lot and repair stream banks, including restoration of riparian buffer. Re-grade streambanks just above confluence, stabilize and install cross-vane to direct energy away from banks.

SU9205 A straightened stream channel increases the velocity of stormwater flows. Install step pools to account for increased slope of straightened stream, improve habitat with native riparian vegetation and add in-stream structures such as cross vanes.

SU9500 Herndon High School does not have existing stormwater controls. Install green roof on portion of roof if possible, install rain gardens in interior courtyards and direct roof leaders to them, and implement education programs.

SU9502 Herndon Elementary School does not have existing stormwater controls. Install green roof and initiate educational program.

SU9504 The Reston North Park does not have existing stormwater controls. Install new infiltration basin in upper baseball field, daylight storm sewers to basin, vegetate and naturalize existing swales, and install educational signage.

SU9509 Install a new rain garden in the central island of the Trader Joe's parking lot and investigate headcuts in the adjacent stream.

SU9512 The majority of Reston Hospital does not have existing stormwater controls. Install bioretention area along walking path with vegetated swales to direct parking lot drainage into bioretention. Install educational signage.

Upper Middle Sugarland 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Middle Sugarland WMA.

SU9120 Existing dry ponds (0434DP and 0845DP) provide only water quantity control. Retrofit both to enhanced extended detention dry basins with marsh areas, remove the trickle ditches, and install proper outlet structures.

SU9124 Two existing dry ponds provide limited stormwater controls for Union Mill (1032DP) and North Point Glen subdivisions. Retrofit ponds to enhanced extended detention dry basins, remove concrete trickle ditch, repair embankment damage, and re-grade to prevent short circuiting.

SU9128 The majority of Reston Section 53 does not have existing stormwater treatment. Retrofit dry pond (0887DP) to enhanced extended detention dry basin with proper outlet structure, marsh areas and removal of concrete trickle ditch for improved water quality and quantity controls.

SU9137 A portion of Reston Section 49 does not have existing stormwater treatment. Construct new enhanced extended detention dry basin with marsh areas to provide both water quality and water quantity controls and install educational signage.

SU9501 Retrofit existing swale below Lake Newport Road to a vegetated swale to provide water quality treatment for portions of Summer Ridge and Reston Section 57.

Upper Middle Sugarland Non-Structural Projects

The following non-structural projects are designed to reduce stormwater flow volumes and decrease peak flows in areas with no existing stormwater management and no opportunity for new structural stormwater controls.

SU9908 Targeted rain barrel program at Stuart Ridge, Shaker Woods, Shaker Grove, Kingstream, Hunters Creek, Potomac Fairways, Iron Ridge Sec. 2, Graymoor, Chestnut Grove, Old Drainsville Hunt Club, Jeneba Woods, Reston Sec. 49, and Sugar Land Heights subdivisions.

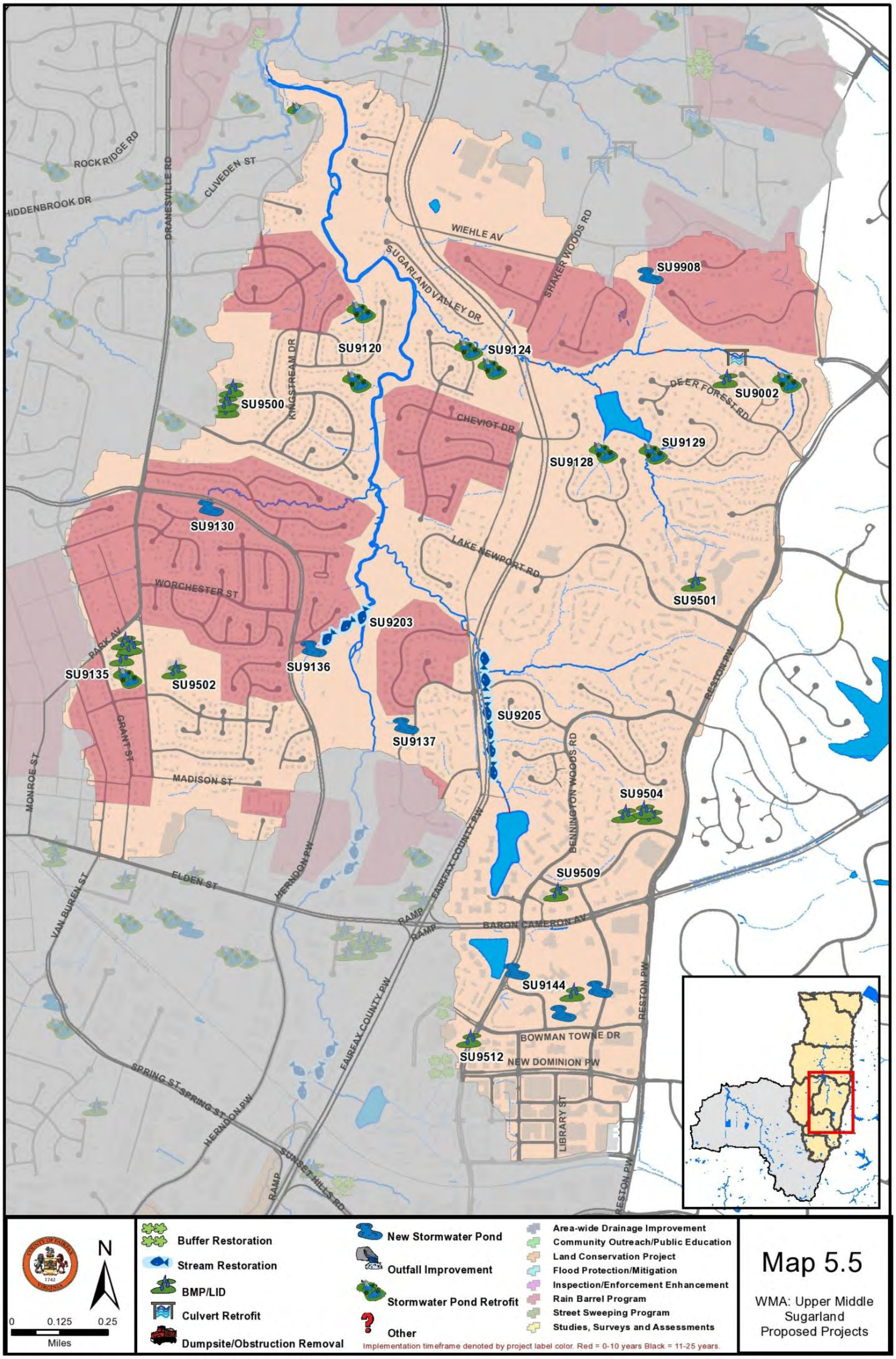
10-Year and 25-Year Project Information Tables for Upper Middle Sugarland WMA

Table 5.5 lists all structural and non-structural projects proposed in the Upper Middle Sugarland WMA. Project locations for all structural and non-structural projects are shown on Map 5.5.

Table 5.5
Project List – Upper Middle Sugarland WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
SU9002	Regional Pond Alternative Suite	SU-RI-0003	Near Wheile Ave, between Pellow Circle Terrace & Reston Ave	Quality/ Quantity	County/ Private	0 - 10
SU9129	Stormwater Pond Retrofit	SU-RI-0002	Near Quail Ridge Court cul-de-sac	Quality	Private	0 - 10

Table 5.5 Project List – Upper Middle Sugarland WMA						
Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
SU9130	New Stormwater Pond	SU-SU-0034	Near Jenny Ann Court cul-de-sac	Quality/ Quantity	Private	0 - 10
SU9135	Stormwater Pond Retrofit, BMP/LID	SU-SU-0039	Trinity Presbyterian Church	Quality/ Quantity	Private	0 - 10
SU9136	New Stormwater Pond	SU-SU-0039	Near Queens Row Street & Herndon Parkway	Quality/ Quantity	Private	0 - 10
SU9144	New Stormwater Pond, BMP/LID	SU-SU-0037	Bowman Towne Drive & Fountain Drive	Quality/ Quantity	Park/ Private	0 - 10
SU9203	Stream Restoration	SU-SU-0039	Hunters Creek HOA and Runnymede Park	Quality/ Quantity	Local/ Private	0 - 10
SU9205	Stream Restoration	SU-SU-0035	Fairfax County Parkway & Walnut Branch Road	Quality/ Quantity	State/ Private	0 - 10
SU9500	BMP/LID	SU-SU-0032	Herndon High School	Quality	County	0 - 10
SU9502	BMP/LID	SU-SU-0039	Herndon Elementary School	Quality/ Quantity	County	0 - 10
SU9504	BMP/LID	SU-SU-0035	Reston North Park	Quality/ Quantity	Park	0 - 10
SU9509	BMP/LID	SU-SU-0035	Trader Joe's	Quality	County/ Private	0 - 10
SU9512	BMP/LID	SU-SU-0037	Reston Hospital	Quality	Private	0 - 10
SU9120	Stormwater Pond Retrofit	SU-SU-0032	Near Eddyspark Drive & Kingsvale Circle	Quality/ Quantity	County/ Private	11 - 25
SU9124	Stormwater Pond Retrofit	SU-RI-0001	Near Rosiers Branch Drive & Heather Down Drive	Quantity/ Quality	County	11 - 25
SU9128	Stormwater Pond Retrofit	SU-RI-0002	Between the Fawn Ridge Lane culs-de-sac	Quantity/ Quality	County/ Private	11 - 25
SU9137	New Stormwater Pond	SU-SU-0038	Walnut Branch Road & Purple Sage Court	Quantity/ Quality	Private	11 - 25
SU9501	BMP/LID	SU-RI-0002	Lake Newport Road & North Point Drive	Quality	County/ Private	11 - 25
Non-Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	
SU9908	Rain Barrel Programs	SU-RI-0003	Stuart Ridge, Shaker Woods, Shaker Grove, Kingstream, Hunters Creek, Potomac Fairways, Iron Ridge Sec. 2, Graymoor, Chestnut Grove, Old Drainsville Hunt Club, Jeneba Woods, Reston Sec. 49, and Sugar Land Heights Subdivisions	Quantity	Private	



Map 5.5

WMA: Upper Middle Sugarland Proposed Projects

5.1.7 Upper Sugarland WMA

Description of Key WMA Conditions

Approximately 88 percent of the Upper Sugarland WMA is urbanized. The expected changes in land use show increases in high density residential, high intensity commercial and industrial areas and decreases in lower density residential, lower intensity commercial and rural areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Upper Sugarland WMA contains 38 existing stormwater facilities. Approximately 70 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Upper Sugarland WMA contributes approximately 15 percent of the total suspended solids, 17 percent of the total nitrogen, and 15 percent of the total phosphorus annual loads to the Sugarland Watershed.

Upper Sugarland WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Sugarland WMA.

SU9139 Retrofit Towns at Stuart Pointe dry pond (1456 DP) to enhanced extended detention with marsh areas. Remove concrete trickle ditch and install proper outlet structure.

SU9143 Retrofit two existing dry ponds along Grove Street to enhanced extended detention dry basins with marsh areas and appropriate outlet structures to improve pond efficiency and function.

SU9146 The residential and institutional area along Van Buren Street has inadequate existing stormwater control. Construct new extended detention dry pond and improve the existing dry pond by removing concrete trickle ditch and planting wetland vegetation.

SU9147 Retrofit existing dry pond (DP0372) to enhanced extended detention basin with marsh areas, and proper outlet structure; daylight inlet pipes and remove concrete trickle ditch to improve pond efficiency and provide improved treatment for professional building complex.

SU9505 The commercial areas along Elden Street have no stormwater management controls and high impervious coverage and pollutant runoff. Install rain gardens, infiltration trenches and vegetated swales within the already developed commercial area.

SU9514 The existing concrete channel along Sunset Hills Road provides no stream habitat or stormwater treatment. Remove trapezoidal ditch and replace with natural stream channel with cross-vanes to dissipate energy. Construct new pocket wetland at upstream end of channel.

Upper Sugarland WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Sugarland WMA.

SU9140 The commercial development along Grove Street has minimal existing stormwater treatment. Retrofit existing dry pond at shopping center to enhanced extended detention dry basin and raise outlet structure. Construct new enhanced extended detention dry basin in existing depression.

SU9141 This area does not have existing stormwater treatment. Improve dry pond (no StormNet ID) to extended detention basin. Raise and retrofit outlet structure and naturalize with native plantings.

SU9206 Comprehensive stream restoration of Sugarland Run behind high density residential buildings around Tamarack Way. Repair pedestrian bridges, streambank erosion and headcuts in drainage channels, educate homeowners to stop mowing to banks and apply LID concepts to parking lot.

SU9207 Repair and stabilize eroded Sugarland Run streambanks below Spring Street, install in stream structures to direct flows away from banks and restore riparian buffers.

SU9510 The commercial development near Elden and Fairfax County PW does not have existing treatment. Install green roofs on three commercial buildings, rain gardens at Cardinal Bank and in parking lot islands and court yard, retrofit existing swale along Fairfax County PW to vegetated swale and disconnect roof drains to landscaped areas.

SU9513 Portions of the Downs subdivision are in need of additional water quality controls. Retrofit existing swales to vegetated swales with check dams for improved water quality and energy dissipation and install a new rain garden at existing storm drain.

Upper Sugarland WMA Non-Structural Projects

The following non-structural projects are designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

SU9905 Targeted rain barrel program at Crestview Sec. 1, Runnymede Manor, Stuart Woods, Reston Sec 49, and Towns at Stuart Pointe subdivisions.

SU9906 Vegetate several existing County dry ponds throughout Sugarland Upper WMA DP0564, DP0421, DP0440, and DP0202. Vegetate the existing dry pond northwest of Van Buren St and Worldgate Dr and the existing swale northwest of Town Center PW and New Dominion PW.

SU9907 Obtain conservation easement and restore buffer at least 100-foot wide around the streams northwest of Fairfax County PW and Dulles Access Rd to provide nutrient and sediment removal and flood control for area slated for industrial development.

10-Year and 25-Year Project Information Tables for Upper Sugarland WMA

Table 5.6 lists all structural and non-structural projects proposed in the Upper Sugarland WMA. Project locations for all structural and non-structural projects are shown on Map 5.6.

Table 5.6
Project List – Upper Sugarland WMA

Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
SU9139	Stormwater Pond Retrofit	SU-SU-0040	Towns at Stuart Pointe Subdivision, Stuart Pointe Lane	Quality/ Quantity	County	0 - 10
SU9143	Stormwater Pond Retrofit	SU-SU-0041	Near Grove Street & Herndon Parkway	Quality/ Quantity	Private	0 - 10
SU9146	Stormwater Pond Retrofit, New Stormwater Pond	SU-SU-0041	Next to St. Timothy's Episcopal Church, Spring Street	Quality/ Quantity	County/ Private	0 - 10
SU9147	Stormwater Pond Retrofit	SU-SU-0046	Near Edmund Halley Drive & Sunrise Valley Drive	Quality/ Quantity	Private	0 - 10
SU9505	BMP/LID	SU-SU-0041	Near Elden Street & Van Buren Street	Quality/ Quantity	Private	0 - 10
SU9514	BMP/LID	SU-SU-0045	Sunset Hills Road & Fairfax County Parkway	Quality	State/ Private	0 - 10
SU9515	BMP/LID	SU-SU-0045	Sunset Hills Road & Town Center Parkway	Quantity	Private	0 - 10
SU9140	New Stormwater Pond, Stormwater Pond Retrofit	SU-SU-0041	Safeway; corner of Post Drive & Grove Street	Quantity/ Quality	Private	11 - 25
SU9141	Stormwater Pond Retrofit	SU-SU-0041	Substation near Grove Street & Grant Street	Quality/ Quantity	Private	11 - 25
SU9206	Stream Restoration	SU-SU-0040	Near Herndon Parkway & Tamarack Way	Quality	Private	11 - 25
SU9207	Stream Restoration	SU-SU-0042	Near Fairfax County Parkway & New Dominion Parkway	Quality	Private	11 - 25
SU9510	BMP/LID	SU-SU-0040	Near Elden Street & Fairfax County Parkway	Quality	State/ Private	11 - 25
SU9513	BMP/LID	SU-SU-0043	Near Old Dominion Avenue & Aspen Drive	Quality	Private	11 - 25

Non-Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner
SU9905	Rain Barrel Programs	SU-SU-0040	Crestview Sec. 1, Runnymede Manor, Stuart Woods, Reston Sec. 49, and Towns at Stuart Pointe Subdivisions	Quantity	Private
SU9906	Buffer Restoration	SU-SU-0040	Near Fairfax County Parkway & Sunset Hills Road	Quality	County/ Private
SU9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	SU-SU-0040	Stream corridors near Herndon Parkway & Fairbrook Drive	Quality	Private

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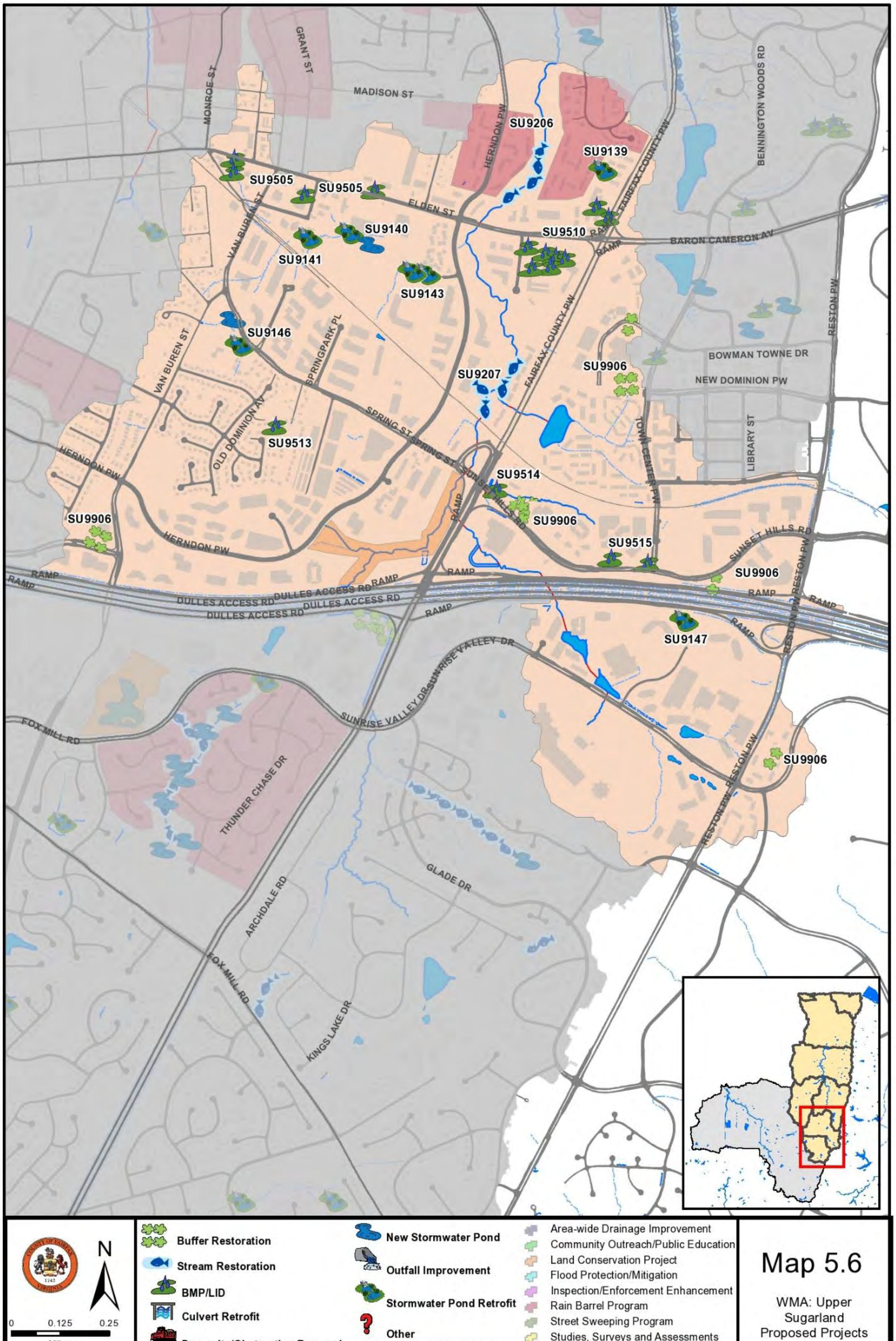
MADISON ST
GRANT ST
MONROE ST
SU9206
SU9139
SU9505
SU9505
ELDEN ST
SU9140
SU9510
BARON CAMERON AV
SU9141
SU9143
SU9146
SPRINGPARK PL
VAN BUREN ST
SU9207
FAIRFAX COUNTY PW
SU9906
BOWMAN TOWNE DR
NEW DOMINION PW
BENNINGTON WOODS RD
RESTON PW
OLD DOMINION AV
SU9513
SPRING ST
HERNDON PW
SU9514
TOWN CENTER PW
LIBRARY ST
SU9906
SU9906
SUNSET HILLS RD
SU9515
SU9906
DULLES ACCESS RD
RAMP
SU9147
SUNRISE VALLEY DR
FOX MILL RD
THUNDER CHASE DR
SU9906
GLADE DR
ARCHDALE RD
KINGS LAKE DR
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
N
0 0.125 0.25
Miles
Map 5.6
WMA: Upper Sugarland Proposed Projects

5.2 Horsepen Creek Watershed WMAs

Each subsection of Section 5.2 includes a description of key WMA conditions, a description of proposed structural and non-structural 10-year projects in the WMA, a listing of 10-year and 25-year projects for the WMA, and a map showing the types and locations of all 10-year and 25-year projects within the WMA. Each WMA in the Horsepen Creek watershed is described separately. Additional project details, benefits, and design considerations for the projects in the 10-year implementation plan are included on the project fact sheets located in Section 5.3.

5.2.1 Cedar Run WMA

Description of Key WMA Conditions

Approximately 73 percent of the Cedar Run WMA is urbanized. The expected changes in land use show increases in high and low density residential areas and decreases in estate residential and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Cedar Run WMA contains 16 existing stormwater facilities. Approximately 67 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Cedar Run WMA contributes approximately five percent of the total suspended solids, seven percent of the total nitrogen, and seven percent of the total phosphorus annual loads to the Horsepen Watershed.

Cedar Run WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Cedar Run WMA.

HC9007 HC-CR-0002 does not have any existing stormwater controls. Construct a new in-line enhanced extended detention basin (modified scope of RP H-07) and various energy dissipation and stream and habitat restoration projects throughout the subwatershed.

HC9013 Subbasins HC-CR-0004 and 0005 have minimal stormwater controls. A combination of eighteen basin retrofits, wetlands, BMPs and outfall improvements will provide stormwater controls for more than two-thirds of the subbasins' 421 acres.

HC9133 Retrofit existing dry pond (no StormNet ID) to enhanced extended dry detention basin including removal of paved ditch and intercepting additional upstream drainage. Improve channel downstream with energy dissipating structures and replace upstream paved ditches with vegetated swales.

HC9143 Existing dry ponds 1001DP and 1116DP provide only water quantity control. Retrofit basins to enhanced extended detention basins to improve quality and quantity treatment. Remove concrete channels, raise outlet structure, and repair erosion at outfalls.

Cedar Run WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Cedar Run WMA.

HC9135 Existing dry pond 0443DP provides only water quantity treatment. Retrofit basin to enhanced extended detention basin to improve quality and quantity controls. Removing concrete trickle ditches, clear sediment from inlets and improve energy dissipation at outfall.

HC9138 A portion of Emerald Chase subdivision has no stormwater controls and erosion is impacting walking path. Construct small constructed wetlands at three locations just below the walking trail and improve downstream channels with energy dissipation.

HC9146 Existing dry ponds 1059DP and 0406DP provide only water quantity control. Retrofit basins to extended detention basins to improve quality and quantity treatment. Replace concrete channels within ponds and in nearby channel with vegetated swales.

HC9302 Stormwater drainage is piped without treatment along Fairfax County Parkway. Disconnected piped drainage and re-route stormwater flows through a natural swale with rock check dams installed for energy dissipation.

Cedar Run WMA Non-Structural Projects

The following non-structural project is designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

HC9901 Restore riparian buffer along Cedar Branch (east of Ashburton Ave) and along a tributary stream within Chantilly Highlands (north of Grey Friars Pl). Targeted rain barrel program for homes on Cross Creek Ln & Cross Creek Ct. Remove invasive vegetation from existing dry pond 0603DP and replant with native vegetation.

10-Year and 25-Year Project Information Tables for Cedar Run WMA

Table 5.7 lists all structural and non-structural projects proposed in the Cedar Run WMA. Project locations for all structural and non-structural projects are shown on Map 5.7.

Table 5.7
Project List – Cedar Run WMA

Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
HC9007	Regional Pond Alternative Suite	HC-CR-0002	Between Ladybank Lane & Mother Well Court	Quality/ Quantity	Park/ Private	0 - 10
HC9013	Regional Pond Alternative Suite	HC-CR-0004/05	Between Franklin Farm Rd, West Ox Rd & Ashburton Ave	Quality/ Quantity	County/ Private	0 - 10
HC9133	Stormwater Pond Retrofit, BMP/LID, Stream Restoration	HC-CR-0001	Near Glen Taylor Lane & Mother Well Court	Quantity/ Quality	Park/ Private	0 - 10
HC9143	Stormwater Pond Retrofit	HC-CR-0003	Off of Ashburton Avenue, near Thistlethorn Drive & Saffron Drive	Quantity/ Quality	County	0 - 10
HC9135	Stormwater Pond Retrofit	HC-CR-0001	Near Emerald Chase Drive & Rover Glen Court	Quantity/ Quality	Private	11 - 25
HC9138	New Stormwater Pond	HC-CR-0001	Near Emerald Chase Drive & Ruby Lace Court	Quality	Park	11 - 25
HC9146	Stormwater Pond Retrofit, BMP/LID	HC-CR-0003	Near Ashburton Avenue & Wheeler Way	Quantity/ Quality	County/ Private	11 - 25
HC9302	Area-wide Drainage Improvement	HC-CR-0001	Burchlawn Street cul-de-sac	Quality	N/A	11 - 25

Non-Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner
HC9901	Buffer Restoration, Rain Barrel Programs	HC-CR-0002	Near Ashburton Avenue & Thistlethorn Drive	Quality/ Quantity	Park/ Private

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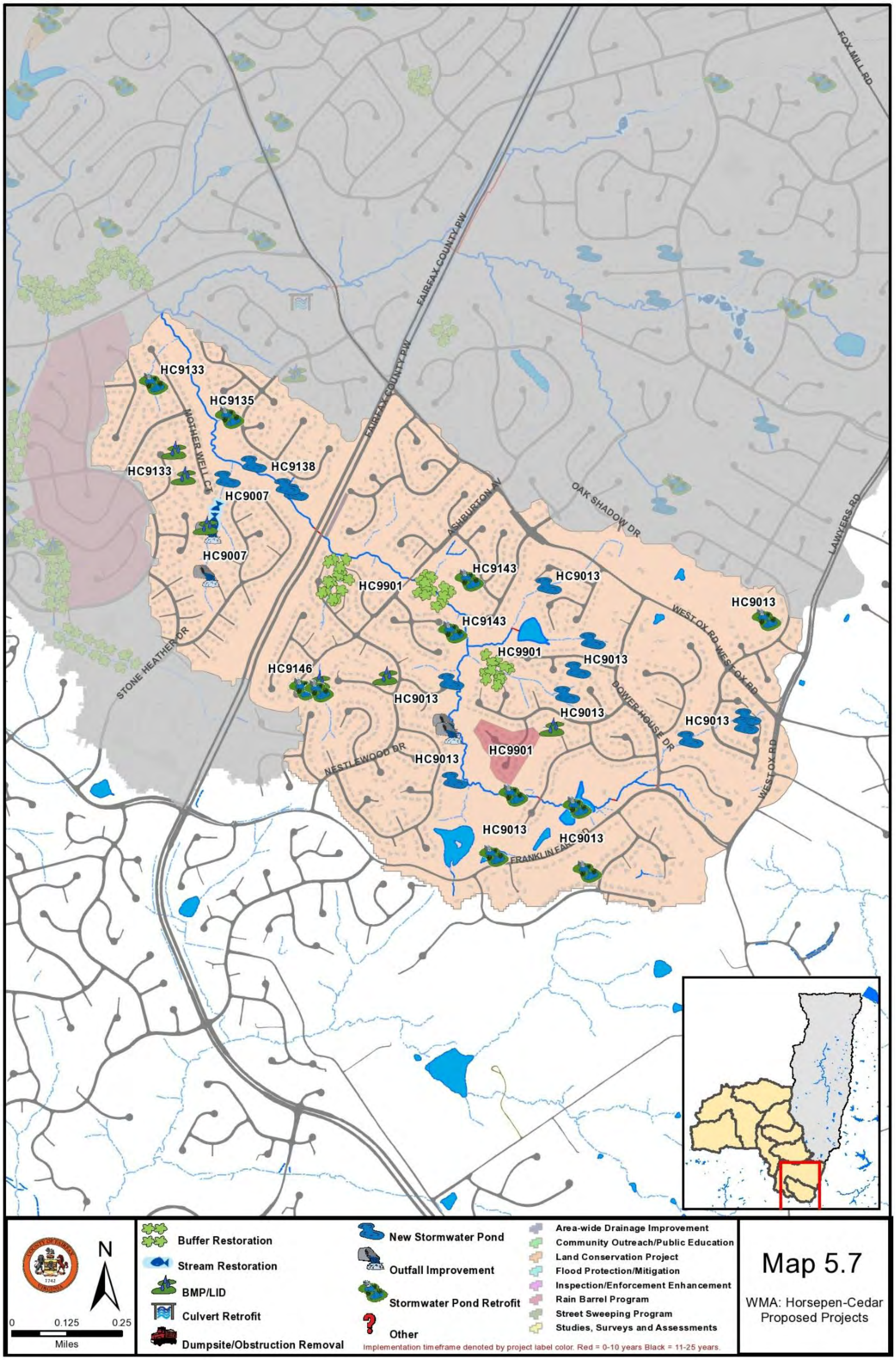
HC9133
HC9135
HC9133
HC9138
HC9007
HC9007
HC9901
HC9143
HC9143
HC9013
HC9013
HC9901
HC9013
HC9146
HC9013
HC9013
HC9013
HC9901
HC9013
HC9013
HC9013
FOX MILL RD
FAIRFAX COUNTY PW
FAIRFAX COUNTY PW
MOTHER WELL CT
ASHBURTON AV
OAK SHADOW DR
LAWYERS RD
WEST OX RD
WEST OX RD
WEST OX RD
DOWER HOUSE DR
STONE HEATHER DR
NESTLEWOOD DR
FRANKLIN FARM RD
N
0
0.125
0.25
Miles
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
Map 5.7
WMA: Horsepen-Cedar
Proposed Projects

5.2.2 Frying Pan WMA

Description of Key WMA Conditions

Approximately 72 percent of the Frying Pan WMA is urbanized. The expected changes in land use show increases in higher density residential and commercial/industrial areas and decreases in low density residential, institutional, and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Frying Pan WMA contains 24 existing stormwater facilities. Approximately 59 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Frying Pan WMA contributes approximately seven percent of the total suspended solids, 10 percent of the total nitrogen, and 10 percent of the total phosphorus annual loads to the Horsepen Watershed.

Frying Pan WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Frying Pan WMA.

HC9106 The current outlet structure for dry pond 1288DP is a large five foot culvert. The pond will be improved by adding a box weir to the culvert with a low flow orifice, re-grading the bottom of the pond for more capacity and replanting with native vegetation.

HC9109 Retrofit existing dry pond (0406DP) to an enhanced extended dry detention basin to improve quality and quantity treatment. Remove concrete trickle ditch, create a forebay at each inlet, install marsh areas and retrofit the outlet structure for extended detention.

HC9114 Retrofit existing dry pond (1416DP) to an enhanced extended dry detention basin to improve quality and quantity treatment. Install a forebay north of the walking path, re-grade the basin bottom with a meander and marsh areas and install a proper outlet structure.

HC9116 Sycamore Ridge area does not have existing stormwater controls. The drainage channels show signs of erosion. Construct new pocket wetlands at outfalls to slow stormwater and increase nutrient uptake. Repair drainage channels with rock and vegetation.

HC9119 Existing dry pond (0610DP) provides only water quantity control. Improve basin to an enhanced extended detention dry basin, disconnect three upstream outfalls and install two small forebays and a proper outlet structure to provide quality treatment and improve quantity controls.

HC9127 Existing dry ponds (0563DP and 0631DP) provide only water quantity control. Improve basins to enhanced extended dry detention basins with marsh areas including the removal of a concrete trickle ditch and the installation of proper outlet structures.

HC9503 Frying Pan Park/Kidwell Farm does not have existing stormwater controls. Install vegetated swale along east side of horse ring to intercept overland flow from parking lot and divert to new bioretention area south of horse ring. Install educational signage.

Frying Pan WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Frying Pan WMA.

HC9111 Retrofit existing dry ponds 1485DP and 0933DP to enhanced extended detention dry basins to improve quantity and quality functions. Remove concrete trickle ditches and repair culverts and erosion below outfalls.

HC9117 Improve quality and quantity benefits of existing dry pond (1224DP) by removing concrete trickle ditch, raising outfall structure for additional storage capacity, and planting low marsh vegetation for improved nutrient removal.

HC9124 Retrofit existing dry pond 1222DP to improve water quality control. Repair erosion upstream of concrete trickle ditch, replace concrete trickle ditches with meandering vegetated swales, and vegetated basin bottom with low marsh plants.

Frying Pan WMA Non-Structural Projects

The following non-structural project is designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

HC9902 Much of the riparian buffer in the Copper Crossing subdivision has been removed. Restore riparian buffer along Frying Pan Branch within the Copper Crossing Subdivision.

10-Year and 25-Year Project Information Tables for Frying Pan WMA

Table 5.8 lists all structural and non-structural projects proposed in the Frying Pan WMA. Project locations for all structural and non-structural projects are shown on Map 5.8.

Table 5.8
Project List – Frying Pan WMA

Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
HC9106	Stormwater Pond Retrofit	HC-FP-0001	Frying Pan Road & Centreville Road	Quality/ Quantity	State/ County/ Private	0 - 10
HC9109	Stormwater Pond Retrofit	HC-FP-0002	Between Coppermine Rd, Thomas Jefferson Dr & Masons Ferry Dr	Quality/ Quantity	Private	0 - 10
HC9114	Stormwater Pond Retrofit	HC-FP-0004	Fox Mill Road & Cabin Creek Road	Quality/ Quantity	Private	0 - 10
HC9116	New Stormwater Pond	HC-FP-0003	Near Halterbreak Court & Curved Iron Road culs-de sac	Quality	Park	0 - 10
HC9119	Stormwater Pond Retrofit	HC-FP-0005	Colts Brook Drive & Fox Mill Road	Quality/ Quantity	County	0 - 10
HC9127	Stormwater Pond Retrofit	HC-FP-0003	Near Medow Hall Drive & New Carson Drive	Quality/ Quantity	County/ Private	0 - 10
HC9503	BMP/LID	HC-FP-0001	Frying Pan Park/Kidwell Farm	Quality	Park	0 - 10
HC9111	Stormwater Pond Retrofit	HC-FP-0004	Near Frying Pan Road & Coppermine Road	Quantity/ Quality	County/ Park	11 - 25
HC9117	Stormwater Pond Retrofit	HC-FP-0004	Monroe Manor Drive cul-de-sac	Quantity/ Quality	County	11 - 25
HC9124	Stormwater Pond Retrofit	HC-FP-0005	Near Locksley Court cul-de-sac	Quantity/ Quality	County	11 - 25

Non-Structural Projects

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner
HC9902	Buffer Restoration	HC-FP-0001	Stream corridors near Copper Bed Road & Copper Hill Road	Quality	County/Park

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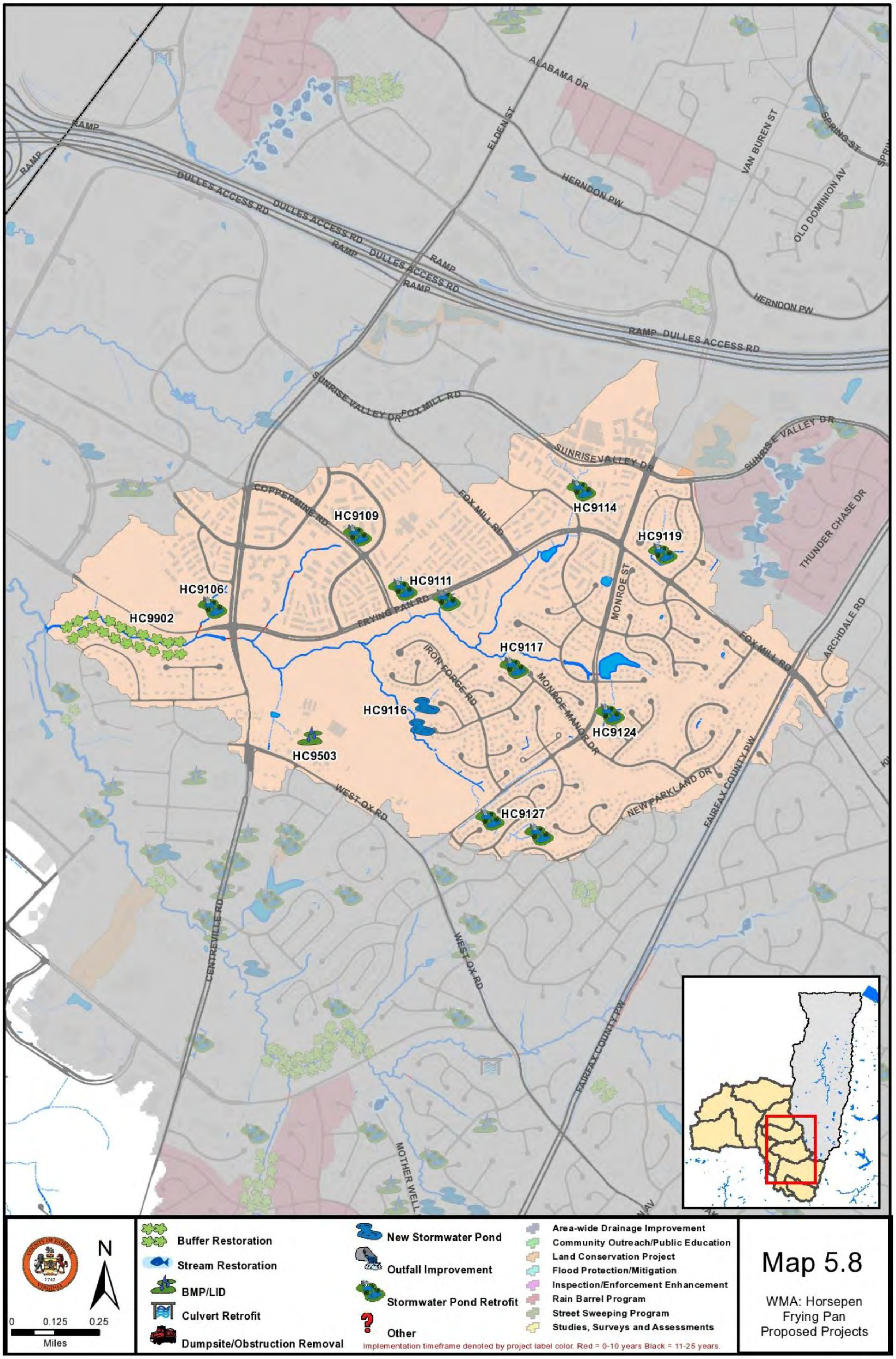

Map 5.8

WMA: Horsepen Frying Pan Proposed Projects

5.2.3 Indian WMA, Lower Horsepen WMA, and Stallion WMA

Description of Key WMA Conditions

The portion of the Indian WMA that is located within Fairfax County consists of only 5.3 acres, and contains mostly medium density residential land use. Approximately 49 percent of the Indian WMA is urbanized. The Indian WMA contains no existing stormwater facilities within Fairfax County.

The portion of the Lower Horsepen WMA that is located within Fairfax County consists of only 20.6 acres, and contains mostly industrial land use. Approximately 44 percent of the Lower Horsepen WMA is urbanized. The expected changes in land use show no changes to this WMA within Fairfax County. The Lower Horsepen WMA contains no existing stormwater facilities within Fairfax County.

The Stallion WMA lies entirely within Loudoun County. Approximately 16 percent of the Stallion WMA is urbanized.

Due to the limited areas located within Fairfax County, no projects are proposed in these WMAs.

5.2.4 Lower Middle Horsepen WMA

Description of Key WMA Conditions

Approximately 68 percent of the Lower Middle Horsepen WMA is urbanized. The expected changes in land use show increases in high density/intensity areas and decreases in low density/intensity rural areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Lower Middle Horsepen WMA contains 37 existing stormwater facilities. Approximately 89 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Lower Middle Horsepen WMA contributes approximately 11 percent of the total suspended solids, 12 percent of the total nitrogen, and 13 percent of the total phosphorus annual loads to the Horsepen Watershed.

Lower Middle Horsepen WMA 10-Year Projects

The following structural project is designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Middle Horsepen WMA.

HC9200 Horsepen Creek streambanks are eroded and incised in a park-like area below Parcher Avenue. Retrofit culvert with micro pool above Parcher Ave. and install small basin below athletic court to control stormwater flows. Re-grade and stabilize stream banks, vegetate stone drainage channels and install check dams, restore buffer and install educational signage.

Lower Middle Horsepen WMA 25-Year Projects

The following structural project is designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Lower Middle Horsepen WMA.

HC9100 Install a new enhanced extended detention dry basin in existing drainage swale with established wetland vegetation, including installation of an outlet structure and minimal grading.

HC9101 Existing dry pond in Four Seasons Section 2 provides only quantity controls. Retrofit pond to an enhanced, extended detention dry basin to improve water quantity controls and provide water quality treatment.

HC9400 A culvert under Rock Hill Road is habitually clogging with sediment and debris. Install a micro-pool above the weir to reduce clogging. Improve wetland vegetation within weir for additional nutrient removal.

Lower Middle Horsepen WMA Non-Structural Projects

The following non-structural project is designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

HC9903 Targeted Rain Barrel Program at Reflection Lake Homeowners Association and Four Season Homeowners Association. Restore riparian buffer upstream of Parcher Avenue in Reflection Lake Sections 9 & 10.

10-Year and 25-Year Project Information Tables for Lower Middle Horsepen WMA

Table 5.9 lists all structural and non-structural projects proposed in the Lower Middle Horsepen WMA. Project locations for all structural and non-structural projects are shown on Map 5.9.

Table 5.9
Project List – Lower Middle Horsepen WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
HC9200	Culvert Retrofit, Stream Restoration	HC-HC-0020	Near Parcher Avenue & Monaghan Drive, next to the Reflection Lake pool	Quality	Private	0 - 10
HC9100	Stormwater Pond Retrofit	HC-HC-0018	Rock Hill Road & Turquoise Lane	Quantity/ Quality	Private	11 - 25
HC9101	Stormwater Pond Retrofit	HC-HC-0017	Near Spring Knoll Drive & Summerset Place	Quantity/ Quality	Private	11 - 25
HC9400	Culvert Retrofit	HC-HC-0019	Near Rock Hill Road & Innovation Avenue	Quality	State/ Private	11 - 25
HC9401	Culvert Retrofit	HC-HC-0018	Near Rock Hill Road & Innovation Avenue	Quantity	State	11 - 25

Table 5.9 Project List – Lower Middle Horsepen WMA					
Non-Structural Projects					
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**
HC9903	Buffer Restoration, Rain Barrel Programs	HC-HC-0018	Reflection Lake HOA & Four Season HOA (Herndon)	Quality/ Quantity	Private

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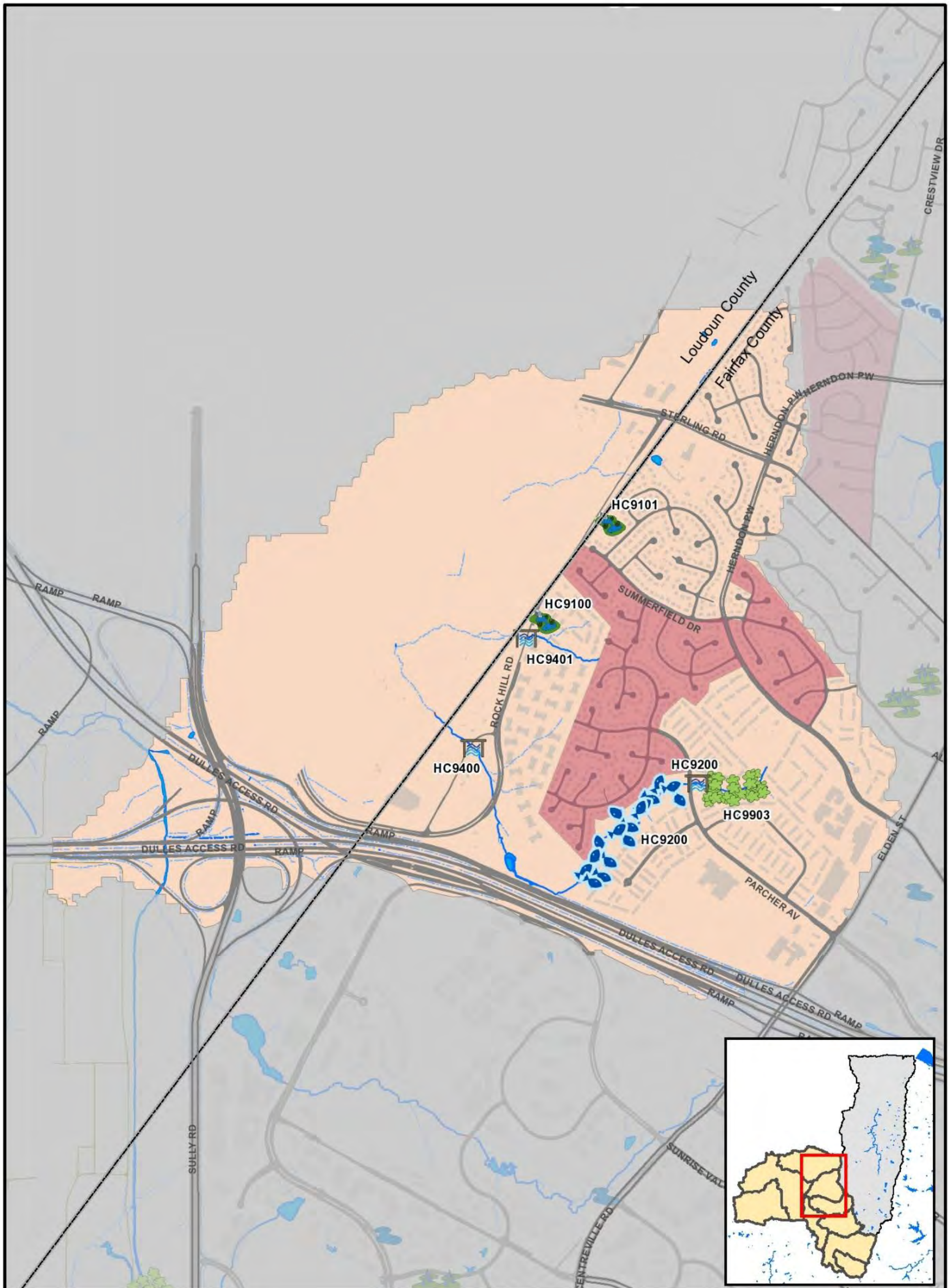

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Miles

Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

Map 5.9

WMA: Horsepen Lower Middle Proposed Projects

5.2.5 Merrybrook WMA

Description of Key WMA Conditions

Approximately 79 percent of the Merrybrook WMA is urbanized. The expected changes in land use show increases in high and low density residential, commercial and industrial areas and decreases in estate residential, institutional and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Merrybrook WMA contains no existing stormwater facilities. Approximately 76 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Merrybrook WMA contributes approximately seven percent of the total suspended solids, 10 percent of the total nitrogen, and nine percent of the total phosphorus annual loads to the Horsepen Watershed.

Merrybrook WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Merrybrook WMA.

HC9107 The community around Arkansas Ave. and Palmer Dr. does not have existing stormwater controls. Construct new enhanced extended detention dry basin with marsh areas to collect stormwater runoff conveyed in storm sewers and swale outlet to stream channel.

HC9110 The community around Palmer Drive does not have existing stormwater controls. Daylight piped storm sewers and construct new enhanced extended detention dry basin below new outfall.

Merrybrook WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Merrybrook WMA.

HC9104 Construct new enhanced extended detention dry basin below untreated commercial park, an extended detention outlet structure and wetland vegetation will provide quantity and quality controls for this area.

Merrybrook WMA Non-Structural Projects

The following non-structural project is designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

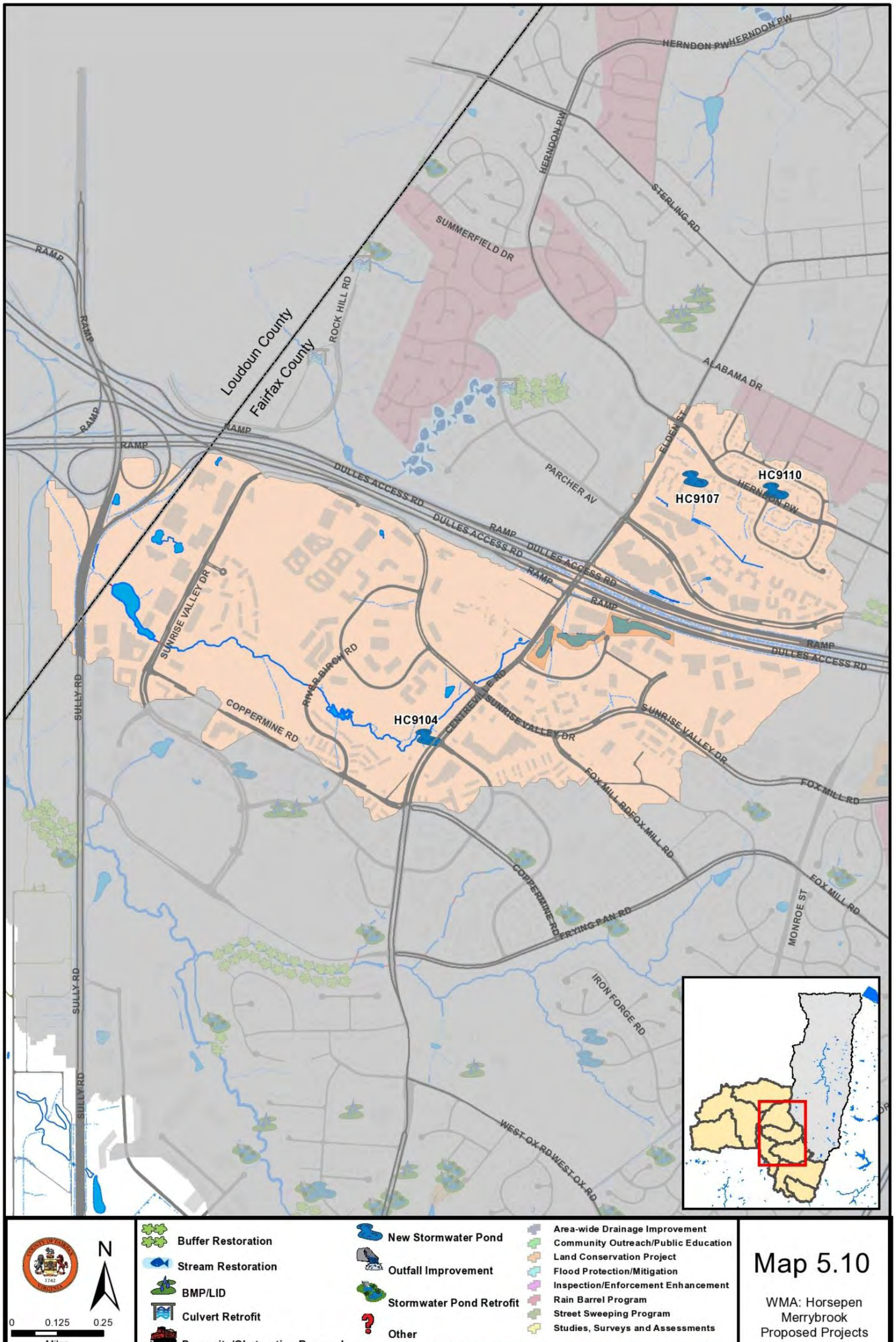
HC9907 Obtain conservation easement and restore buffer around a series of wet ponds at the intersection of Dulles Access Road and Centreville Road.

10-Year and 25-Year Project Information Tables for Merrybrook WMA

Table 5.10 lists all structural and non-structural projects proposed in the Merrybrook WMA. Project locations for all structural and non-structural projects are shown on Map 5.10.

Table 5.10
Project List – Merrybrook WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
HC9107	New Stormwater Pond	HC-MR-0004	Palmer Drive & Dogwood Court	Quality/ Quantity	Local	0 - 10
HC9110	New Stormwater Pond	HC-MR-0004	Herndon Parkway & Campbell Way	Quality/ Quantity	Private	0 - 10
HC9104	New Stormwater Pond	HC-MR-0002	Centreville Road & McNair Farms Drive	Quality	Private	11 - 25
Non-Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	
HC9907	Conservation Acquisition Project/ Land Conservation Coordination Project, Buffer Restoration	HC-MR-0002	Centreville Road & Woodland Park Road	Quality	County/ Private	


HERNDON PW
HERNDON PW
HERNDON PW
STERLING RD
SUMMERFIELD DR
RAMP
ROCK HILL RD
Loudoun County
Fairfax County
ALABAMA DR
ELDEN ST
PARCHER AV
HC9110
HC9107
HERNDON PW
DULLES ACCESS RD
SUNRISE VALLEY DR
RIVER BIRCH RD
COPPERMINE RD
HC9104
CENTREVILLE RD
SUNRISE VALLEY DR
FOX MILL RD
SULLY RD
IRON FORGE RD
FRYING PAN RD
MONROE ST
WEST OX RD
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
N
0 0.125 0.25
Miles
Map 5.10
WMA: Horsepen Merrybrook Proposed Projects

5.2.6 Middle Horsepen WMA

Description of Key WMA Conditions

Approximately 69 percent of the Middle Horsepen WMA is urbanized. The expected changes in land use show increases in high and low density residential, low intensity commercial and industrial areas and decreases in estate residential, high intensity commercial and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Middle Horsepen WMA contains no existing stormwater facilities. Approximately 75 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Middle Horsepen WMA contributes approximately six percent of the total suspended solids, six percent of the total nitrogen, and six percent of the total phosphorus annual loads to the Horsepen Watershed.

Middle Horsepen WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Middle Horsepen WMA.

HC9102 An existing swale with wetland vegetation is a prime location for a new enhanced extended detention dry pond with minimal grading required for low marsh areas and berm along tennis courts.

HC9108 Retrofit existing dry pond 0426DP to an enhanced extended detention dry pond to improve quantity and quality functions. Improve and repair erosion to the inlet and downstream channel.

HC9500 Install rain garden at the entrance of Sutters Mill Drive with curb cuts in the existing curbing. Re-grade and vegetate existing basin bottom. Cut existing outlet pipe and fit with a raised yard drain outlet structure.

Middle Horsepen WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Middle Horsepen WMA.

HC9103 Retrofit existing sediment basin to a proper extended detention dry pond, intercept stormwater drainage from swale along Dulles Toll Road and re-route into improved stormwater basin.

HC9113 Enlarge and retrofit existing dry pond to extended detention basin including removal of concrete trickle ditches. Intercept storm flow from adjacent drainage ditch, improve outfall to stream, and investigate source of suspicious discharge in drainage ditch.

HC9115 Existing dry pond (0495DP) provides only water quantity treatment. Improve pond by retrofitting outlet structure for extended detention, installing a sediment forebay across Mustang Drive to the east, and maintaining existing natural vegetation.

HC9501 Mountain View subdivision does not have existing stormwater controls and overland flow is causing erosion. Construct vegetated swales with bioretention to manage and treat overland stormwater flows.

HC9502 Floris Elementary School does not have existing stormwater controls. Retrofit existing drainage swale along athletic fields to a vegetated swale and direct swale and overland flow into a new infiltration basin in the lower end of the fields.

Middle Horsepen WMA Non-Structural Projects

The following non-structural project is designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

HC9904 Restore riparian buffers along three sections of Horsepen Run: west of Sully Road, within Rogers Farm Section 1, and within Mustang Crossing. Obtain conservation easement to protect riparian buffer and existing habitat below existing wet pond WP0342.

10-Year and 25-Year Project Information Tables for Middle Horsepen WMA

Table 5.11 lists all structural and non-structural projects proposed in the Middle Horsepen WMA. Project locations for all structural and non-structural projects are shown on Map 5.11.

Table 5.11
Project List – Middle Horsepen WMA

Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
HC9102	New Stormwater Pond	HC-HC-0026	Legacy Circle & Sunrise Valley Drive	Quality/ Quantity	Private	0 - 10
HC9108	Stormwater Pond Retrofit	HC-HC-0028	Near Copper Creek Road & Copper Creek Court	Quantity/ Quality	County/ Park	0 - 10
HC9500	BMP/LID	HC-HC-0026	Wellesley Subdivision, Stratford Glen Place	Quality	Private	0 - 10
HC9103	Stormwater Pond Retrofit	HC-HC-0025	Dulles Int'l Airport, near Sully Rd & electric substation	Quantity/ Quality	Federal	11 - 25
HC9113	Stormwater Pond Retrofit	HC-HC-0028	Towerview Road cul-de-sac	Quantity/ Quality	Private	11 - 25
HC9115	Stormwater Pond Retrofit, New Stormwater Pond	HC-HC-0028	Near Mustang Drive & Maverick Lane	Quantity/ Quality	County/ Private	11 - 25
HC9501	BMP/LID	HC-HC-0028	Along stream corridor between Floris Street & Mountainview Court	Quality	Private	11 - 25
HC9502	BMP/LID	HC-HC-0028	Floris Elementary School	Quality	Park	11 - 25

Table 5.11 Project List – Middle Horsepen WMA					
Non-Structural Projects					
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**
HC9904	Conservation Acquisition Project/ Land Conservation Coordination Project	HC-HC-0026	Stream corridors near Sully Road & Park Center Road	Quality	Federal/County/ Park/ Private

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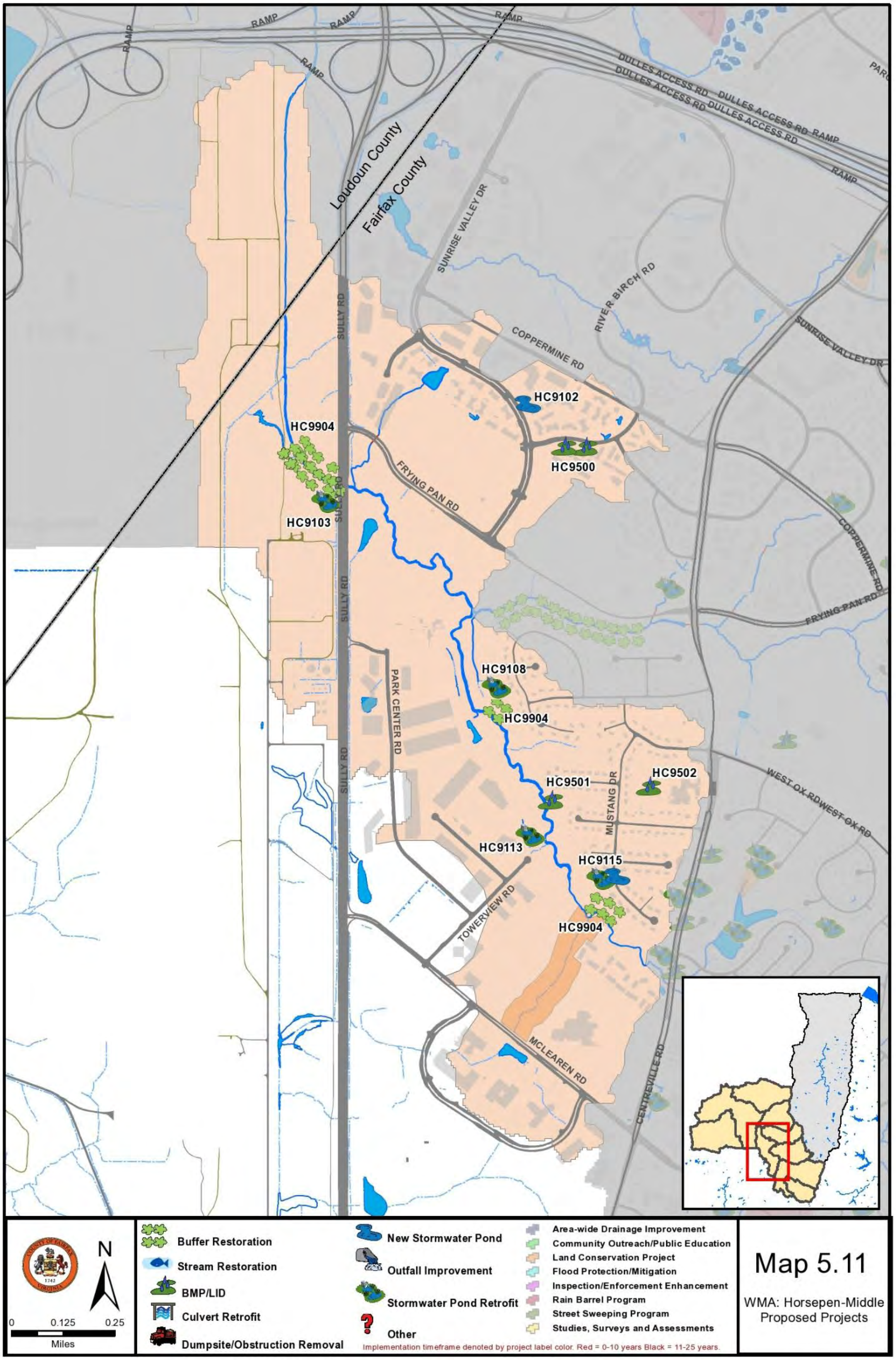

Map 5.11

WMA: Horsepen-Middle Proposed Projects

5.2.7 Upper Horsepen WMA

Description of Key WMA Conditions

Approximately 80 percent of the Upper Horsepen WMA is urbanized. The expected changes in land use show increases in low and medium density residential, high intensity commercial and industrial areas and decreases in estate residential, low intensity commercial, and open space areas. Higher density urban areas that contain less pervious surface introduce greater volumes of stormwater run off and more intense peak flows. Increases in urban development also lead to degraded wildlife habitat, increased pollutants in stormwater runoff, and worsening stream conditions.

The Upper Horsepen WMA contains 38 existing stormwater facilities. Approximately 67 percent of this WMA is not treated by an existing stormwater facility. According to the existing condition STEPL model results, the Upper Horsepen WMA contributes approximately 12 percent of the total suspended solids, 17 percent of the total nitrogen, and 18 percent of the total phosphorus annual loads to the Horsepen Watershed.

Upper Horsepen WMA 10-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Horsepen WMA.

HC9118 Existing dry basins (0803DP and unnamed dry basin) provide only water quantity control. The basins will be improved to enhanced extended dry detention basins by retrofitting existing or installing new outlet structures and planting native vegetation.

HC9121 Three existing dry ponds (VDOT29068, DP0015, DP0015) provide only water quantity control. Improve basins with water quality controls and remove concrete trickle ditches. Install vegetated swales in road dividers.

HC9122 Existing non-stormwater pond (FM0014) will be retrofitted to a stormwater wet pond including a slight draw down of the water level to provide additional storage, installing an outlet structure, installing vegetation and repairing a seep in the dam.

HC9123 Retrofit existing dry pond (0196DP) to an enhanced extended dry detention basin by removing a concrete trickle ditch, adding an outlet structure, restoring the downstream channel with vegetation and restoring access to the site.

HC9126 Existing dry pond (0562DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, enlarge size for more capacity, install a forebay to catch sediment and install an outlet structure.

HC9128 The Korean Orthodox Presbyterian dry pond (no StormNet ID) provides only water quantity control. Improve basin to an enhanced extended dry detention basin including the removal of a concrete trickle ditch and the addition of an outlet structure.

HC9129 Improve existing dry pond (0568DP) to an enhanced extended dry detention basin with marsh areas, install a natural low flow channel and retrofit outlet structure.

Concrete swales will be removed/vegetated and educational signage will be installed.

HC9132 Highland Mews existing dry pond (1055DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, remove concrete trickle ditch, install an outlet structure and install riprap at outfalls for energy dissipation.

HC9134 Chantilly Highlands community does not have existing stormwater controls. Improve regional pond H-19 (0747DP) by adding a box weir to detain water and naturalize. Install small forebays at each outfall and naturalize swales to a new bioretention basin.

HC9136 Fox Mill Estates' existing dry pond provides only water quantity control. Improve basin to a constructed wetland. Enlarge basin, install a low v-notch weir as an outlet structure, install a fence and educational signage.

HC9137 A portion of Fox Mill Estates does not have existing stormwater controls. Install three constructed wetlands, redirect and meander channels, and restore streambank with grading, boulder toe and vegetation. Restore the riparian vegetated buffer.

HC9140 Fox Mill Estates' existing dry pond (0243DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, install outlet structure, raise the emergency spillway and naturalize the basin.

HC9142 Fox Mill Estates' existing dry pond (0176DP) provides only water quantity control. Install forebay, slightly enlarge basin and retrofit outlet structure. Install constructed wetland near Kettering Drive and install riprap in channel below outfall.

HC9149 Remove existing concrete channel between Chasbarb Terrace and Viking Drive and vegetate. Install check dams in the channel for energy dissipation and install a constructed wetland in the lower portion of the channel.

HC9201 A portion of the Fox Mill Estates community does not have existing stormwater controls. Re-grade eroded streambanks and vegetate with floodplain vegetation. Restore channel with several rock vanes.

Upper Horsepen WMA 25-Year Projects

The following structural projects are designed to reduce stormwater runoff volumes, decrease peak flows, reduce pollutants in stormwater runoff, and improve overall habitat and stream quality in the Upper Horsepen WMA.

HC9125 Spring Lakes Estates West Sect. 2 does not have any stormwater controls. Install a new constructed wetland within a small clearing below stormwater outfall, include energy dissipation below outfall and repair drainage channel downstream.

HC9130 Improve Middleton Farm existing dry pond (1349DP) to an enhanced extended dry detention basin by removing the concrete trickle ditch, replacing the concrete apron with riprap, installing an outlet structure, and raising the emergency overflow.

HC9131 Existing dry pond 1349DP provides only water quantity treatment, improve quantity and quality controls by retrofitting to an enhanced extended detention pond. Improve channel and repair culvert under nearby walking path, install constructed wetland below culvert.

HC9139 The Fox Mill Estates community around Bradwell Road has no stormwater controls. Install new constructed wetlands below two stormwater outfalls to provide water quality and water quantity treatment.

HC9148 Existing stormwater ponds 0011DP and 0012DP provide only water quantity control. Retrofit basins to enhanced extended detention basins, utilizing and expanding on the natural wetlands and improving stream channels above and below the ponds.

HC9505 Existing stormwater pond 0440DP provides only water quantity controls. Improve quantity and quality controls by replacing concrete channel with a vegetated swale and raising outlet structure. Maintain mowed field for community support.

Upper Horsepen WMA Non-Structural Projects

The following non-structural projects are designed to reduce stormwater flow volumes and decrease peak flows in areas lacking sufficient stormwater management with limited opportunity for new structural stormwater controls. Project implementation will also promote sediment deposition, decrease erosion, improve water quality and increase wildlife habitat.

HC9905 Obtain conservation easement above existing pond (FM0014) to preserve riparian buffer and existing habitat. Remove obstructions in Horsepen Creek below McLearen Road (SPA reach 9-1) and restore riparian buffer. Restore riparian buffers above and below Kinross Circle. Stop mowing and existing dry pond in Franklin Woods subdivision and allow natural vegetation to mature. Vegetate existing dry pond (0440DP) in Monterey subdivision and break up concrete trickle ditch.

HC9906 Targeted rain barrel programs for portions of Chantilly Highlands without any existing or proposed stormwater controls.

10-Year and 25-Year Project Information Tables for Upper Horsepen WMA

Table 5.12 lists all structural and non-structural projects proposed in the Upper Horsepen WMA. Project locations for all structural and non-structural projects are shown on Map 5.12.

Table 5.12
Project List – Upper Horsepen WMA

Project #	Project Type	Subwatershed	Location	Watershed Benefit	Land Owner	Phase
Structural Projects						
HC9118	Stormwater Pond Retrofit	HC-HC-0030	Between Floris Lane & Merricourt Lane culs-de-sac	Quality/ Quantity	Private	0 - 10
HC9121	Stormwater Pond Retrofit, BMP/LID	HC-HC-0030	Centreville Road & Lake Shore Drive	Quality/ Quantity	State/ Park/ Private	0 - 10
HC9122	Stormwater Pond Retrofit	HC-HC-0030	Lake Shore Drive & Running Pump Lane	Quality/ Quantity	Private	0 - 10
HC9123	Stormwater Pond Retrofit	HC-HC-0030	Near Point Rider Lane & Equus Court	Quality/ Quantity	County	0 - 10
HC9126	Stormwater Pond Retrofit	HC-HC-0034	Monterey Estates Drive & West Ox Road	Quality/ Quantity	County	0 - 10
HC9128	Stormwater Pond Retrofit	HC-HC-0031	Korean Orthodox Presbyterian Church, McLearen Road & Centreville Road	Quality/ Quantity	Private	0 - 10
HC9129	Stormwater Pond Retrofit, BMP/LID	HC-HC-0034	West Ox Road & New Parkland Drive	Quality/ Quantity	County/ State	0 - 10
HC9132	Stormwater Pond Retrofit	HC-HC-0032	Highland Mews Subdivision, Hutumn Court & Highland Mews Court	Quality/ Quantity	Private	0 - 10
HC9134	Stormwater Pond Retrofit, BMP/LID	HC-HC-0033	Kinross Circle & Scotsmore Way	Quality/ Quantity	Private	0 - 10
HC9136	Stormwater Pond Retrofit	HC-HC-0037	Near Viking Drive & Pinecrest Road	Quality/ Quantity	Private	0 - 10
HC9137	Stream Restoration, New Stormwater Pond	HC-HC-0039	Between Tewksbury Drive & Kettering Drive	Quality	Private	0 - 10
HC9140	Stormwater Pond Retrofit	HC-HC-0037	Huntington Drive cul-de-sac	Quality/ Quantity	Private	0 - 10
HC9142	Stormwater Pond Retrofit, New Stormwater Pond	HC-HC-0040	Quincy Adams Drive & Quincy Adams Court	Quality/ Quantity	Private	0 - 10
HC9149	New Stormwater Pond	HC-HC-0040	Chasbarb Terrace & Chasbarb Court	Quality	Private	0 - 10
HC9201	Stream Restoration	HC-HC-0037	Between Claxton Drive & Conquest Place culs-de-sac	Quality	Private	0 - 10
HC9202	Stream Restoration	HC-HC-0039	Between Quincy Adams Court, Viking Court & Prince Harold Court culs-de-sac	Quality	Private	0 - 10
HC9125	New Stormwater Pond	HC-HC-0031	Near Spring Chapel Court cul-de-sac	Quality	Park	11 - 25

Table 5.12
Project List – Upper Horsepen WMA

HC9130	Stormwater Pond Retrofit	HC-HC-0031	Middleton Farm Subdivision, between Middleton Farm Lane & Blue Holly Lane culs-de-sac	Quality/ Quantity	Park	11 - 25
HC9131	Stormwater Pond Retrofit, Culvert Retrofit	HC-HC-0035	Near West Ox Road & McLearen Road	Quantity/ Quality	County/ Private	11 - 25
HC9139	New Stormwater Pond	HC-HC-0039	Near Bradwell Road & Litchfield Drive	Quality	County	11 - 25
HC9148	Stormwater Pond Retrofit, New Stormwater Pond	HC-HC-0039	Near Glenbrooke Woods Drive cul-de-sac	Quality	Private	11 - 25
HC9505	BMP/LID	HC-HC-0035	Near Emerald Chase Drive & Lazy Glen Court	Quality	County	11 - 25
Non-Structural Projects						
Project #	**Project Type**	**Subwatershed**	**Location**	**Watershed Benefit**	**Land Owner**	
HC9905	Conservation Acquisition Project/ Land Conservation Coordination Project, Dumpsite/ Obstruction Removal, Buffer Restoration	HC-HC-0030	Stream corridors near McLearen Road & Cobra Drive	Quality	County/ Park/ Private	
HC9906	Rain Barrel Programs	HC-HC-0030	Chantilly Highlands	Quantity	Private	

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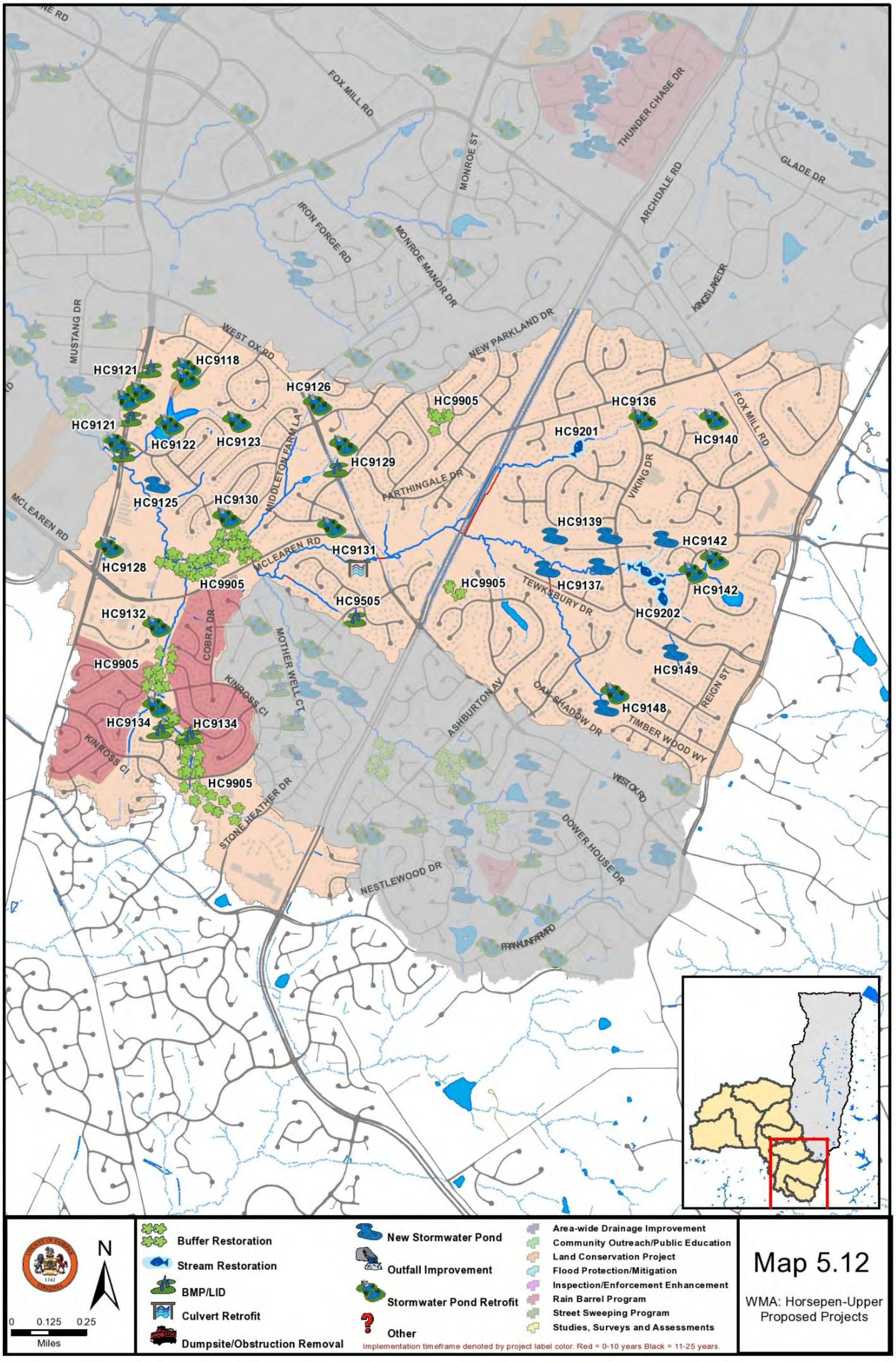
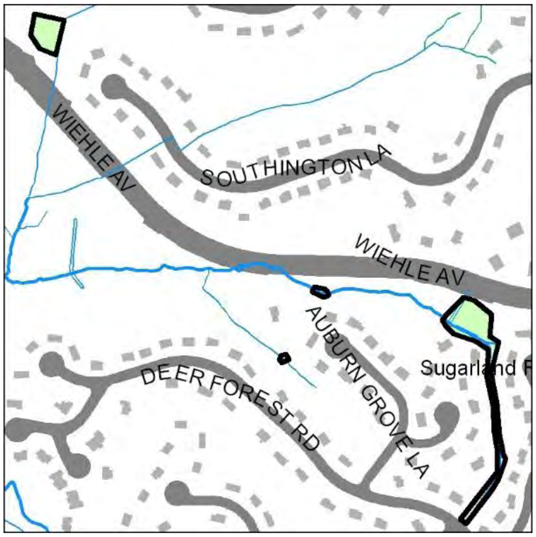

FOX MILL RD
THUNDER CHASE DR
MONROE ST
GLADE DR
ARCHDALE RD
IRON FORGE RD
MONROE MANOR DR
KINGS LAKE DR
MUSTANG DR
WEST OX RD
NEW PARKLAND DR
HC9121
HC9118
HC9126
HC9905
HC9136
HC9201
HC9140
HC9122
HC9123
HC9129
PARTHINGALE DR
VIKING DR
MCLEAREN RD
HC9125
HC9130
MIDDLETON FARM LA
HC9139
HC9142
HC9131
HC9128
HC9137
TEWKSBURY DR
HC9505
HC9202
HC9132
COBRA DR
MOTHER WELL CT
HC9149
REIGN ST
KINROSS CI
ASHBURTON AV
OAK SHADOW DR
HC9148
TIMBER WOOD WY
HC9134
WEST OX RD
STONE HEATHER DR
DOWER HOUSE DR
NESTLEWOOD DR
FRANKLIN FARM RD
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Area-wide Drainage Improvement
Community Outreach/Public Education
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
N
0 0.125 0.25
Miles
Map 5.12
WMA: Horsepen-Upper
Proposed Projects

SU9002 Regional Pond Alternative Suite



Address:	11583 Southington Lane (central)
Location:	Near Wheile Avenue, between Pellow Circle Terrace & Reston Avenue
Land Owner:	County/Private
PIN:	0112-05-0136, 0112-05-D, 0112-05-O, 0112-06-C
Control Type	Quality/Quantity
Drainage Area	62.8 acres
Receiving Waters	Rosiers Branch

Description: Improve existing dry pond (0337DP) to an enhanced extended detention dry basin with marsh area (SU9002C). Install new enhanced extended detention dry pond (SU9002A). Install new rain garden with educational signage (SU9002B). Repair eroded streambanks and culvert and install micro-pool (SU9002D). Larger projects are discussed below.

Project Area Map

Project Benefits: An estimated two tons/yr of total suspended solids, 51 lbs/yr of nitrogen, and 10 lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. In addition, the rain garden will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat. The project will furthermore stabilize streambanks and provide educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. 0337DP is an existing County facility located within a storm drainage easement. New stormwater pond, rain garden and stream bank erosion are located within Colonial gas easements on private land. Additional storm drainage easements will be necessary. Accessibility is excellent from Wiehle Avenue or Deer Forest Road. Tree impacts are expected. No significant construction issues are anticipated.

Overall Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	1167	$50.00	$58,350.00
Bioretention Filters & Basin	SY	109	$150.00	$16,350.00
Organic Compost Soil Amendment	CY	439	$40.00	$17,560.00
Plantings	AC	0.93	$25,000.00	$23,250.00
Clear and Grub	AC	0.55	$8,500.00	$4,675.00
Grading and Excavation	CY	5071	$35.00	$177,485.00
Earthen Berm	CY	300	$35.00	$10,500.00
Access Road	SY	225	$25.00	$5,625.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	65	$100.00	$6,500.00
Embankment	CY	400	$50.00	$20,000.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Construct New Channel	LF	50	$200.00	$10,000.00
Additional Cost (first 500LF)	LF	50	$200.00	$10,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$392,295.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$19,614.75
Erosion and Sediment Control: 10% of project costs				$39,229.50
			Base Construction Costs	**$451,139.25**
			Mobilization (5%)	$22,556.96
			Subtotal 1	**$473,696.21**
			Contingency (25%)	$118,424.05
			Subtotal 2	**$592,120.27**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$266,454.12
			Total Costs	**$858,574.39**
			Estimated Project Costs	***$860,000.00***

SU9002A

Description: Construct a new enhanced extended detention dry pond in low area adjacent to gas easement to intercept storm drains from Caris Glenne subdivision.

Project Area Map

***SU9002A* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	81	$40.00	$3,240.00
Plantings	AC	0.30	$25,000.00	$7,500.00
Clear and Grub	AC	0.27	$8,500.00	$2,295.00
Grading and Excavation	CY	1950	$35.00	$68,250.00
Access Road	SY	225	$25.00	$5,625.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	65	$100.00	$6,500.00
Embankment	CY	200	$50.00	$10,000.00
			Initial Project Costs	**$115,910.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$5,795.50
Erosion and Sediment Control: 10% of project costs				$11,591.00
			Base Construction Costs	**$133,296.50**
			Mobilization (5%)	$6,664.83
			Subtotal 1	**$139,961.33**
			Contingency (25%)	$34,990.33
			Subtotal 2	**$174,951.66**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$78,728.25
			Total Costs	**$253,679.90**
			Estimated Project Costs	***$254,000.00***

SU9002C

Description: Improve existing dry pond (0337DP) to an enhanced extended detention dry basin with marsh area. Remove concrete channels leading to basin, install vegetated swales with check dams and improve outfalls with rip rap aprons.

Project Area Map

***SU9002C* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	1167	$50.00	$58,350.00
Organic Compost Soil Amendment	CY	340	$40.00	$13,600.00
Plantings	AC	0.57	$25,000.00	$14,250.00
Clear and Grub	AC	0.24	$8,500.00	$2,040.00
Grading and Excavation	CY	2921	$35.00	$102,235.00
Embankment	CY	200	$50.00	$10,000.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$219,975.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$10,998.75
Erosion and Sediment Control: 10% of project costs				$21,997.50
			Base Construction Costs	**$252,971.25**
			Mobilization (5%)	$12,648.56
			Subtotal 1	**$265,619.81**
			Contingency (25%)	$66,404.95
			Subtotal 2	**$332,024.77**
Engineering Design, Surveys, Land Acquisition, Utility			*Relocation and Permits (45%)*	$149,411.14
			Total Costs	**$481,435.91**
			Estimated Project Costs	***$482,000.00***

SU9002D

Description: Repair and stabilize eroded stream banks and culvert under walking path. Construct micro-pool upstream of culvert and include educational signage.

Project Area Map

***SU9002D* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	9	$40.00	$360.00
Plantings	AC	0.04	$25,000.00	$1,000.00
Clear and Grub	AC	0.04	$8,500.00	$340.00
Grading and Excavation	CY	200	$35.00	$7,000.00
Earthen Berm	CY	300	$35.00	$10,500.00
Construct New Channel	LF	50	$200.00	$10,000.00
Additional Cost (first 500LF)	LF	50	$200.00	$10,000.00
			Initial Project Costs	**$39,200.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$1,960.00
Erosion and Sediment Control: 10% of project costs				$3,920.00
			Base Construction Costs	**$45,080.00**
			Mobilization (5%)	$2,254.00
			Subtotal 1	**$47,334.00**
			Contingency (25%)	$11,833.50
			Subtotal 2	**$59,167.50**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$26,625.38
			Total Costs	**$85,792.88**
			Estimated Project Costs	***$86,000.00***

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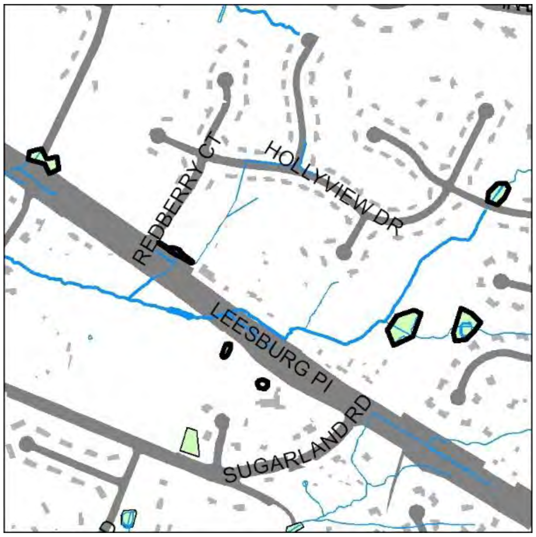
SU9005 Stormwater Pond Retrofit



Address:	11800 Leesburg Pike
Location:	Near Leesburg Pike, between Rolling Holly Drive & Sugarland Road
Land Owner:	County/Private
PIN:	0063-04-I, 0063-04-J, 0063-09-D, 0064-01-0066B, 0064-01-0041, 0064-15-C, 0064-15-0018, 0064-06-B
Control Type	Quality
Drainage Area	N/A
Receiving Waters	Sugarland Run

Description: The majority of this area does not have existing stormwater controls. Install infiltration trench/vegetated swales, rain gardens, and include eductional signage. Retrofit dry ponds (DP0562, 0570DP, and 1332DP) to enhanced extended detention dry bains and remove trickle ditches. Improve existing farm pond with vegetation and install outlet structure.

Project Area Map

Project Benefits: An estimated five tons/yr of total suspended solids will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. In addition, the rain garden will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat. The project will also provide educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. 0570DP and 1332DP are existing County facilities located within storm drainage easements. Infiltration trench/vegetated swale is also located within an existing storm drainage easement. DP0562 is an existing stormwater facility located on private land, farm pond retrofit and rain gardens are also located on private land. Additional storm drainage easements will be necessary. Accessibility is good from nearby roads or parking lots. Tree impacts are expected. No tree impacts or significant construction issues are anticipated.

Overall Costs

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	300	$50.00	$15,000.00
Bioretention Filters & Basin	SY	800	$150.00	$120,000.00
Organic Compost Soil Amendment	CY	150	$40.00	$6,000.00
Plantings	AC	0.64	$25,000.00	$16,000.00
Clear and Grub	AC	0.30	$8,500.00	$2,550.00
Grading and Excavation	CY	2940	$35.00	$102,900.00
Structural BMP Retrofit and Incidentals (Low)	LS	4	$10,000.00	$40,000.00
Embankment	CY	100	$50.00	$5,000.00
Outflow Pipe	LF	340	$125.00	$42,500.00
RipRap Stabilization	SY	60	$100.00	$6,000.00
			Initial Project Costs	**$355,950.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$17,797.50
Erosion and Sediment Control: 10% of project costs				$35,595.00
			Base Construction Costs	**$409,342.50**
			Mobilization (5%)	$20,467.13
			Subtotal 1	**$429,809.63**
			Contingency (25%)	$107,452.41
			Subtotal 2	**$537,262.03**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$241,767.91
			Total Costs	**$779,029.95**
			Estimated Project Costs	***$780,000.00***

SU9005C

Description: Construct new rain garden in church yard to provide water quantity control for storms up to a 10-year event and water quality treatment for church property. Install educational signage.

Project Area Map

***SU9005C* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	300	$150.00	$45,000.00
Organic Compost Soil Amendment	CY	10	$40.00	$400.00
Plantings	AC	0.05	$25,000.00	$1,250.00
			Initial Project Costs	**$46,650.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,332.50
Erosion and Sediment Control: 10% of project costs				$4,665.00
			Base Construction Costs	**$53,647.50**
			Mobilization (5%)	$2,682.38
			Subtotal 1	**$56,329.88**
			Contingency (25%)	$14,082.47
			Subtotal 2	**$70,412.34**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$31,685.55
			Total Costs	**$102,097.90**
			Estimated Project Costs	***$103,000.00***

SU9005E

Description: Retrofit existing dry pond 0570DP to enhanced extended detention dry basin, remove concrete trickle ditch and naturalize basin bottom with wetland vegetation.

Project Area Map

***SU9005E* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	30	$40.00	$1,200.00
Plantings	AC	0.15	$25,000.00	$3,750.00
Clear and Grub	AC	0.10	$8,500.00	$850.00
Grading and Excavation	CY	1000	$35.00	$35,000.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Embankment	CY	40	$50.00	$2,000.00
Outflow Pipe	LF	75	$125.00	$9,375.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
			Initial Project Costs	**$64,175.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,208.75
Erosion and Sediment Control: 10% of project costs				$6,417.50
			Base Construction Costs	**$73,801.25**
			Mobilization (5%)	$3,690.06
			Subtotal 1	**$77,491.31**
			Contingency (25%)	$19,372.83
			Subtotal 2	**$96,864.14**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$43,588.86
			Total Costs	**$140,453.00**
			Estimated Project Costs	***$141,000.00***

SU9005F

Description: Retrofit existing dry pond 1332DP to enhanced extended detention dry basin, remove concrete trickle ditch and naturalize basin bottom with wetland vegetation.

Project Area Map

***SU9005F* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	50	$40.00	$2,000.00
Plantings	AC	0.26	$25,000.00	$6,500.00
Clear and Grub	AC	0.10	$8,500.00	$850.00
Grading and Excavation	CY	1500	$35.00	$52,500.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Embankment	CY	40	$50.00	$2,000.00
Outflow Pipe	LF	115	$125.00	$14,375.00
RipRap Stabilization	SY	30	$100.00	$3,000.00
			Initial Project Costs	**$91,225.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,561.25
Erosion and Sediment Control: 10% of project costs				$9,122.50
			Base Construction Costs	**$104,908.75**
			Mobilization (5%)	$5,245.44
			Subtotal 1	**$110,154.19**
			Contingency (25%)	$27,538.55
			Subtotal 2	**$137,692.73**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$61,961.73
			Total Costs	**$199,654.46**
			Estimated Project Costs	***$200,000.00***

SU9005G

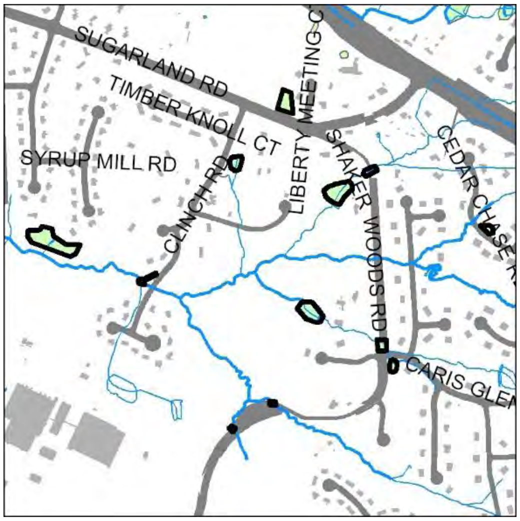
Description: Construct new rain garden/bioretention filter strip above and below culvert to provide for nutrient removal and reduced storm flows for up to a 10-year storm event.

Project Area Map

***SU9005G* Costs:**

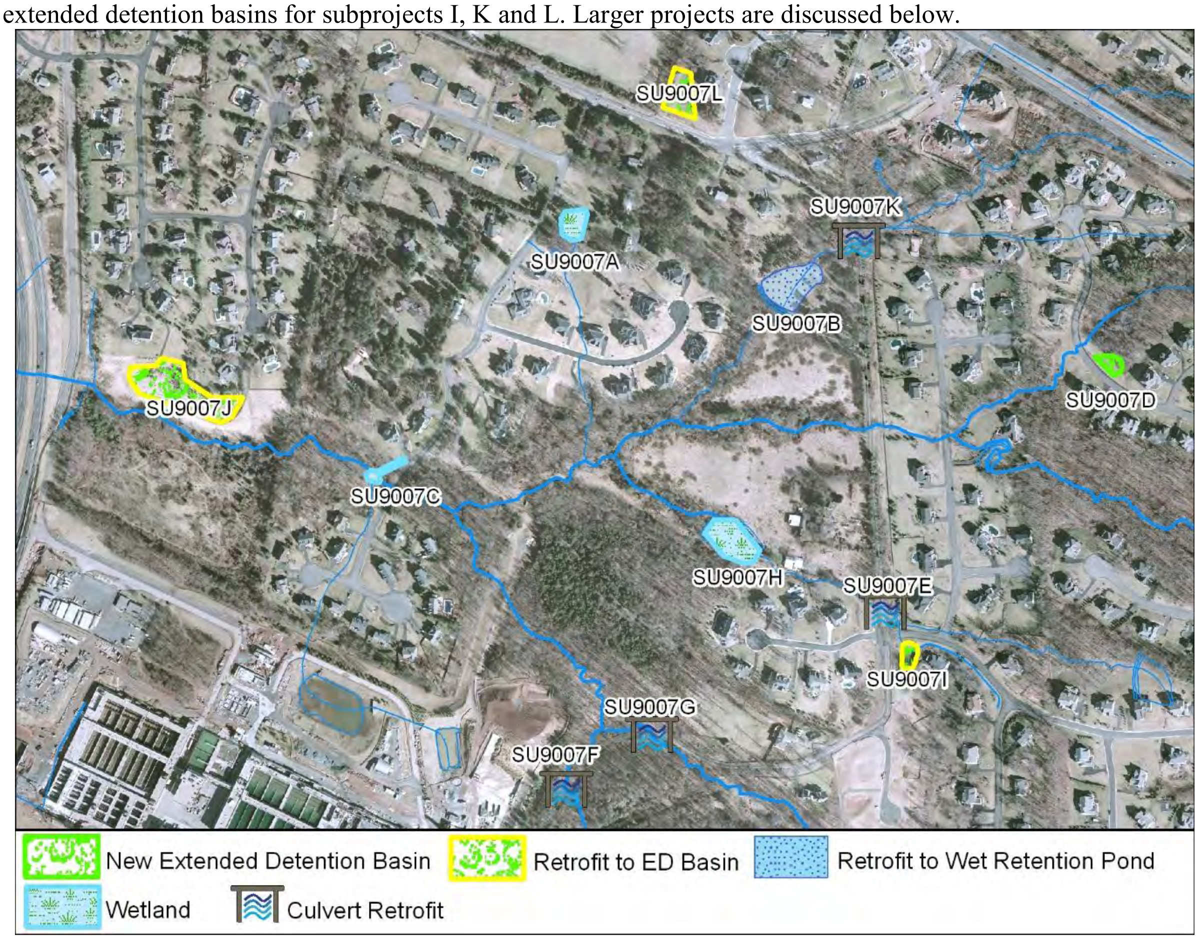
Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	500	$150.00	$75,000.00
Organic Compost Soil Amendment	CY	10	$40.00	$400.00
Plantings	AC	0.02	$25,000.00	$500.00
			Initial Project Costs	**$75,900.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,795.00
Erosion and Sediment Control: 10% of project costs				$7,590.00
			Base Construction Costs	**$87,285.00**
			Mobilization (5%)	$4,364.25
			Subtotal 1	**$91,649.25**
			Contingency (25%)	$22,912.31
			Subtotal 2	**$114,561.56**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$51,552.70
			Total Costs	**$166,114.27**
			Estimated Project Costs	***$167,000.00***

SU9007 Regional Pond Alternative Suite



Address:	
Location:	Between Leesburg Pike, Fairfax County Parkway & Wiehle Avenue
Land Owner:	State/County/Park/Private
PIN:	0063-18-0001, 0064-01-0072, 0064-01-0073, 0064-14-A, 0111-09-0039, 0111-09-A, 0111-09-B, 0111-12-A, 0112-01-0001, 0112-11-A, 0112-18-D
Control Type	Quality/Quantity
Drainage Area	281 acres
Receiving Waters	Offuts Branch

Description: Subbasins SU-FF-0002, 0003 and 0004 have minimal stormwater controls. A combination of twelve basin retrofits, wetlands, culvert retrofits and a new basin will provide stormwater controls for nearly two-thirds of the subbasins' 457 acres. Subprojects A and H involve converting an existing non-stormwater pond to a stormwater wetland. A new stormwater wetland will be constructed for SU9007B and three existing dry basins will be retrofitted to extended detention basins for subprojects I, K and L. Larger projects are discussed below.



Project Area Map

Project Benefits: This project will improve water quality in downstream waterbodies by removing an estimated nine tons/yr of total suspended solids, 77 lbs/yr of nitrogen, and 16 lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Culvert retrofits will reduce local roadway flooding.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. A new constructed wetland and farm pond retrofit are located within existing County storm drainage easements. Two farm pond retrofits, a new stormwater basin, and two existing dry pond retrofits are located on private land. A third existing dry pond retrofit is located on County park land, and four culvert retrofits are located within VDOT rights-of-way. Additional storm drainage easements will be necessary. Accessibility is ranges from excellent to difficult. Tree impacts are expected. No significant construction issues are anticipated.

Overall Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	190	$50.00	$9,500.00
Bioretention Filters & Basin	SY	70	$150.00	$10,500.00
Organic Compost Soil Amendment	CY	350	$40.00	$14,000.00
Plantings	AC	0.85	$25,000.00	$21,250.00
Clear and Grub	AC	0.74	$8,500.00	$6,290.00
Grading and Excavation	CY	3020	$35.00	$105,700.00
Earthen Berm	CY	10	$35.00	$350.00
Access Road	SY	405	$25.00	$10,125.00
Access Road Gate	EA	2	$2,500.00	$5,000.00
Structural BMP and Incidentals (Low)	LS	6	$10,000.00	$60,000.00
New Storm Pipe (Low)	LF	180	$100.00	$18,000.00
Embankment	CY	250	$50.00	$12,500.00
Outflow Pipe	LF	140	$125.00	$17,500.00
RipRap Stabilization	SY	200	$100.00	$20,000.00
Structural BMP Retrofit and Incidentals (Low)	LS	2	$10,000.00	$20,000.00
			Initial Project Costs	**$330,715.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$16,535.75
Erosion and Sediment Control: 10% of project costs				$33,071.50
			Base Construction Costs	**$380,322.25**
			Mobilization (5%)	$19,016.11
			Subtotal 1	**$399,338.36**
			Contingency (25%)	$99,834.59
			Subtotal 2	**$499,172.95**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$224,627.83
			Total Costs	**$723,800.78**
			Estimated Project Costs	***$730,000.00***

SU9007C

Description: Install new in-line constructed wetland near nature trail. Replace gravel bed with vegetated swale to direct runoff towards new constructed wetlands. Educate adjacent homeowners regarding best practices and appropriate stormwater management.

Project Area Map

***SU9007C Costs*:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	80	$50.00	$4,000.00
Bioretention Filters & Basin	SY	70	$150.00	$10,500.00
Organic Compost Soil Amendment	CY	113	$40.00	$4,520.00
Plantings	AC	0.28	$25,000.00	$7,000.00
Clear and Grub	AC	0.02	$8,500.00	$170.00
Grading and Excavation	CY	1245	$35.00	$43,575.00
Access Road	SY	180	$25.00	$4,500.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	25	$100.00	$2,500.00
Embankment	CY	40	$50.00	$2,000.00
			Initial Project Costs	**$91,265.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,563.25
Erosion and Sediment Control: 10% of project costs				$9,126.50
			Base Construction Costs	**$104,954.75**
			Mobilization (5%)	$5,247.74
			Subtotal 1	**$110,202.49**
			Contingency (25%)	$27,550.62
			Subtotal 2	**$137,753.11**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$61,988.90
			Total Costs	**$199,742.01**
			Estimated Project Costs	***$200,000.00***

SU9007D

Description: Construct new extended detention dry basin in low area to intercept storm drains.

Project Area Map

***SU9007D* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	40	$40.00	$1,600.00
Plantings	AC	0.10	$25,000.00	$2,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	390	$35.00	$13,650.00
Access Road	SY	225	$25.00	$5,625.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	30	$100.00	$3,000.00
Embankment	CY	25	$50.00	$1,250.00
			Initial Project Costs	**$40,550.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,027.50
Erosion and Sediment Control: 10% of project costs				$4,055.00
			Base Construction Costs	**$46,632.50**
			Mobilization (5%)	$2,331.63
			Subtotal 1	**$48,964.13**
			Contingency (25%)	$12,241.03
			Subtotal 2	**$61,205.16**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$27,542.32
			Total Costs	**$88,747.48**
			Estimated Project Costs	***$89,000.00***

SU9007E

Description: Roadway culvert is undersized and filling with sediment. Remove sediment blocking culvert, replace culvert with adequately sized culvert, and raise road bed as necessary. Construct micro-pool with wetland vegetation upstream of culvert to settle sediment loads and prevent clogging of culverts.

Project Area Map

***SU9007E* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	40	$40.00	$1,600.00
Plantings	AC	0.10	$25,000.00	$2,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	410	$35.00	$14,350.00
Access Road	SY	400	$25.00	$10,000.00
New Storm Pipe (Low)	LF	40	$100.00	$4,000.00
Embankment	CY	110	$50.00	$5,500.00
Earthen Berm	CY	5	$35.00	$175.00
RipRap Stabilization	SY	65	$100.00	$6,500.00
			Initial Project Costs	**$45,050.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,252.50
Erosion and Sediment Control: 10% of project costs				$4,505
			Base Construction Costs	**$51,807.50**
			Mobilization (5%)	$2,590.38
			Subtotal 1	**$54,397.88**
			Contingency (25%)	$13,599.47
			Subtotal 2	**$67,997.34**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$30,598.80
			Total Costs	**$98,596.15**
			Estimated Project Costs	***$99,000.00***

SU9007F

Description: Roadway culvert is undersized and has been damaged by debris from large flows. Replace damaged culvert with appropriately sized culvert and raise road bed. Construct a plunge pool and plant with wetland vegetation downstream of culvert.

Project Area Map

***SU9007F* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	20	$40.00	$800.00
Plantings	AC	0.05	$25,000.00	$1,250.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	410	$35.00	$14,350.00
Access Road	SY	400	$25.00	$10,000.00
New Storm Pipe (Low)	LF	40	$100.00	$4,000.00
Embankment	CY	110	$50.00	$5,500.00
Earthen Berm	CY	3	$35.00	$105.00
RipRap Stabilization	SY	65	$100.00	$6,500.00
			Initial Project Costs	**$42,930.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,146.50
Erosion and Sediment Control: 10% of project costs				$4,293.00
			Base Construction Costs	**$49,369.50**
			Mobilization (5%)	$2,468.48
			Subtotal 1	**$51,837.98**
			Contingency (25%)	$12,959.49
			Subtotal 2	**$64,797.47**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$29,158.86
			Total Costs	**$93,956.33**
			Estimated Project Costs	***$94,000.00***

SU9007G

Description: Roadway culvert is undersized and filling with sediment. Remove sediment blocking culvert and stabilize eroded stream banks. Replace culvert with adequately sized culvert, and raise road bed as necessary.

Project Area Map

***SU9007G Costs*:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	20	$40.00	$800.00
Plantings	AC	0.05	$25,000.00	$1,250.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	370	$35.00	$12,950.00
Access Road	SY	400	$25.00	$10,000.00
New Storm Pipe (Low)	LF	40	$100.00	$4,000.00
Embankment	CY	110	$50.00	$5,500.00
Earthen Berm	CY	3	$35.00	$105.00
RipRap Stabilization	SY	65	$100.00	$6,500.00
			Initial Project Costs	**$41,530.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,076.50
Erosion and Sediment Control: 10% of project costs				$4,153.00
			Base Construction Costs	**$47,759.50**
			Mobilization (5%)	$2,387.98
			Subtotal 1	**$50,147.48**
			Contingency (25%)	$12,536.87
			Subtotal 2	**$62,684.34**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$28,207.95
			Total Costs	**$90,892.30**
			Estimated Project Costs	***$91,000.00***

SU9007K

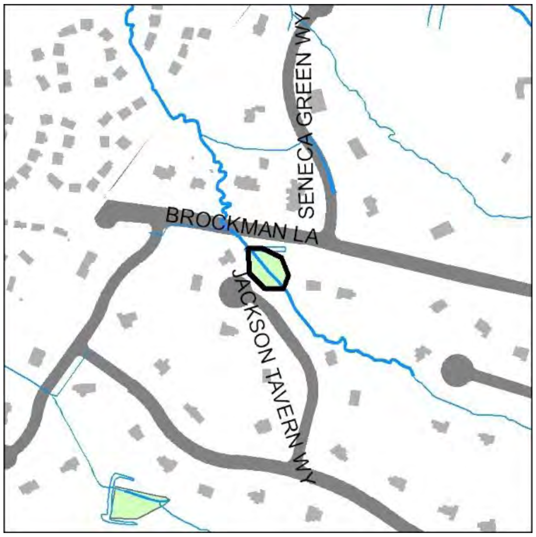
Description: Improve dry pond 0727DP to extended detention dry basin. Raise elevation of embankments and retrofit outlet structure for additional storage capacity. Naturalize basin bottom with wetland plantings.

Project Area Map

***SU9007K* Costs:**

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	20	$40.00	$1,600.00
Plantings	AC	0.10	$25,000.00	$2,500.00
Clear and Grub	AC	0.10	$8,500.00	$850.00
Grading and Excavation	CY	370	$35.00	$12,950.00
Access Road	SY	400	$25.00	$10,000.00
New Storm Pipe (Low)	LF	50	$100.00	$5,000.00
Embankment	CY	120	$50.00	$6,000.00
RipRap Stabilization	SY	75	$100.00	$7,500.00
			Initial Project Costs	**$46,400.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,320.00
Erosion and Sediment Control: 10% of project costs				$4,640.00
			Base Construction Costs	**$53,360.00**
			Mobilization (5%)	$2,668.00
			Subtotal 1	**$56,028.00**
			Contingency (25%)	$14,007.00
			Subtotal 2	**$70,035.00**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$31,515.75
			Total Costs	**$101,550.75**
			Estimated Project Costs	***$102,000.00***

SU9100 Stormwater Pond Retrofit



Address:	501 Jackson Tavern Way
Location:	Jackson Tavern Way cul-de-sac
Land Owner:	County
PIN:	0024-09-0025A
Control Type	Quality/Quantity
Drainage Area	53 acres
Receiving Waters	Sugarland Run

Description: The Great Falls West basin provides only water quantity control. Retrofit existing dry pond (1445DP) to enhanced extended detention dry basin with marsh areas, including installation of proper outlet structure and clearing of blocked culvert pipe.

Project Area Map

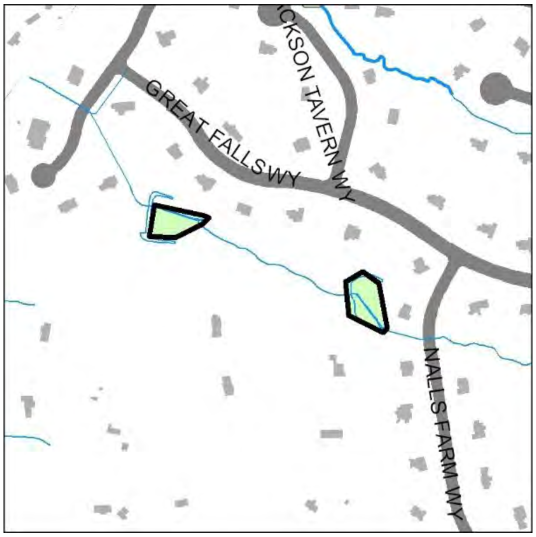
Project Benefits: An estimated one ton/yr of total suspended solids, 33 lbs/yr of nitrogen, and six lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Projects in RPAs may require exceptions. This is an existing County facility located within a storm drainage easement on private land. Accessibility is excellent from Jackson Tavern Lane. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	109	$40.00	$4,360.00
Plantings	AC	0.27	$25,000.00	$6,750.00
Clear and Grub	AC	0.17	$8,500.00	$1,445.00
Grading and Excavation	CY	1305	$35.00	$45,675.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$73,830.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,691.50
Erosion and Sediment Control: 10% of project costs				$7,383.00
			Base Construction Costs	**$84,904.50**
			Mobilization (5%)	$4,245.23
			Subtotal 1	**$89,149.73**
			Contingency (25%)	$22,287.43
			Subtotal 2	**$111,437.16**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$50,146.72
			Total Costs	**$161,583.88**
			Estimated Project Costs	***$170,000.00***

SU9101 Stormwater Pond Retrofit



Address:	11639 Great Falls Way
Location:	Near Great Falls Way & Jackson Tavern Way
Land Owner:	County/Private
PIN:	0024-09-0032, 0024-09-0033, 0024-09-0038
Control Type	Quality/Quantity
Drainage Area	50 acres
Receiving Waters	Sugarland Run

Description: The Great Falls West basins provide only water quantity control. Retrofit existing dry ponds (1447DP and 1446DP) to enhanced extended detention dry basin with marsh areas, remove trickle ditches, install proper outlet structures and increase spillway elevation.

Project Area Map

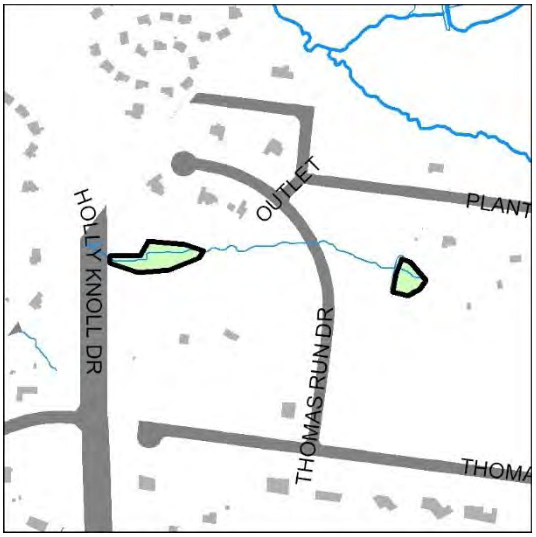
Project Benefits: This project will reduce sediment and nutrient loadings pollutions, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. 1446DP is an existing County facility located within a storm drainage easement on private land. 1447DP is an existing stormwater facility located on private land, a drainage easement will be necessary for 1447DP, which is located near an access easement. Accessibility may be difficult, and access easements may be required as they are located on private residential properties. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	269	$40.00	$10,760.00
Plantings	AC	0.66	$25,000.00	$16,500.00
Clear and Grub	AC	0.43	$8,500.00	$3,655.00
Grading and Excavation	CY	3222	$35.00	$112,770.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	40	$125.00	$5,000.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$176,185.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$8,809.25
Erosion and Sediment Control: 10% of project costs				$17,618.50
			Base Construction Costs	**$202,612.75**
			Mobilization (5%)	$10,130.64
			Subtotal 1	**$212,743.39**
			Contingency (25%)	$53,185.85
			Subtotal 2	**$265,929.23**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$119,668.16
			Total Costs	**$385,597.39**
			Estimated Project Costs	***$390,000.00***

SU9103 Stormwater Pond Retrofit



Address:	812 Thomas Run Drive
Location:	Thomas Run Drive
Land Owner:	County/Private
PIN:	0061-01-0012A, 0061-10-A
Control Type	Quality/Quantity
Drainage Area	73 acres
Receiving Waters	Sugarland Run

Description: Kentland Farms and Thomas Avenue have few stormwater controls. Retrofit existing dry pond to an enhanced extended detention dry basin with marsh areas and micro-pool, remove trickle ditch. Drain near-by farm pond to create a new constructed wetland.

Project Area Map

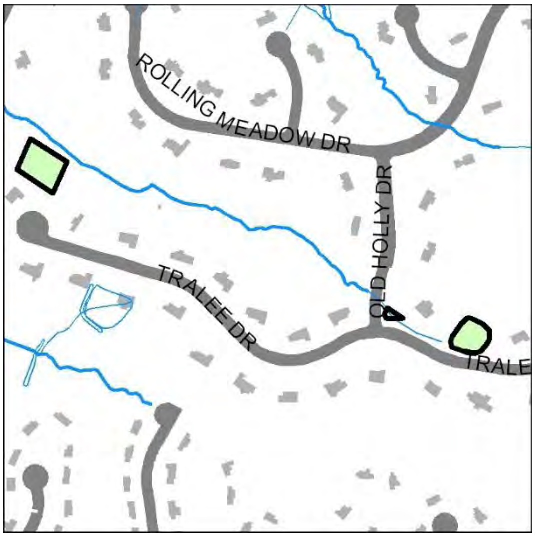
Project Benefits: An estimated two tons/yr of total suspended solids, 71 lbs/yr of nitrogen, and 14 lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The existing dry pond is located within a storm drainage easement, restrictive planting easement, and Fairfax water easement, and is adjacent to an access easement. A storm drainage easement will be necessary for the constructed wetland. Accessibility is excellent via the access easement from Thomas Run Drive and the private driveway from Plantation Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	297	$40.00	$11,880.00
Plantings	AC	0.74	$25,000.00	$18,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	1281	$35.00	$44,835.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	8	$100.00	$800.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$94,690.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,734.50
Erosion and Sediment Control: 10% of project costs				$9,469.00
			Base Construction Costs	**$108,893.50**
			Mobilization (5%)	$5,444.68
			Subtotal 1	**$114,338.18**
			Contingency (25%)	$28,584.54
			Subtotal 2	**$142,922.72**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$64,315.22
			Total Costs	**$207,237.94**
			Estimated Project Costs	***$210,000.00***

SU9106 Stormwater Pond Retrofit, BMP/LID



Address:	11558 and 11538 Tralee Drive
Location:	Near Tralee Drive & Old Holly Drive
Land Owner:	Private
PIN:	0064-13-0006, 0064-13020020, 0064-1302-A1, 0064-13-A2
Control Type	Quality/Quantity
Drainage Area	33
Receiving Waters	Sugarland Run

Description: Retrofit existing dry ponds (1382DP and 1454DP) to extended detention dry basins for improved quality and quantity control. Remove trickle ditches, retrofit outlet structures, and naturalize. Install a rain garden around an existing inlet.

Project Area Map

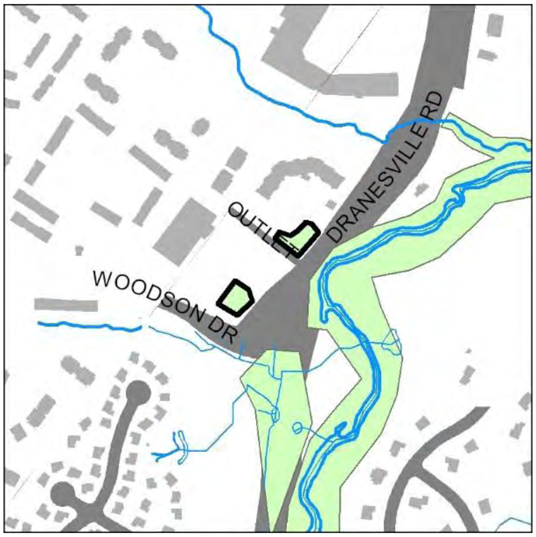
Project Benefits: This project will reduce sediment and nutrient loadings to downstream waterbodies, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. The rain garden will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Projects in RPAs may require exceptions. These basins are existing stormwater facilities located on private land. Storm drainage easements will be necessary. Accessibility is excellent from Tralee Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	222	$150.00	$33,300.00
Organic Compost Soil Amendment	CY	237	$40.00	$9,480.00
Plantings	AC	0.86	$25,000.00	$21,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	2622	$35.00	$91,770.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Low)	LS	2	$10,000.00	$20,000.00
			Initial Project Costs	**$182,725.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$9,136.25
Erosion and Sediment Control: 10% of project costs				$18,272.50
			Base Construction Costs	**$210,133.75**
			Mobilization (5%)	$10,506.69
			Subtotal 1	**$220,640.44**
			Contingency (25%)	$55,160.11
			Subtotal 2	**$275,800.55**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$124,110.25
			Total Costs	**$399,910.79**
			Estimated Project Costs	***$400,000.00***

SU9108 Stormwater Pond Retrofit



Address:	1100 and 1108 Dranesville Road
Location:	Dranesville Road & Woodson Drive
Land Owner:	Private
PIN:	0063-01-0011, 0063-01-0011A
Control Type	Quality/Quantity
Drainage Area	6 acres
Receiving Waters	Sugarland Run

Description: Retrofit Bowl America dry pond to extended detention dry basin and Sugarland Hill dry pond (0570DP) to enhanced extended detention dry basin with marsh areas for improved quality and quantity controls. Install educational signage.

Project Area Map

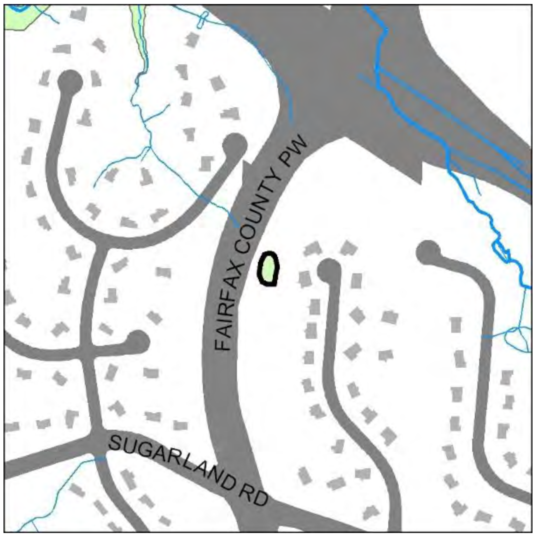
Project Benefits: This project will reduce sediment and nutrient loadings to downstream waterbodies, improve water quality, reduce peak stormwater flows for storms up to a 10- year event, and provide for evapotranspiration and wildlife habitat. By adding educational signs, the general public will be provided with important information on how the basins are protecting water quality in the County.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. SU9108B is an existing stormwater facility located on private land, and is partially located on an access easement. Storm drainage easements will be necessary. Accessibility is excellent from Dranesville Road and adjacent parking lots. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	120	$40.00	$4,800.00
Plantings	AC	0.45	$25,000.00	$11,250.00
Clear and Grub	AC	0.15	$8,500.00	$1,275.00
Grading and Excavation	CY	1439	$35.00	$50,365.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	40	$125.00	$5,000.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Low)	LS	2	$10,000.00	$20,000.00
			Initial Project Costs	**$95,190.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,759.50
Erosion and Sediment Control: 10% of project costs				$9,519.00
			Base Construction Costs	**$109,468.50**
			Mobilization (5%)	$5,473.43
			Subtotal 1	**$114,941.93**
			Contingency (25%)	$28,735.48
			Subtotal 2	**$143,677.41**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$64,654.83
			Total Costs	**$208,332.24**
			Estimated Project Costs	***$210,000.00***

SU9110 Stormwater Pond Retrofit



Address:	1062 Methven Court
Location:	Methven Court cul-de-sac
Land Owner:	County
PIN:	0063-14-A
Control Type	Quality/Quantity
Drainage Area	8 acres
Receiving Waters	Sugarland Run

Description: Existing dry pond in Laing at Sugarland subdivision will be enlarged and retrofitted to extended detention basin to provide additional quantity and quality control. Remove concrete trickle ditch and install proper outlet structure.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings to downstream waterbodies, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. Removal of the trickle ditch will slow stormwater runoff velocities, and a new outlet structure will allow for a more controlled rate of discharge from the basin.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This dry pond is an existing County facility located within a storm drainage easement on private land. Accessibility is excellent via the storm drainage easement Methven Court. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	40	$40.00	$1,600.00
Plantings	AC	0.15	$25,000.00	$3,750.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	944	$35.00	$33,040.00
Embankment	CY	100	$50.00	$5,000.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	8	$100.00	$800.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$57,115.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,855.75
Erosion and Sediment Control: 10% of project costs				$5,711.50
			Base Construction Costs	**$65,682.25**
			Mobilization (5%)	$3,284.11
			Subtotal 1	**$68,966.36**
			Contingency (25%)	$17,241.59
			Subtotal 2	**$86,207.95**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$38,793.58
			Total Costs	**$125,001.53**
			Estimated Project Costs	***$130,000.00***

SU9117 Stormwater Pond Retrofit

Address:	12537 Misty Water Drive & 12573 Rock Ridge Road
Location:	Dranesville Road & Hiddenbrook Drive
Land Owner:	County/Private
PIN:	0102-14-B, 0102-14-H
Control Type	Quality/Quantity
Drainage Area	73 acres
Receiving Waters	Folly Lick Branch

Description: Retrofit existing dry pond (0827DP) to extended detention dry basin and adjacent, existing dry ponds (0637DP and 0934DP) to a single enhanced extended detention dry basin with marsh areas. Remove trickle ditches, install forebay and install/retrofit outlet structure.

Project Area Map

Project Benefits: This project will improve water quality in downstream waterbodies by removing an estimated five tons/yr of total suspended solids, 68 lbs/yr of nitrogen, and 13 lbs/yr of phosphorus. The retrofitted basin will reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Removal of the trickle ditch will slow stormwater velocities, and the installation of the forebay will enhance sediment deposition at the inlet of the basin.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. These basins are existing County facilities. 0934DP and 0827DP are located on storm drainage easements. The storm drainage easement for 0934DP will need to be expanded to include 0637DP. They are all located adjacent to a Colonial Gas easement. Accessibility is excellent from Hiddenbrook Drive, Rock Ridge Road, or the gas easement. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	446	$40.00	$17,840.00
Plantings	AC	1.07	$25,000.00	$26,750.00
Clear and Grub	AC	0.81	$8,500.00	$6,885.00
Grading and Excavation	CY	3820	$35.00	$133,700.00
Embankment	CY	45	$50.00	$2,250.00
Outflow Pipe	LF	50	$125.00	$6,250.00
RipRap Stabilization	SY	22	$100.00	$2,200.00
Structural BMP and Incidentals (Med)	LS	2	$15,000.00	$30,000.00
			Initial Project Costs	**$225,875.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$11,293.75
Erosion and Sediment Control: 10% of project costs				$22,587.50
			Base Construction Costs	**$259,756.25**
			Mobilization (5%)	$12,987.81
			Subtotal 1	**$272,744.06**
			Contingency (25%)	$68,186.02
			Subtotal 2	**$340,930.08**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$153,418.54
			Total Costs	**$494,348.61**
			Estimated Project Costs	***$500,000.00***

SU9123 Stormwater Pond Retrofit

Address:	12538 Philmont Drive
Location:	Near Philmont Drive & Judd Court
Land Owner:	Private
PIN:	0102-16-C4
Control Type	Quality/Quantity
Drainage Area	60 acres
Receiving Waters	Folly Lick Branch

Description: Improve existing regional dry pond S-04 (1440DP) to enhanced extended detention dry basin with marsh areas. Remove concrete trickle ditch and retrofit outlet structure.

Project Area Map

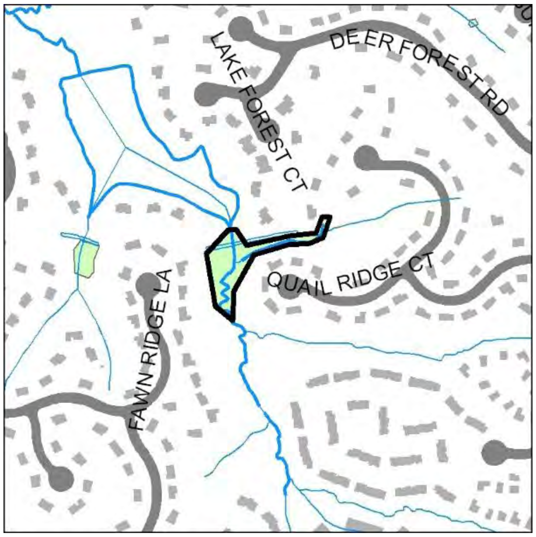
Project Benefits: An estimated one ton/yr of total suspended solids, 75 lbs/yr of nitrogen, and 10 lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Projects in RPAs may require exceptions. This is an existing stormwater facility located on private land. A storm drainage easement will be necessary. Accessibility is excellent from Philmont Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	158	$40.00	$6,320.00
Plantings	AC	0.79	$25,000.00	$19,750.00
Grading and Excavation	CY	2535	$35.00	$88,725.00
Embankment	CY	200	$50.00	$10,000.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$138,395.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,919.75
Erosion and Sediment Control: 10% of project costs				$13,839.50
			Base Construction Costs	**$159,154.25**
			Mobilization (5%)	$7,957.71
			Subtotal 1	**$167,111.96**
			Contingency (25%)	$41,777.99
			Subtotal 2	**$208,889.95**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$94,000.48
			Total Costs	**$302,890.43**
			Estimated Project Costs	***$310,000.00***

SU9129 Stormwater Pond Retrofit



Address:	11600 Quail Ridge Court
Location:	Near Quail Ridge Court cul-de-sac
Land Owner:	Private
PIN:	0113-01-0003, 0114-07-A
Control Type	Quality
Drainage Area	117 acres
Receiving Waters	Rosiers Branch

Description: The outlet structure for existing dry pond (0336DP) is frequently clogged, reducing the funcionality of the pond. Install a micro-pool with wetland vegetation above outlet structure to reduce clogging. Vegetate the pond bottom and replace concrete channel upstream with vegetated swale with check dams for energy dissipation.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings pollutions, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. This basin is an existing stormwater facility. A small part of the concrete channel is located on a storm drainage easement. The pond and the remainder of the concrete channel are located on private land and will require a stormwater easement. Accessibility is good from an adjacent Colonial Gas easement from Quail Ridge Court. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	440	$50.00	$22,000.00
Organic Compost Soil Amendment	CY	282	$40.00	$11,280.00
Plantings	AC	1.05	$25,000.00	$26,250.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	163	$35.00	$5,705.00
Structural BMP and Incidentals (High)	LS	1	$20,000.00	$20,000.00
			Initial Project Costs	**$86,085.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,304.25
Erosion and Sediment Control: 10% of project costs				$8,608.50
			Base Construction Costs	**$98,997.75**
			Mobilization (5%)	$4,949.89
			Subtotal 1	**$103,947.64**
			Contingency (25%)	$25,986.91
			Subtotal 2	**$129,934.55**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$58,470.55
			Total Costs	**$188,405.09**
			Estimated Project Costs	***$190,000.00***

SU9130 New Stormwater Pond

Address:	702 Jenny Ann Court
Location:	Near Jenny Ann Court cul-de-sac
Land Owner:	Private
PIN:	0104-02-0057E, 0104-17-0044, 0104-17-0045, 0104-17-0046, 0104-17-0047, 0104-17-0048, 0104-17-0049, 0104-17-0050
Control Type	Quality/Quantity
Drainage Area	80 acres
Receiving Waters	Sugarland Run

Description: 'Iron Ridge Section 2, Potomac Fairways, Van Vlecks, Chestnut Grove, and Graymor subdivisions do not have existing stormwater controls. Install new extended detention dry basin and install vegetated swale behind homes/along Herndon Parkway to direct runoff to new facility.

Project Area Map

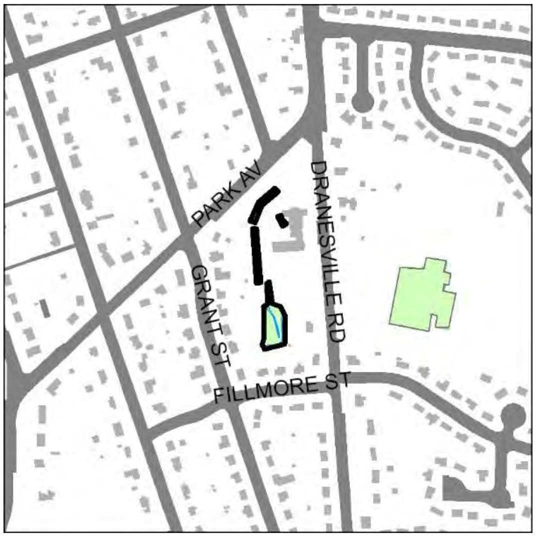
Project Benefits: An estimated six tons/yr of total suspended solids, 124 lbs/yr of nitrogen, and 23 lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. The vegetated swale will promote additional infiltration, evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Storm drainage easements will be necessary. Accessibility may be difficult due to treeline along Herndon Parkway and surrounding residential dwellings. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	300	$50.00	$15,000.00
Organic Compost Soil Amendment	CY	28	$40.00	$1,120.00
Plantings	AC	0.07	$25,000.00	$1,750.00
Clear and Grub	AC	0.13	$8,500.00	$1,105.00
Grading and Excavation	CY	622	$35.00	$21,770.00
Access Road	SY	222	$25.00	$5,550.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Embankment	CY	8	$50.00	$400.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	20	$200.00	$4,000.00
			Initial Project Costs	**$68,195.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,409.75
Erosion and Sediment Control: 10% of project costs				$6,819.50
			Base Construction Costs	**$78,424.25**
			Mobilization (5%)	$3,921.21
			Subtotal 1	**$82,345.46**
			Contingency (25%)	$20,586.37
			Subtotal 2	**$102,931.83**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$46,319.32
			Total Costs	**$149,251.15**
			Estimated Project Costs	***$150,000.00***

SU9135 Stormwater Pond Retrofit, BMP/LID



Address:	651 Dranesville Road
Location:	Trinity Presbyterian Church
Land Owner:	Private
PIN:	0104-07-A2
Control Type	Quality/Quantity
Drainage Area	10.2 acres
Receiving Waters	Sugarland Run

Description: Retrofit existing dry pond to enhanced extended detention dry basin with marsh areas to improve water quality and quantity treatment. Remove concrete trickle ditch, retrofit outlet structure. Install infiltration trenches in parking lot islands for additional quality control.

Project Area Map

Project Benefits: An estimated one ton/yr of total suspended solids, 25 lbs/yr of nitrogen, and five lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. Additionally, the rain garden and infiltration trenches will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This basin is an existing stormwater facility located on private land. Storm drainage easements will be necessary. Accessibility is excellent from Trinity Presbyterian Church parking lot. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	178	$50.00	$8,900.00
Percolation/Infiltration Trench	SY	939	$75.00	$70,425.00
Bioretention Filters & Basin	SY	84	$150.00	$12,600.00
Organic Compost Soil Amendment	CY	169	$40.00	$6,760.00
Plantings	AC	0.42	$25,000.00	$10,500.00
Grading and Excavation	CY	556	$35.00	$19,460.00
Embankment	CY	10	$50.00	$500.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	8	$100.00	$800.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$142,445.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$7,122.25
Erosion and Sediment Control: 10% of project costs				$14,244.50
			Base Construction Costs	**$163,811.75**
			Mobilization (5%)	$8,190.59
			Subtotal 1	**$172,002.34**
			Contingency (25%)	$43,000.58
			Subtotal 2	**$215,002.92**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$96,751.31
			Total Costs	**$311,754.24**
			Estimated Project Costs	***$320,000.00***

SU9136 New Stormwater Pond

Address:	215 Herndon Parkway
Location:	Hunter's Creek Pool
Land Owner:	Private
PIN:	0113-04-C
Control Type	Quality/Quantity
Drainage Area	161 acres
Receiving Waters	Sugarland Run

Description: Hunter's Creek and Hunter's Creek Section 2, Ashburn, The Villages, Runnymeade Manor Chelmstord, Cassa Goettling, Sugar Land Heights, Yount, and Madison Forest subdivisions have no existing stormwater controls and the recieving stream is deteriorating due to high storm flows. Install a new extended detention dry basin just downstream of Runnymeade Park on Hunter's Creek Pool property.

Project Area Map

Project Benefits: An estimated three tons/yr of total suspended solids, 51 lbs/yr of nitrogen, and nine lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. A storm drainage easement will be necessary. Accessibility is excellent from Hunter's Creek pool parking lot. Some tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	35	$40.00	$1,400.00
Plantings	AC	0.05	$25,000.00	$1,250.00
Clear and Grub	AC	0.80	$8,500.00	$6,800.00
Grading and Excavation	CY	400	$35.00	$14,000.00
Access Road	SY	60	$25.00	$1,500.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Embankment	CY	15	$50.00	$750.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	30	$200.00	$6,000.00
			Initial Project Costs	**$49,200.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,460.00
Erosion and Sediment Control: 10% of project costs				$4,920.00
			Base Construction Costs	**$56,580.00**
			Mobilization (5%)	$2,829.00
			Subtotal 1	**$59,409.00**
			Contingency (25%)	$14,852.25
			Subtotal 2	**$74,261.25**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$33,417.56
			Total Costs	**$107,678.81**
			Estimated Project Costs	***$110,000.00***

SU9139 Stormwater Pond Retrofit

Address:	1748 Stuart Pointe Lane
Location:	Towns at Stuart Pointe Subdivision, Stuart Pointe Lane
Land Owner:	County
PIN:	0171-24-A
Control Type	Quality/Quantity
Drainage Area	3 acres
Receiving Waters	Sugarland Run

Description: Retrofit Towns at Stuart Pointe dry pond (1456 DP) to enhanced extended detention with marsh areas. Remove concrete trickle ditch and install proper outlet structure.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings pollutions, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This basin is an existing County facility, and is located within a storm drainage easement on private land. Accessibility is excellent from Stuart Pointe Lane. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	***Units***	***Quantity***	***Unit Cost***	***Total***
Organic Compost Soil Amendment	CY	31	$40.00	$1,240.00
Plantings	AC	0.08	$25,000.00	$2,000.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	367	$35.00	$12,845.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	8	$100.00	$800.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$30,360.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$1,518.00
Erosion and Sediment Control: 10% of project costs				$3,036.00
			Base Construction Costs	**$34,914.00**
			Mobilization (5%)	$1,745.70
			Subtotal 1	**$36,659.70**
			Contingency (25%)	$9,164.93
			Subtotal 2	**$45,824.63**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$20,621.08
			Total Costs	**$66,445.71**
			Estimated Project Costs	***$70,000.00***

SU9143 Stormwater Pond Retrofit

Address:	347 Elden Street
Location:	Near Grove Street & Herndon Parkway
Land Owner:	Private
PIN:	0171-02-0027, 0171-02-0028, 0171-02-0029
Control Type	Quality/Quantity
Drainage Area	3 acres
Receiving Waters	Sugarland Run

Description: Retrofit two existing dry ponds along Grove Street to enhanced extended detention dry basins with marsh areas and appropriate outlet structures to improve pond efficiency and function.

Project Area Map

Project Benefits: This project will generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. These basins are existing stormwater facilities located on private land. Storm drainage easements will be necessary. Accessibility is excellent from Grove Street and nearby parking lots. No tree impacts or significant construction issues are anticipated. These basins are landscaped with herbaceous vegetation.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	63	$40.00	$2,520.00
Plantings	AC	0.23	$25,000.00	$5,750.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	756	$35.00	$26,460.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	40	$125.00	$5,000.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Low)	LS	2	$10,000.00	$20,000.00
			Initial Project Costs	**$63,080.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,154.00
Erosion and Sediment Control: 10% of project costs				$6,308.00
			Base Construction Costs	**$72,542.00**
			Mobilization (5%)	$3,627.10
			Subtotal 1	**$76,169.10**
			Contingency (25%)	$19,042.28
			Subtotal 2	**$95,211.38**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$42,845.12
			Total Costs	**$138,056.49**
			Estimated Project Costs	***$140,000.00***

SU9144 New Stormwater Pond, BMP/LID

Address:	(nearest) 1778 Fountain Drive
Location:	Bowman Towne Drive & Fountain Drive
Land Owner:	Park/Private
PIN:	0171-01-0014B, 0171-01-0014D, 0171-01-0014E, 0171-01-0014F
Control Type	Quality/Quantity
Drainage Area	31 acres
Receiving Waters	Sugarland Run

Description: Some of this area does not have existing stormwater treatment Install three new extended detention dry basins. Daylight stormwater runoff from storm sewers into basin. Install rain garden around existing depressed inlet.

Project Area Map

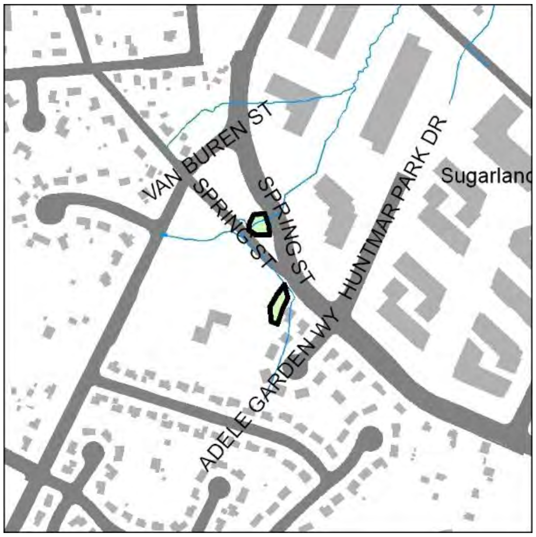
Project Benefits: An estimated 23 tons/yr of total suspended solids, 480 lbs/yr of nitrogen, and 106 lbs/yr of phosphorus will be removed. This project will also generally improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. The rain garden will promote additional infiltration, evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. One of the three new stormwater basins are located on County park land, the remaining two basins and rain garden are located on private land. Storm drainage easements will be necessary. Accessibility is excellent from Town Center Parkway, Fountain Drive, and parking lots off of Bowman Towne Drive. Tree impacts are expected. The basins must be deep enough to intercept piped storm sewers.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	110	$40.00	$4,400.00
Plantings	AC	0.21	$25,000.00	$5,250.00
Clear and Grub	AC	0.15	$8,500.00	$1,275.00
Grading and Excavation	CY	867	$35.00	$30,345.00
Access Road	SY	220	$25.00	$5,500.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	3	$10,000.00	$30,000.00
New Storm Pipe (Low)	LF	60	$100.00	$6,000.00
Embankment	CY	22	$50.00	$1,100.00
RipRap Stabilization	SY	30	$100.00	$3,000.00
			Initial Project Costs	**$89,370.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,468.50
Erosion and Sediment Control: 10% of project costs				$8,937.00
			Base Construction Costs	**$102,775.50**
			Mobilization (5%)	$5,138.78
			Subtotal 1	**$107,914.28**
			Contingency (25%)	$26,978.57
			Subtotal 2	**$134,892.84**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$60,701.78
			Total Costs	**$195,594.62**
			Estimated Project Costs	***$200,000.00***

SU9146 Stormwater Pond Retrofit, New Stormwater Pond



Address:	550 Van Buren Street & 491 Spring Street
Location:	Next to St. Timothy's Episcopal Church, Spring Street
Land Owner:	County/Private
PIN:	0162-02-0156A, 0162-36-A
Control Type	Quality/Quantity
Drainage Area	35.2 acres
Receiving Waters	Sugarland Run

Description: The residential and institutional area along Van Buren Street has inadequate existing stormwater control. Construct new extended detention dry pond and improve the existing dry pond by removing concrete trickle ditch and planting wetland vegetation.

Project Area Map

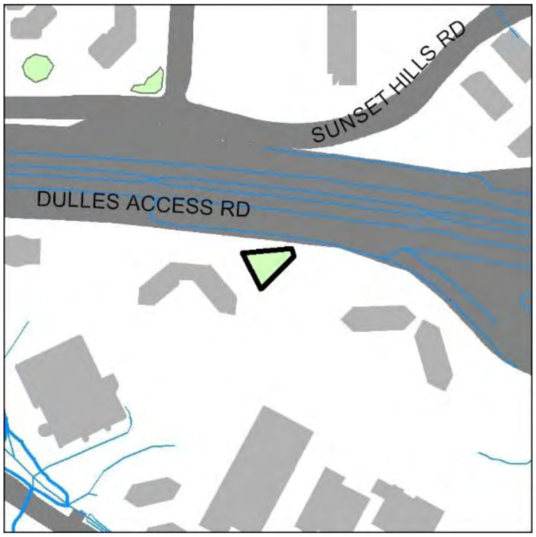
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The existing dry pond is a County stormwater facility and is located within a storm drainage easement and landscape easement. It is adjacent to a private water easement. A storm drainage easement may be necessary for the new dry pond, which is located on private land. Accessibility is excellent from Spring Street and nearby parking lots. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	97	$40.00	$3,880.00
Plantings	AC	0.24	$25,000.00	$6,000.00
Clear and Grub	AC	0.14	$8,500.00	$1,190.00
Grading and Excavation	CY	692	$35.00	$24,220.00
Access Road	SY	111	$25.00	$2,775.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	30	$100.00	$3,000.00
Embankment	CY	15	$50.00	$750.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
			Initial Project Costs	**$55,415.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,770.75
Erosion and Sediment Control: 10% of project costs				$5,541.50
			Base Construction Costs	**$63,727.25**
			Mobilization (5%)	$3,186.36
			Subtotal 1	**$66,913.61**
			Contingency (25%)	$16,728.40
			Subtotal 2	**$83,642.02**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$37,638.91
			Total Costs	**$121,280.92**
			Estimated Project Costs	***$130,000.00***

SU9147 Stormwater Pond Retrofit



Address:	2003 Edmund Halley Drive
Location:	Near Edmund Halley Drive & Sunrise Valley Drive
Land Owner:	Private
PIN:	0173-08-0002A
Control Type	Quality/Quantity
Drainage Area	11 acres
Receiving Waters	Sugarland Run

Description: Retrofit existing dry pond (DP0372) to enhanced extended detention basin with marsh areas, and proper outlet structure; daylight inlet pipes and remove concrete trickle ditch to improve pond efficiency and provide improved treatment for professional building complex.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This basin is an existing stormwater facility located on private land. A storm drainage easement will be necessary. Accessibility is excellent from adjacent parking areas off of Edmund Halley Drive. No tree impacts are expected. The basin must be deep enough to daylight piped storm sewers.

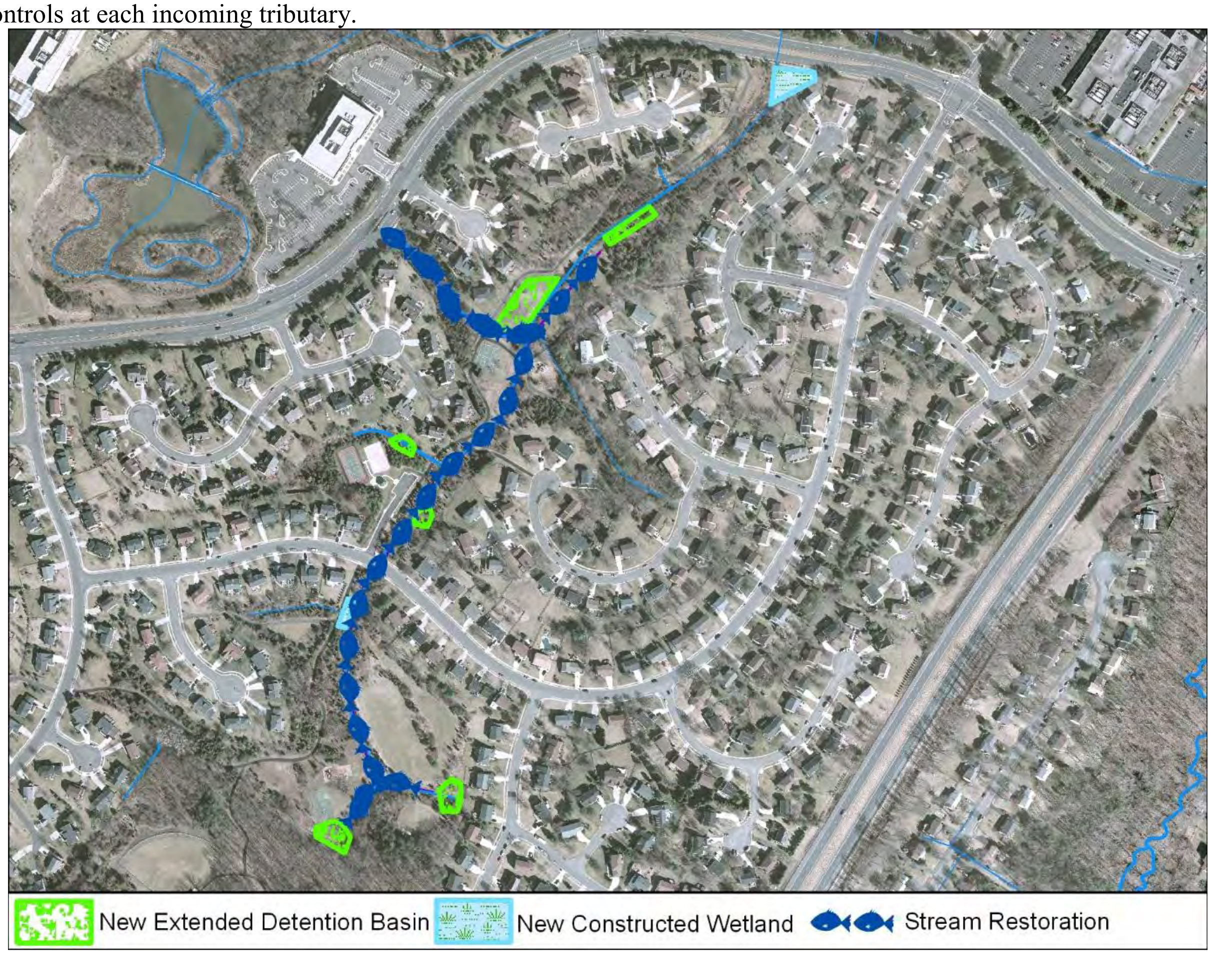
Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	100	$40.00	$4,000.00
Plantings	AC	0.25	$25,000.00	$6,250.00
Grading and Excavation	CY	796	$35.00	$27,860.00
Embankment	CY	200	$50.00	$10,000.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	8	$100.00	$800.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$62,660.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,133.00
Erosion and Sediment Control: 10% of project costs				$6,266.00
			Base Construction Costs	**$72,059.00**
			Mobilization (5%)	$3,602.95
			Subtotal 1	**$75,661.95**
			Contingency (25%)	$18,915.49
			Subtotal 2	**$94,577.44**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$42,559.85
			Total Costs	**$137,137.28**
			Estimated Project Costs	***$140,000.00***

SU9149 New Stormwater Pond, Stream Restoration, Pond Retrofit

Address:	12652 Thunder Chase Drive
Location:	Polo Fields Subdivision
Land Owner:	Private
PIN:	0164-092B-A, 0164-092C-A, 0164-09-A, 0164-09-B, 0164-09-C, 0164-09-D
Control Type	Quality/Quantity
Drainage Area	118 acres
Receiving Waters	Sugarland Run

Description: Headwaters of Sugarland Run race through a network of concrete channels at high flows. Remove concrete channel and replace with a natural stream channel; include cross vanes for energy dissipation and stormwater controls at each incoming tributary.



Project Area Map

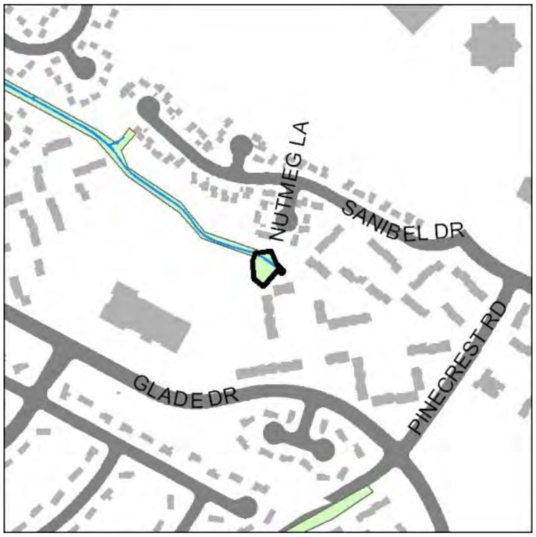
Project Benefits: An estimated one ton/yr of total suspended solids, 81 lbs/yr of nitrogen, and 11 lbs/yr of phosphorus will be removed. This project will also reduce stormwater peak flows, generally reduce sediment and nutrient loadings, improve water quality, promote infiltration, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Storm drainage easements will be necessary. Accessibility is good from Sunrise Valley Drive, Roark Court, Bayard Drive, Darius Lane, Thunder Chase Drive, and an adjacent walking path. Tree impacts are expected. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	133	$40.00	$5,320.00
Plantings	AC	0.32	$25,000.00	$8,000.00
Clear and Grub	AC	0.37	$8,500.00	$3,145.00
Grading and Excavation	CY	2791	$35.00	$97,685.00
Access Road	SY	890	$25.00	$22,250.00
Access Road Gate	EA	4	$2,500.00	$10,000.00
Structural BMP and Incidentals (Low)	LS	7	$10,000.00	$70,000.00
New Storm Pipe (Low)	LF	130	$100.00	$13,000.00
Embankment	CY	93	$50.00	$4,650.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Construct New Channel	LF	2700	$200.00	$540,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
			Initial Project Costs	**$877,650.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$43,882.50
Erosion and Sediment Control: 10% of project costs				$87,765.00
			Base Construction Costs	**$1,009,297.50**
			Mobilization (5%)	$50,464.88
			Subtotal 1	**$1,059,762.38**
			Contingency (25%)	$264,940.59
			Subtotal 2	**$1,324,702.97**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$596,116.34
			Total Costs	**$1,920,819.30**
			Estimated Project Costs	***$1,930,000.00***

SU9150 New Stormwater Pond



Address:	12210 Nutmeg Lane
Location:	Near Nutmeg Lane cul-de-sac
Land Owner:	Private
PIN:	0173-04080099, 0261-10-0010, 0261-10-0011
Control Type	Quality/Quantity
Drainage Area	13 acres
Receiving Waters	Sugarland Run

Description: This area does not have existing stormwater controls. Install new extended detention dry basin behind apartments and school. Capture drainage from outfall and drainage channel.

Project Area Map

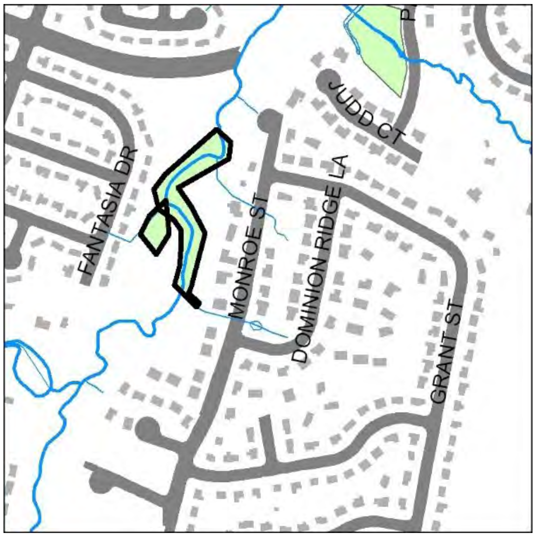
Project Benefits: An estimated one ton/yr of total suspended solids, 16 lbs/yr of nitrogen, and three lbs/yr of phosphorus will be removed. This project will also reduce peak stormwater flows for storms up to a 10-year event, provide for evapotranspiration and improve wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. A storm drainage easement will be necessary. Accessibility may be difficult due to the surrounding woodland. Access can be taken from Laurel Glade Court and Nutmeg Lane. Tree impacts are expected. The basin must be deep enough to intercept piped storm sewers.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	56	$40.00	$2,240.00
Plantings	AC	0.28	$25,000.00	$7,000.00
Clear and Grub	AC	0.28	$8,500.00	$2,380.00
Grading and Excavation	CY	1340	$35.00	$46,900.00
Access Road	SY	111	$25.00	$2,775.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Embankment	CY	500	$50.00	$25,000.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	30	$200.00	$6,000.00
			Initial Project Costs	**$109,795.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$5,489.75
Erosion and Sediment Control: 10% of project costs				$10,979.50
			Base Construction Costs	**$126,264.25**
			Mobilization (5%)	$6,313.21
			Subtotal 1	**$132,577.46**
			Contingency (25%)	$33,144.37
			Subtotal 2	**$165,721.83**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$74,574.82
			Total Costs	**$240,296.65**
			Estimated Project Costs	***$250,000.00***

SU9201 New Stormwater Pond, Stream Restoration



Address:	12628 Fantasia Drive
Location:	Folly Lick stream corridor between Fantasia Drive & Monroe Street
Land Owner:	Park/Private
PIN:	0102-02-0001, 0102-02-0001B, 0102-02-0001C, 0102-02-0001D, 0102-02-0002A, 0102-02-0003B, 0102-04-D, 0104-02-0001B
Control Type	Quality/Quantity
Drainage Area	1400 acres
Receiving Waters	Folly Lick Branch

Description: The community around Fantasia Drive does not have existing stormwater controls and significant stream erosion is occurring downstream. Construct an extended detention dry pond, improve the outfall and repair stream erosion impacts.

Project Area Map

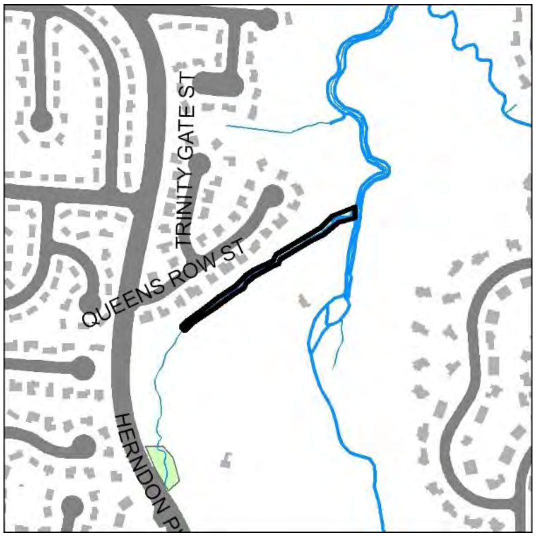
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. The streambank restoration will stabilize the streambanks, reduce sediment and nutrient loadings, and improve water quality.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. The new pond and western stream bank are located on County park land, the eastern stream bank is privately owned by several residential parcels. A storm drainage easement will be necessary. Accessibility may be difficult due to the surrounding woodland and residential properties. Access can be taken from Fantasia Drive and a nearby storm drainage easement. Tree impacts are expected. There are no significant construction issues anticipated.

Costs:

Item	***Units***	***Quantity***	***Unit Cost***	***Total***
Organic Compost Soil Amendment	CY	26	$40.00	$1,040.00
Plantings	AC	0.41	$25,000.00	$10,250.00
Grading and Excavation	CY	478	$35.00	$16,730.00
Access Road	SY	111	$25.00	$2,775.00
Access Road Gate	EA	1	$2,500.00	$2,500.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	20	$100.00	$2,000.00
Embankment	CY	11	$50.00	$550.00
RipRap Stabilization	SY	34	$100.00	$3,400.00
Construct New Channel	LF	1300	$200.00	$260,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
Clear and Grub (Stream)	AC	0.25	$10,000.00	$2,500.00
			Initial Project Costs	**$411,745.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$20,587.25
Erosion and Sediment Control: 10% of project costs				$41,174.50
			Base Construction Costs	**$473,506.75**
			Mobilization (5%)	$23,675.34
			Subtotal 1	**$497,182.09**
			Contingency (25%)	$124,295.52
			Subtotal 2	**$621,477.61**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$279,664.92
			Total Costs	**$901,142.53**
			Estimated Project Costs	***$910,000.00***

SU9203 Stream Restoration



Address:	417 Queens Row Street
Location:	Hunters Creek HOA & Runnymede Park
Land Owner:	Local/Private
PIN:	0113-02-0004C, 0113-04-C
Control Type	Quality/Quantity
Drainage Area	224 acres
Receiving Waters	Sugarland Run

Description: Tributary to Sugarland Run is eroding. Remove multiflora rose obstruction below Hunter's Creek Pool parking lot and repair stream banks, including restoration of riparian buffer. Re-grade streambanks just above confluence, stabilize and install cross-vane to direct energy away from banks.

Project Area Map

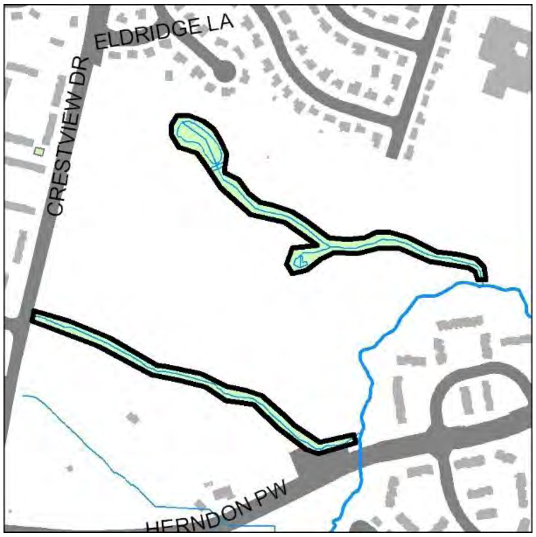
Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, and improve water quality.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The project is located on private land and Town of Herndon land, access agreements will be necessary. Accessibility is good from the Hunters Creek HOA parking lot and the walking trail. Tree impacts are expected. There are no significant construction issues anticipated. New stormwater pond project SU9136 is directly upstream of this project and should be constructed prior to, and may be coordinated with, stream restoration project SU9203.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Clear and Grub	AC	0.01	$8,500.00	$85.00
Grading and Excavation	CY	150	$35.00	$5,250.00
Plantings	AC	0.10	$25,000.00	$2,500.00
RipRap Stabilization	SY	50	$100.00	$5,000.00
Clear and Grub (Stream)	AC	0.50	$10,000.00	$5,000.00
Percolation/Infiltration Trench	SY	150	$75.00	$11,250.00
Earthen Berm	CY	20	$35.00	$700.00
Construct New Channel	LF	250	$200.00	$50,000.00
Additional Cost (first 500LF)	LF	250	$200.00	$50,000.00
			Initial Project Costs	**$129,785.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,489.25
Erosion and Sediment Control: 10% of project costs				$12,978.50
			Base Construction Costs	**$149,252.75**
			Mobilization (5%)	$7,462.64
			Subtotal 1	**$156,715.39**
			Contingency (25%)	$39,178.85
			Subtotal 2	**$195,894.23**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$88,152.41
			Total Costs	**$284,046.64**
			Estimated Project Costs	***$290,000.00***

SU9204 Stream Restoration



Address:	1270 Old Heights Road
Location:	Herndon Centennial Park golf course
Land Owner:	Local
PIN:	0103-02-0014, 0103-02-0016, 0103-02-0018, 0104-02-0009
Control Type	Quality/Quantity
Drainage Area	73 acres
Receiving Waters	Folly Lick Branch

Description: The streams in the golf course have been straightened and lack sufficient buffer. Create meander and add structures to channel to slow flow. Install riparian buffer planting as allowed by height restrictions. Stabilize right bank at lower extent of reach.

Project Area Map

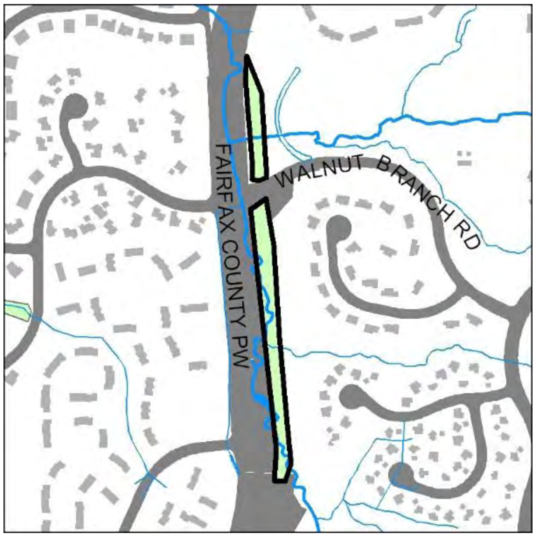
Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, and improve water quality. Riparian buffer restoration will provide for additional evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The project is located on Town of Herndon land, access agreements will be necessary. Accessibility is good from golf course paths, Herndon Parkway, and Crestview Drive Tree impacts are anticipated. There are no significant construction issues anticipated. Riparian buffer plantings must be designed according to height restrictions.

Costs:

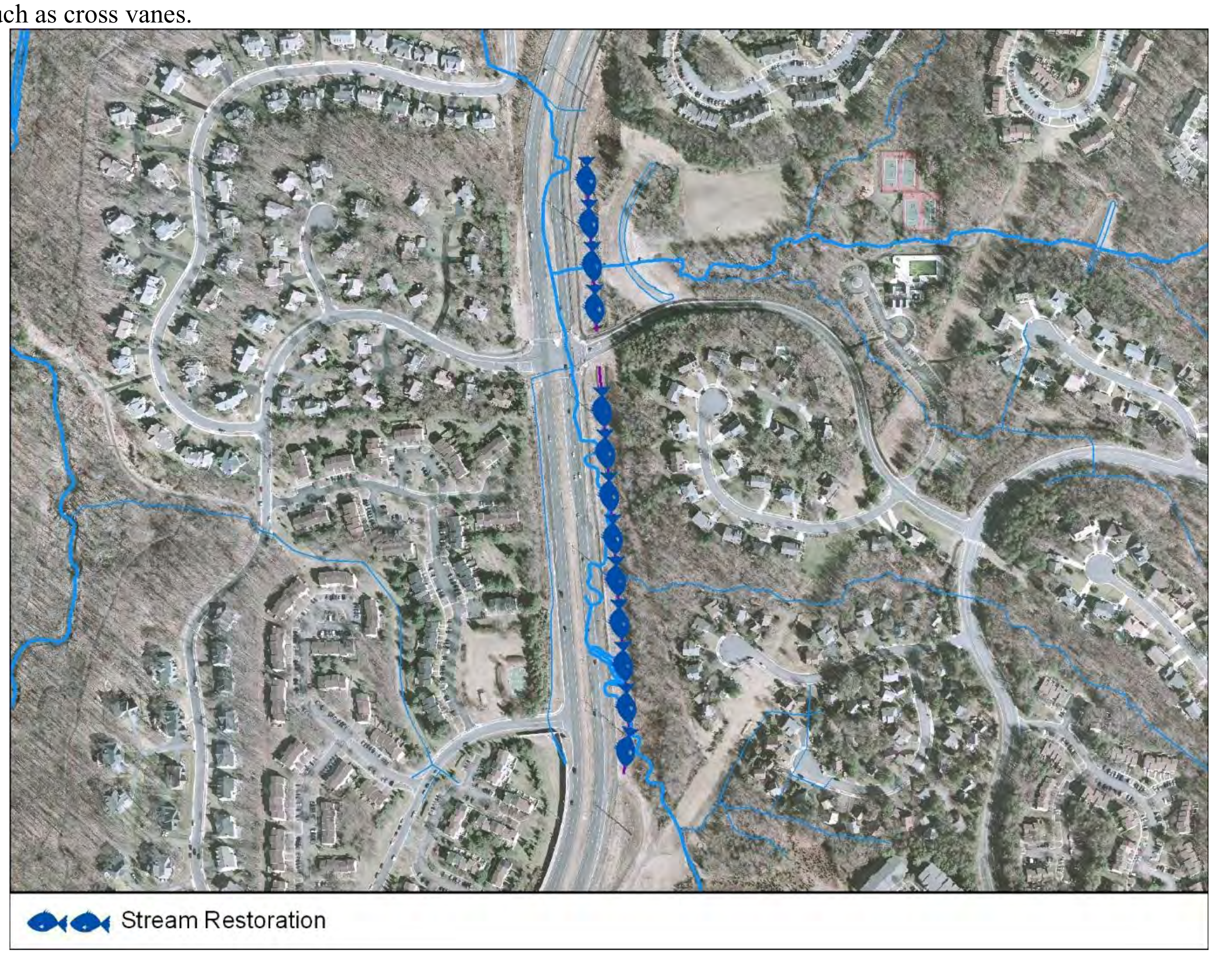
Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	1844	$40.00	$73,760.00
Plantings	AC	4.57	$25,000.00	$114,250.00
Construct New Channel	LF	3335	$200.00	$667,000.00
			Initial Project Costs	**$855,010.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$42,750.50
Erosion and Sediment Control: 10% of project costs				$85,501.00
			Base Construction Costs	**$983,261.50**
			Mobilization (5%)	$49,163.08
			Subtotal 1	**$1,032,424.58**
			Contingency (25%)	$258,106.14
			Subtotal 2	**$1,290,530.72**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$580,738.82
			Total Costs	**$1,871,269.54**
			Estimated Project Costs	***$1,880,000.00***

SU9205 Stream Restoration



Address:	11950 Walnut Branch Road
Location:	Fairfax County Parkway & Walnut Branch Road
Land Owner:	State/Private
PIN:	0113-08-0007
Control Type	Quality/Quantity
Drainage Area	520 acres
Receiving Waters	Sugarland Run

Description: A straightened stream channel increases the velocity of stormwater flows. Install step pools to account for increased slope of straightened stream, improve habitat with native riparian vegetation and add in-stream structures such as cross vanes.



Project Area Map

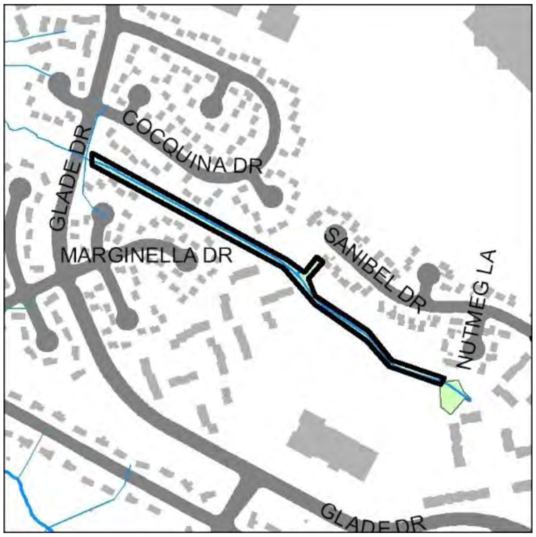
Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, and improve water quality. Riparian buffer restoration will provide for additional evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. The project is located within a Dominion electric easement and adjacent to a storm drainage easement, which may need to be enlarged. Accessibility is excellent from Fairfax County Parkway and Walnut Branch Road. No tree impacts are expected. There are no significant construction issues anticipated.

Costs:

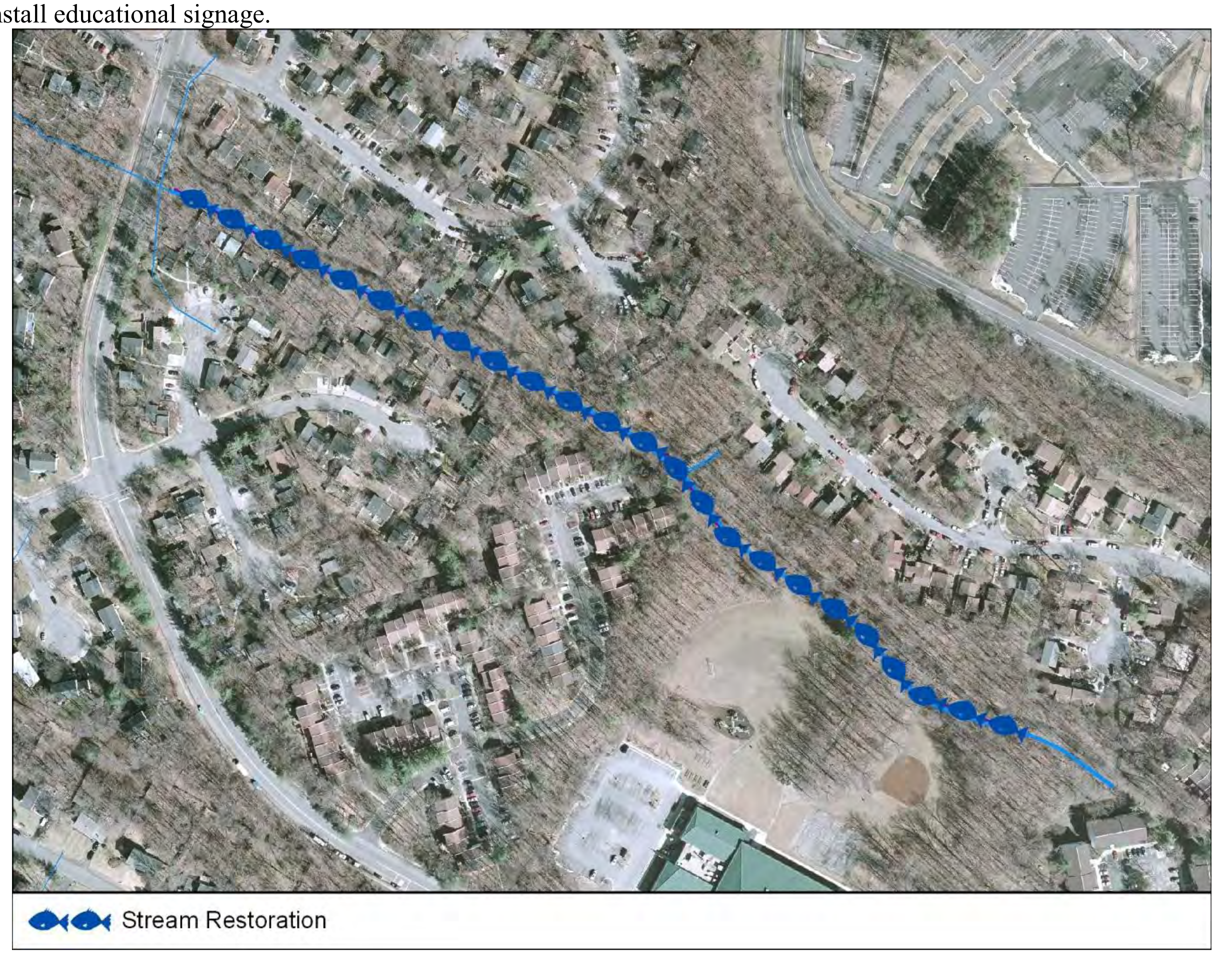
Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	556	$40.00	$22,240.00
Plantings	AC	2.76	$25,000.00	$69,000.00
Construct New Channel	LF	890	$200.00	$178,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
			Initial Project Costs	**$369,240.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$18,462.00
Erosion and Sediment Control: 10% of project costs				$36,924.00
			Base Construction Costs	**$424,626.00**
			Mobilization (5%)	$21,231.30
			Subtotal 1	**$445,857.30**
			Contingency (25%)	$111,464.33
			Subtotal 2	**$557,321.63**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$250,794.73
			Total Costs	**$808,116.36**
			Estimated Project Costs	***$810,000.00***

SU9208 Stream Restoration



Address:	12300 Glade Drive
Location:	Near Sanibel Drive & Tigers Eye Court culs-de-sac
Land Owner:	Private
PIN:	0173-04070010, 0173-04070097, 0173-04080030, 0173-04080099, 0173-04130006A, 0173-04130007A, 0173-04130008, 0173-04130009, 0173-04130044A, 0261-10-0011, 0261-10120099
Control Type	Quality
Drainage Area	80 acres
Receiving Waters	Sugarland Run

Description: The stream channel is a steep concrete channel with no energy dissipation. Restore naturalized stream channel with step pool features, restore/repair two foot bridges, install energy dissipation to incoming storm drain and install educational signage.



Project Area Map

Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, improve water quality, reduce stormwater peak flows, promote infiltration, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The project is located on private land and access agreements will be necessary. Accessibility may be difficult due to woodland cover and residential dwellings. Access can be taken from Glade Drive, Sanibel Drive, Nutmeg Lane, and the adjacent walking path. Tree impacts are expected. There are no significant construction issues anticipated. New stormwater pond project SU9150 is directly upstream of this project and should be constructed prior to, and may be coordinated with, stream restoration project SU9208.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Plantings	AC	0.2	$25,000.00	$5,000.00
Clear and Grub	AC	0.41	$8,500.00	$3,485.00
Grading and Excavation	CY	1500	$35.00	$52,500.00
RipRap Stabilization	SY	111	$100.00	$11,100.00
Construct New Channel	LF	1800	$200.00	$360,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
			Initial Project Costs	**$532,085.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$26,604.25
Erosion and Sediment Control: 10% of project costs				$53,208.50
			Base Construction Costs	**$611,897.75**
			Mobilization (5%)	$30,594.89
			Subtotal 1	**$642,492.64**
			Contingency (25%)	$160,623.16
			Subtotal 2	**$803,115.80**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$361,402.11
			Total Costs	**$1,164,517.91**
			Estimated Project Costs	***$1,170,000.00***

SU9209 Stream Restoration

Address:	2287 Dosinia Court
Location:	Pinecrest Road & Glade Drive
Land Owner:	State/Private
PIN:	0261-114B-B
Control Type	Quality
Drainage Area	7 acres
Receiving Waters	Sugarland Run

Description: This stream is eroding below the outfall and also creating overland drainage channels due to lack of energy dissipating structures and vegetation. Repair head cuts, install check dams/energy dissipation, vegetate understory and remove invasive plants.

Project Area Map

Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, and improve overall water quality.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This project is located on private land and partially within a right-of-way, access agreements will be necessary. Accessibility may be difficult due to woodland cover and residential dwellings. Access can be taken from Glade Drive and Lofty Heights Place. Tree impacts are expected. There are no significant construction issues anticipated.

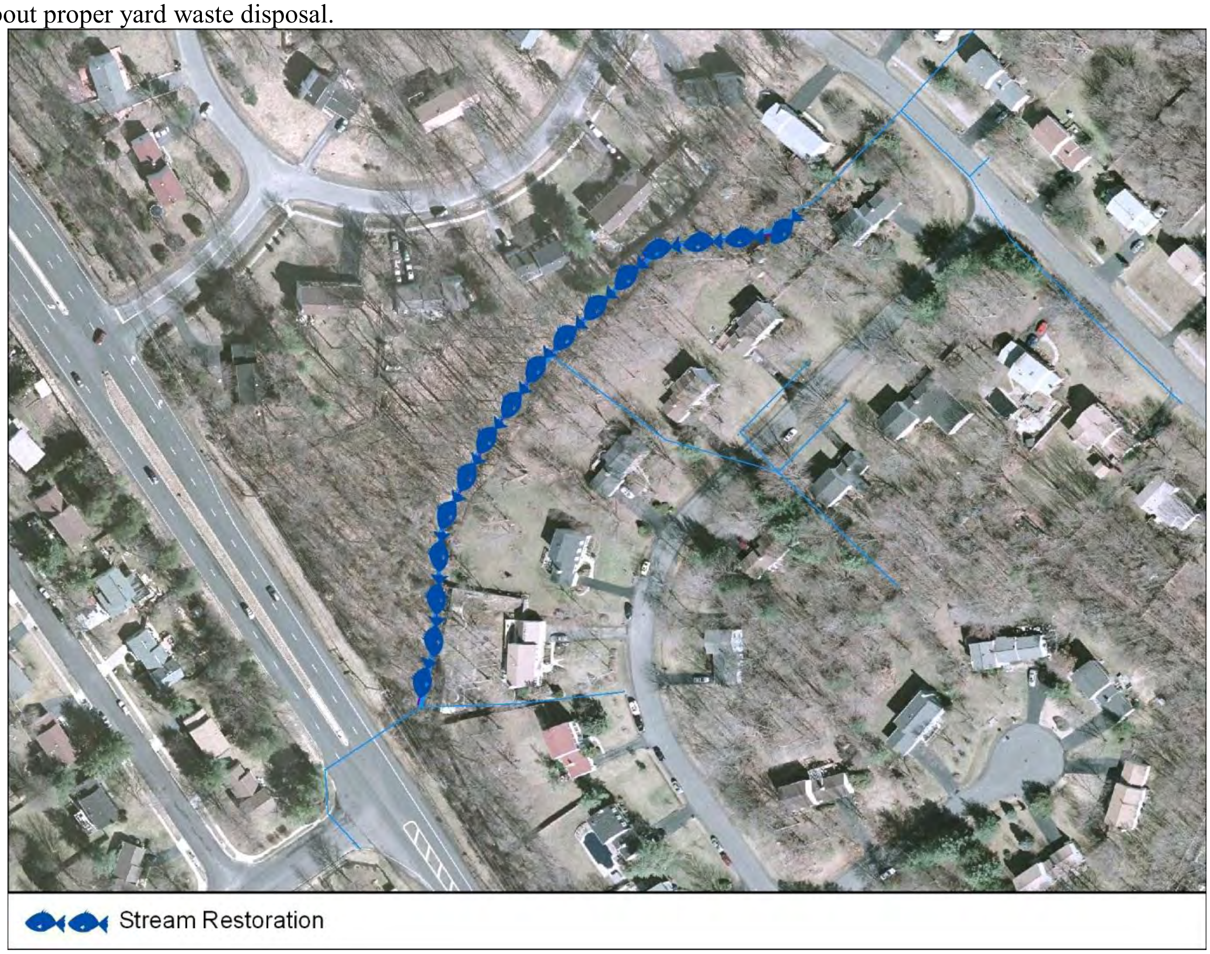
Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Plantings	AC	0.09	$25,000.00	$2,250.00
Clear and Grub	AC	0.09	$8,500.00	$765.00
Grading and Excavation	CY	28	$35.00	$980.00
RipRap Stabilization	SY	56	$100.00	$5,600.00
Construct New Channel	LF	300	$200.00	$60,000.00
Additional Cost (first 500LF)	LF	300	$200.00	$60,000.00
			Initial Project Costs	**$129,595.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,479.75
Erosion and Sediment Control: 10% of project costs				$12,959.50
			Base Construction Costs	**$149,034.25**
			Mobilization (5%)	$7,451.71
			Subtotal 1	**$156,485.96**
			Contingency (25%)	$39,121.49
			Subtotal 2	**$195,607.45**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$88,023.35
			Total Costs	**$283,630.81**
			Estimated Project Costs	***$290,000.00***

SU9210 Stream Restoration

Address:	2410 Ivywood Road
Location:	Fox Mill Road & Keele Drive
Land Owner:	Private
PIN:	0252-04-0078, 0252-04-0079, 0252-04-0080, 0252-04-0081, 0252-04-0082, 0252-04-0083, 0252-04-0084, 0252-04-0086, 0252-04-0087, 0252-04-B
Control Type	Quality
Drainage Area	45 acres
Receiving Waters	Sugarland Run

Description: The streambanks in this stream are eroding and the concrete channel provides no energy dissipation. Break up concrete channel and add rock for energy dissipation, re-plant riparian understory and educate homeowners about proper yard waste disposal.



Project Area Map

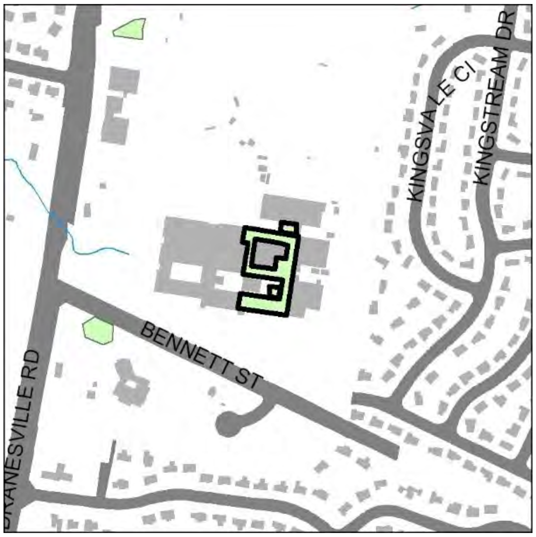
Project Benefits: This project will stabilize streambanks, reduce sediment and nutrient loadings, and improve water quality. Riparian buffer restoration will provide for additional evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The project is located on private land, access agreements will be necessary. Accessibility may be difficult due to woodland cover and residential dwellings. Access can be taken from Fox Mill Road, Ivywood Road, and Rosedown Drive. Tree impacts are expected. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	50	$40.00	$2,000.00
Plantings	AC	0.25	$25,000.00	$6,250.00
Grading and Excavation	CY	730	$35.00	$25,550.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Clear and Grub (Stream)	AC	0.1	$10,000.00	$1,000.00
			Initial Project Costs	**$35,900.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$1,795.00
Erosion and Sediment Control: 10% of project costs				$3,590.00
			Base Construction Costs	**$41,285.00**
			Mobilization (5%)	$2,064.25
			Subtotal 1	**$43,349.25**
			Contingency (25%)	$10,837.31
			Subtotal 2	**$54,186.56**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$24,383.95
			Total Costs	**$78,570.52**
			Estimated Project Costs	***$80,000.00***

SU9500 BMP/LID



Address:	700 Bennett Street
Location:	Herndon High School
Land Owner:	County
PIN:	0102-01-0006A
Control Type	Quality
Drainage Area	2 acres
Receiving Waters	Sugarland Run

Description: Herndon High School does not have existing stormwater controls. Install green roof on portion of roof if possible, install rain gardens in interior courtyards and direct roof leaders to them, and implement education programs.

Project Area Map

Project Benefits: An estimated 10 tons/yr of total suspended solids, 40 lbs/yr of nitrogen, and 11 lbs/yr of phosphorus will be removed. The green roof will reduce stormwater peak flows, insulate the building, increase the life of the roof, and provide for evapotranspiration and wildlife habitat. The rain gardens will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat. This project will also provide additional educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Accessibility is excellent from Bennett Street and adjacent parking lots. No significant tree impacts or construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	578	$150.00	$86,700.00
Organic Compost Soil Amendment	CY	48	$40.00	$1,920.00
Plantings	AC	0.12	$25,000.00	$3,000.00
Vegetated Roof (No Struct. Mod.)	SY	1300	$225.00	$292,500.00
			Initial Project Costs	**$384,120.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$19,206.00
Erosion and Sediment Control: 10% of project costs				$38,412.00
			Base Construction Costs	**$441,738.00**
			Mobilization (5%)	$22,086.90
			Subtotal 1	**$463,824.90**
			Contingency (25%)	$115,956.23
			Subtotal 2	**$579,781.13**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$260,901.51
			Total Costs	**$840,682.63**
			Estimated Project Costs	***$850,000.00***

SU9502 BMP/LID

Address:	630 Dranesville Road
Location:	Herndon Elementary School
Land Owner:	County
PIN:	0104-02-0066A
Control Type	Quality/Quantity
Drainage Area	2 acres
Receiving Waters	Sugarland Run

Description: Herndon Elementary School does not have existing stormwater controls. Install green roof and initiate educational program.

Project Area Map

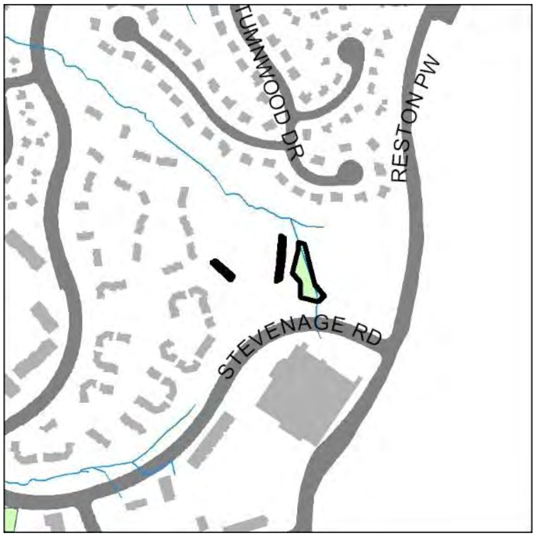
Project Benefits: This project will reduce stormwater peak flows, insulate the building, increase the life of the roof, and provide for evapotranspiration and wildlife habitat. This project will also provide additional educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Accessibility is excellent from Dranesville Road and adjacent parking lots. No significant tree impacts or construction issues are anticipated.

Costs:

Item	***Units***	***Quantity***	***Unit Cost***	***Total***
Vegetated Roof (Struct Mod. Req)	SY	560	$450.00	$252,000.00
			Initial Project Costs	**$252,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$12,600.00
Ancillary Items: 5% of project cost				$12,600.00
Erosion and Sediment Control: 10% of project costs				$25,200.00
			Base Construction Costs	**$302,400.00**
			Mobilization (5%)	$15,120.00
			Subtotal 1	**$317,520.00**
			Contingency (25%)	$79,380.00
			Subtotal 2	**$396,900.00**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$178,605.00
			Total Costs	**$575,505.00**
			Estimated Project Costs	***$580,000.00***

SU9504 New Stormwater Pond, BMP/LID



Address:	1635 Reston Parkway
Location:	Reston North Park
Land Owner:	Park
PIN:	0171-09-0002
Control Type	Quality/Quantity
Drainage Area	9 acres
Receiving Waters	Sugarland Run

Description: The Reston North Park does not have existing stormwater controls. Install new infiltration basin in upper baseball field, daylight storm sewers to basin, vegetate and naturalize existing swales, and install educational signage.

Project Area Map

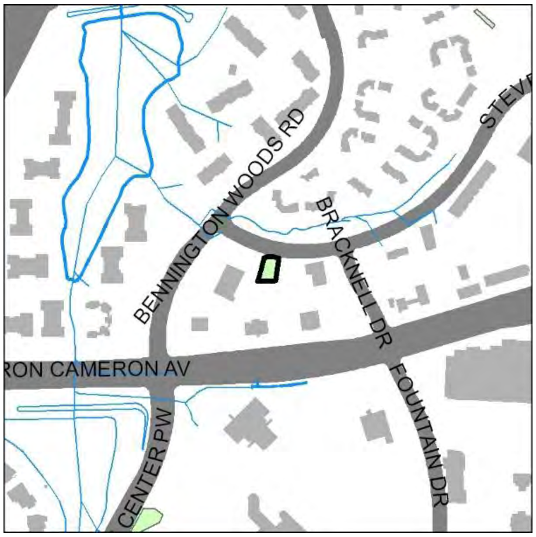
Project Benefits: An estimated nine lbs/yr of nitrogen will be removed. This project will also generally reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, promote infiltration, and provide for evapotranspiration and wildlife habitat. This project will also provide educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Accessibility is excellent from Stevenage Road and nearby parking lots. No tree impacts are expected. The basin must be deep enough to intercept piped storm sewers.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	87	$40.00	$3,480.00
Plantings	AC	0.21	$25,000.00	$5,250.00
Grading and Excavation	CY	585	$35.00	$20,475.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Outflow Pipe	LF	125	$125.00	$15,625.00
RipRap Stabilization	SY	8	$100.00	$800.00
			Initial Project Costs	**$55,630.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,781.50
Erosion and Sediment Control: 10% of project costs				$5,563.00
			Base Construction Costs	**$63,974.50**
			Mobilization (5%)	$3,198.73
			Subtotal 1	**$67,173.23**
			Contingency (25%)	$16,793.31
			Subtotal 2	**$83,966.53**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$37,784.94
			Total Costs	**$121,751.47**
			Estimated Project Costs	***$130,000.00***

SU9509 BMP/LID



Address:	11958 Killingsworth Avenue
Location:	Trader Joe's
Land Owner:	County/Private
PIN:	0171-07-0004C5
Control Type	Quality
Drainage Area	4 acres
Receiving Waters	Sugarland Run

Description: Install a new rain garden in the central island of the Trader Joe's parking lot and investigate headcuts in the adjacent stream.

Project Area Map

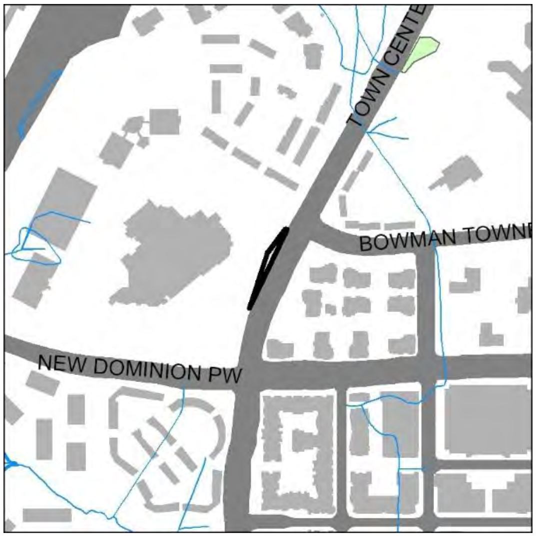
Project Benefits: this project will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. The project is located on private land, partially within a storm drainage easement, which may need to be enlarged. Accessibility is excellent from Stevenage Road and adjacent parking lots. Tree impacts are expected. The rain garden must be deep enough to intercept piped storm sewers.

Costs:

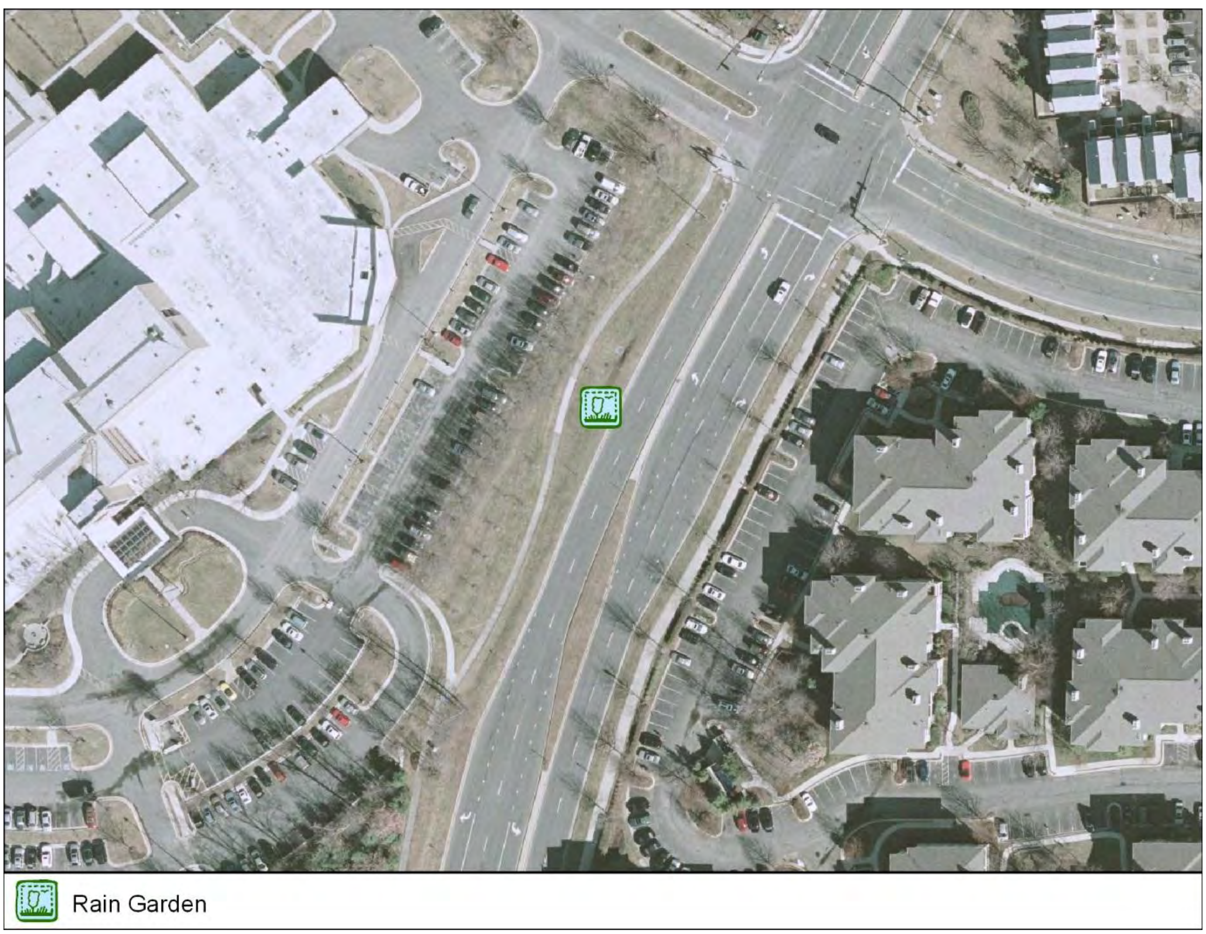
Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	806	$150.00	$120,900.00
Organic Compost Soil Amendment	CY	67	$40.00	$2,680.00
Plantings	AC	0.17	$25,000.00	$4,250.00
Clear and Grub	AC	0.02	$8,500.00	$170.00
Construct New Channel	LF	50	$200.00	$10,000.00
Additional Cost (first 500LF)	LF	50	$200.00	$10,000.00
			Initial Project Costs	**$148,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$7,400.00
Erosion and Sediment Control: 10% of project costs				$14,800.00
			Base Construction Costs	**$170,200.00**
			Mobilization (5%)	$8,510.00
			Subtotal 1	**$178,710.00**
			Contingency (25%)	$44,677.50
			Subtotal 2	**$223,387.50**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$100,524.38
			Total Costs	**$323,911.88**
			Estimated Project Costs	***$330,000.00***

SU9512 BMP/LID



Address:	1850 Town Center Drive
Location:	Reston Hospital
Land Owner:	Private
PIN:	0171-01-0015B
Control Type	Quality
Drainage Area	4 acres
Receiving Waters	Sugarland Run

Description: The majority of Reston Hospital does not have existing stormwater controls. Install bioretention area along walking path with vegetated swales to direct parking lot drainage into bioretention. Install educational signage.



Project Area Map

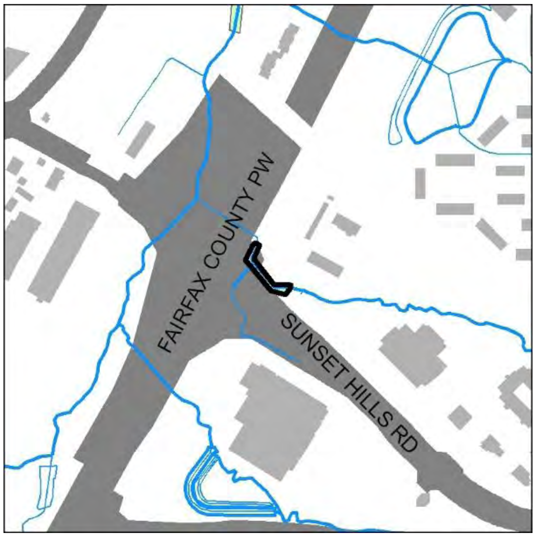
Project Benefits: An estimated 23 tons/yr of total suspended solids, 480 lbs/yr of nitrogen, and 106 lbs/yr of phosphorus will be removed. This project will also reduce stormwater peak flows for small storm events, generally reduce sediment and nutrient loadings, improve water quality, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat. This project will also provide educational opportunities for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This project is located on private land, partially within a Dominion electric easement. A storm drainage easement will be necessary. Accessibility is excellent from Town Center Parkway and nearby parking lots. No significant tree impacts or construction issues are anticipated.

Costs:

Item	***Units***	***Quantity***	***Unit Cost***	***Total***
Vegetated Swale	SY	375	$50.00	$18,750.00
Bioretention Filters & Basin	SY	436	$150.00	$65,400.00
Organic Compost Soil Amendment	CY	68	$40.00	$2,720.00
Plantings	AC	0.17	$25,000.00	$4,250.00
			Initial Project Costs	**$91,120.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,556.00
Erosion and Sediment Control: 10% of project costs				$9,112.00
			Base Construction Costs	**$104,788.00**
			Mobilization (5%)	$5,239.40
			Subtotal 1	**$110,027.40**
			Contingency (25%)	$27,506.85
			Subtotal 2	**$137,534.25**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$61,890.41
			Total Costs	**$199,424.66**
			Estimated Project Costs	***$200,000.00***

SU9514 New Stormwater Pond



Address:	12250 Sunset Hills Road
Location:	Sunset Hills Road & Fairfax County Parkway
Land Owner:	State/Private
PIN:	0173-01-0002A
Control Type	Quality
Drainage Area	94 acres
Receiving Waters	Sugarland Run

Description: The existing concrete channel along Sunset Hills Road provides no stream habitat or stormwater treatment. Remove trapezoidal ditch and replace with natural stream channel with cross-vanes to dissipate energy. Construct new pocket wetland at upstream end of channel.

Project Area Map

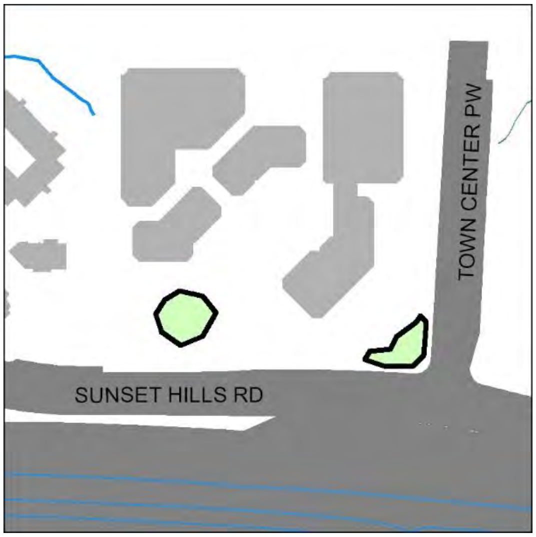
Project Benefits: An estimated seven tons/yr of total suspended solids, 111 lbs/yr of nitrogen, and 22 lbs/yr of phosphorus will be removed. This project will also reduce stormwater peak flows, reduce sediment and nutrient loadings, improve water quality, and provide for evaporation, evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Part of this project is located within a right-of-way, Fairfax water easement, and Colonial gas easement. A storm drainage easement will be necessary. Accessibility is excellent from Sunset Hills Road, an access easement, and adjacent parking lots. No significant tree impacts or construction issues are anticipated.

Costs:

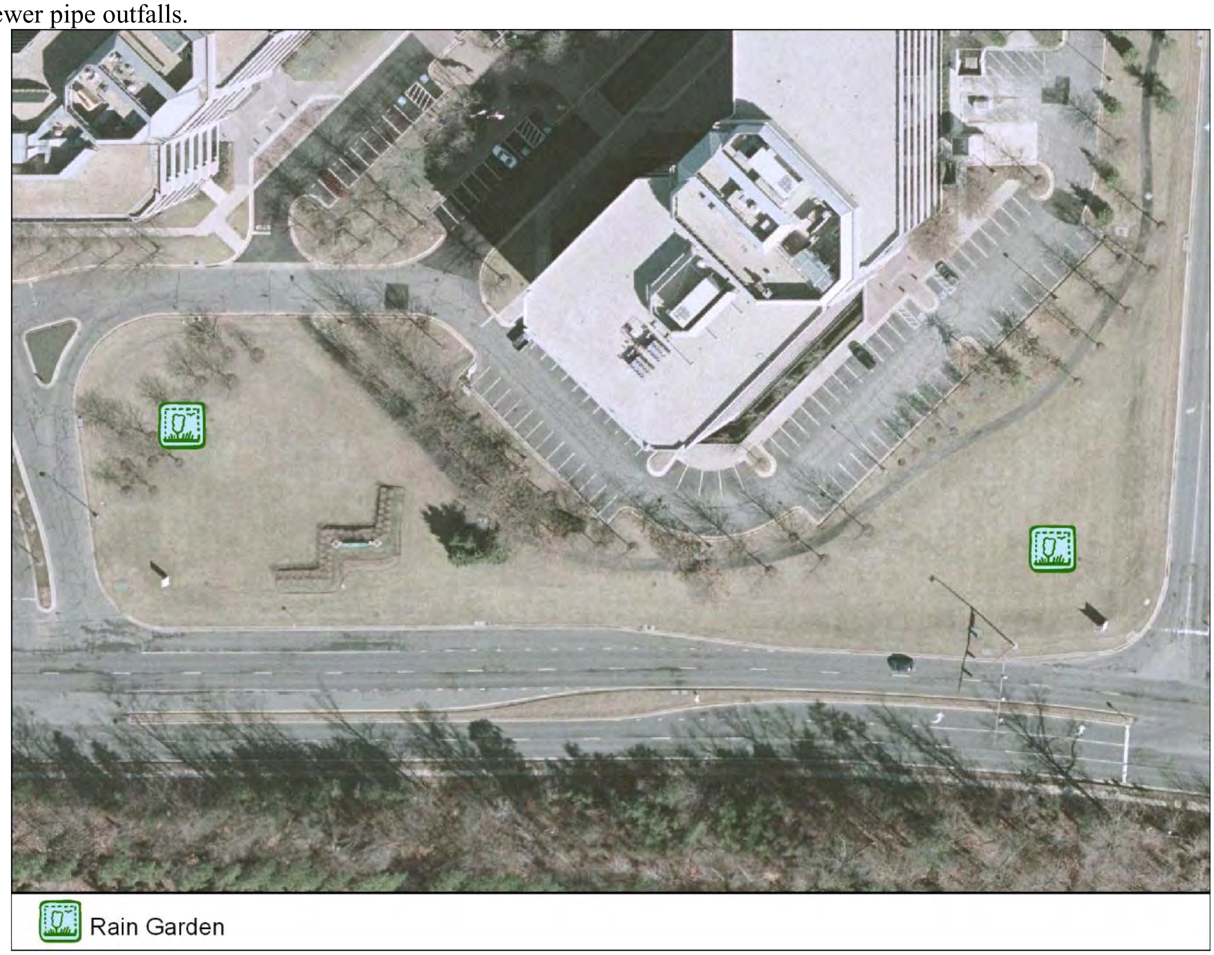
Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	23	$40.00	$920.00
Plantings	AC	0.17	$25,000.00	$4,250.00
Clear and Grub	AC	0.14	$8,500.00	$1,190.00
Grading and Excavation	CY	111	$35.00	$3,885.00
Construct New Channel	LF	300	$200.00	$60,000.00
Additional Cost (first 500LF)	LF	300	$200.00	$60,000.00
			Initial Project Costs	**$130,245.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,512.25
Erosion and Sediment Control: 10% of project costs				$13,024.50
			Base Construction Costs	**$149,781.75**
			Mobilization (5%)	$7,489.09
			Subtotal 1	**$157,270.84**
			Contingency (25%)	$39,317.71
			Subtotal 2	**$196,588.55**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$88,464.85
			Total Costs	**$285,053.39**
			Estimated Project Costs	***$290,000.00***

SU9515 BMP/LID



Address:	12100 Sunset Hills Road
Location:	Sunset Hills Road & Town Center Parkway
Land Owner:	Private
PIN:	0173-01-0028C, 0173-01-0028A
Control Type	Quality
Drainage Area	8.3
Receiving Waters	Sugarland Run

Description: Install two rain gardens near the intersection of Sunset Hills Road and Town Center PW to capture storm sewer pipe outfalls.



Project Area Map

Project Benefits: An estimated one ton/yr of total suspended solids, 23 lbs/yr of nitrogen, and four lbs/yr of phosphorus will be removed. This project will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This project is located on private land, storm drainage easements will be necessary. Accessibility is excellent from Sunset Hills Road, Town Center Parkway, and adjacent parking lots. Tree impacts are not expected.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	47	$40.00	$1,880.00
Plantings	AC	0.04	$25,000.00	$1,000.00
Bioretention Filters and Basin	SY	556	$150.00	$83,400.00
Vegetated Swale	SY	89	$50.00	$4,450.00
			Initial Project Costs	**$90,730.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,536.50
Erosion and Sediment Control: 10% of project costs				$9,073.00
			Base Construction Costs	**$104,339.50**
			Mobilization (5%)	$5,216.98
			Subtotal 1	**$109,556.48**
			Contingency (25%)	$27,389.12
			Subtotal 2	**$136,945.59**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$61,625.52
			Total Costs	**$198,571.11**
			Estimated Project Costs	***$200,000.00***

HC9007 Regional Pond Alternative Suite

Address:	(nearest) 2969 Mother Well Court
Location:	Between Ladybank Lane & Mother Well Court
Land Owner:	Park/Private
PIN:	0253-04-L, 0253-04-P, 0253-04-Q, 0351-02-E, 0351-02-K
Control Type	Quality/Quantity
Drainage Area	68 acres
Receiving Waters	Cedar Run

Description: HC-CR-0002 does not have any existing stormwater controls. Construct a new in-line enhanced extended detention basin (modified scope of RP H-07) and various energy dissipation and stream and habitat restoration projects throughout the subwatershed. Remove concrete channel (HC9007B) and improve drainage channels (HC9007B and HC9007C) with energy dissipation, minor regrading and buffer restoration. Construct rain garden (HC9907F) to intercept overland drainage along the gas easement. Larger projects are discussed below.

Project Area Map

Project Benefits: This project will improve water quality in downstream waterbodies by removing an estimated nine tons/yr of total suspended solids, 238 lbs/yr of nitrogen, and 33 lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Streambank stabilization projects will help to reduce erosion and will improve both terrestrial and aquatic habitats. Rain gardens will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. New extended detention basin and a stream and habitat restoration project are located on County park land. The remaining stream and habitat restoration and energy dissipation projects are located on private land. A new rain garden and a stream and habitat restoration project are located on an AT&T easement. Storm drainage easements will be necessary. Accessibility is good from Ladybank Lane, though not always close by. Tree impacts are expected. There are no significant construction issues anticipated.

Overall Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	81	$150.00	$12,150.00
Organic Compost Soil Amendment	CY	473	$40.00	$18,920.00
Plantings	AC	3.1	$25,000.00	$77,500.00
Clear and Grub	AC	0.17	$8,500.00	$1,445.00
Grading and Excavation	CY	1726	$35.00	$60,410.00
Embankment	CY	25	$50.00	$1,250.00
RipRap Stabilization	SY	258	$100.00	$25,800.00
Construct New Channel	LF	390	$200.00	$78,000.00
Additional Cost (first 500LF)	LF	390	$200.00	$78,000.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	30	$200.00	$6,000.00
			Initial Project Costs	**$374,475.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$18,723.75
Erosion and Sediment Control: 10% of project costs				$37,447.50
			Base Construction Costs	**$430,646.25**
			Mobilization (5%)	$21,532.31
			Subtotal 1	**$452,178.56**
			Contingency (25%)	$113,044.64
			Subtotal 2	**$565,223.20**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$254,350.44
			Total Costs	**$819,573.64**
			Estimated Project Costs	***$820,000.00***

HC9007A

Description: A debris jam is located in the stream corridor with 4-5 foot eroded stream banks. The debris jam should be removed and eroded banks stabilized with boulder toes and sturdy vegetation.

Project Area Map

HC9007A Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Construct New Channel	LF	300	$200.00	$60,000.00
Additional Cost	LF	300	$200.00	$60,000.00
			Initial Project Costs	**$120,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$6,000.00
Ancillary Items: 5% of project cost				$6,000.00
Erosion and Sediment Control: 10% of project costs				$12,000.00
			Base Construction Costs	**$144,000.00**
			Mobilization (5%)	$7,200.00
			Subtotal 1	**$151,200.00**
			Contingency (25%)	$37,800.00
			Subtotal 2	**$189,000.00**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$85,050.00
			Total Costs	**$274,050.00**
			Estimated Project Costs	***$275,000.00***

HC9007D

Description: Energy dissipation is needed below outfall where erosive flows are damaging the stream channel. Place riprap and rock below the outfall to dissipate the erosive flows, remove nuisance species and re-vegetate all damaged and eroded areas with quality riparian vegetation.

Project Area Map

HC9007D Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	400	$40.00	$16,000.00
Plantings	AC	2.77	$25,000.00	$69,250.00
RipRap Stabilization	SY	22	$100.00	$22,000.00
			Initial Project Costs	**$87,450.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,372.50
Erosion and Sediment Control: 10% of project costs				$8,745.00
			Base Construction Costs	**$100,567.50**
			Mobilization (5%)	$5,028.38
			Subtotal 1	**$105,595.88**
			Contingency (25%)	$26,398.97
			Subtotal 2	**$131,994.84**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$59,397.68
			Total Costs	**$191,392.52**
			Estimated Project Costs	***$192,000.00***

HC9007E

Description: Construct new in-line enhanced extended detention dry basin at proposed location of Regional Pond H-07 to address lack of stormwater management in subwatershed. Incorporate natural meandering stream channel and forebay with gabion weir in design of new basin.

Project Area Map

HC9007E Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	66	$40.00	$2,640.00
Plantings	AC	0.33	$25,000.00	$8,250.00
Clear and Grub	AC	0.17	$8,500.00	$1,445.00
Grading and Excavation	CY	1511	$35.00	$52,885.00
Embankment	CY	25	$50.00	$1,250.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	30	$200.00	$6,000.00
			Initial Project Costs	**$87,470.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,373.50
Erosion and Sediment Control: 10% of project costs				$8,747.00
			Base Construction Costs	**$100,590.50**
			Mobilization (5%)	$5,029.53
			Subtotal 1	**$105,620.03**
			Contingency (25%)	$26,405.01
			Subtotal 2	**$132,025.03**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$59,411.26
			Total Costs	**$191,436.30**
			Estimated Project Costs	***$192,000.00***

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HC9013 Regional Pond Alternative Suite

Address:	
Location:	Between Franklin Farm Road, West Ox Road & Ashburton Avenue
Land Owner:	County/Private
PIN:	0351-0411-D, 0352-05-B, 0352-0807-A, 0352-0811-B, 0352-0813-A, 0352-08-A, 0352-08-I, 0352-08-O1, 0352-14-A1, 0352-17-B, 0352-17-C
Control Type	Quality/Quantity
Drainage Area	291 acres
Receiving Waters	Cedar Run

Description: Subbasins HC-CR-0004 and 0005 have minimal stormwater controls. A combination of eighteen basin retrofits, wetlands, BMPs and outfall improvements will provide stormwater controls for more than two-thirds of the subbasins' 421 acres. Subprojects B and M include expanding existing natural wetlands. Suprojects I and N involve constructing new stormwater wetlands and SU9013J is the retrofit of an existing dry pond to an extended detention basin. The concrete swale at SU9013Q will be replaced with a vegetated swale and improved riparian buffer. These projects will provide improved stormwater controls, water quality and habitat. Larger projects are described below.

Project Area Map

Project Benefits: Through a combination of basin retrofits, wetlands, new BMPs and drainage improvements, this project will reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, reduce stormwater runoff volumes, stabilize waterways, promote infiltration, and provide for evapotranspiration and wildlife habitat. The size of this project will also provide an educational opportunity for the community.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. Two constructed wetland projects are located within existing storm drainage easements. All remaining sub-projects are located on private land and parts of the project are located in Transco gas easements. Additional storm drainage easements will be necessary. Accessibility is generally good, though some areas are surrounded by residential properties. Tree impacts are expected. There are no significant construction issues anticipated.

Overall Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	150	$50.00	$7,500.00
Bioretention Filters & Basin	SY	440	$150.00	$66,000.00
Organic Compost Soil Amendment	CY	1045	$40.00	$41,800.00
Plantings	AC	3.39	$25,000.00	$84,750.00
Clear and Grub	AC	2.19	$8,500.00	$18,615.00
Grading and Excavation	CY	10973	$35.00	$384,055.00
Embankment	CY	35	$50.00	$1,750.00
Outflow Pipe	LF	90	$125.00	$11,250.00
RipRap Stabilization	SY	64	$100.00	$6,400.00
Construct New Channel	LF	1045	$200.00	$209,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
Structural BMP Retrofit and Incidentals (Low)	LS	3	$10,000.00	$30,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$976,120.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$48,806.00
Erosion and Sediment Control: 10% of project costs				$97,612.00
			Base Construction Costs	**$1,122,538.00**
			Mobilization (5%)	$56,126.90
			Subtotal 1	**$1,178,664.90**
			Contingency (25%)	$294,666.23
			Subtotal 2	**$1,473,331.13**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$662,999.01
			Total Costs	**$2,136,330.13**
			Estimated Project Costs	***$2,140,000.00***

HC9013A

Description: Install new rain garden around existing inlet

Project Area Map

HC9013A Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	440	$150.00	$66,000.00
Organic Compost Soil Amendment	CY	35	$40.00	$1,400.00
			Initial Project Costs	**$67,400**
Plantings: 5% of project costs (unless incl. as line item)				$3,370.00
Ancillary Items: 5% of project cost				$3,370.00
Erosion and Sediment Control: 10% of project costs				$6,740.00
			Base Construction Costs	**$80,880.00**
			Mobilization (5%)	$4,044.00
			Subtotal 1	**$84,924.00**
			Contingency (25%)	$21,231.00
			Subtotal 2	**$106,155.00**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$47,769.75
			Total Costs	**$153,924.75**
			Estimated Project Costs	***$154,000.00***

HC9007C, HC9007E, HC9007O

Description: Remove concrete channels and restore natural stream channels. Create shallow marsh areas and new natural wetlands between channels and plant with wetland plantings.

Project Area Map

HC9013C, HC9013E, HC9013O Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	191	$40.00	$7,640.00.00
Plantings	AC	0.62	$25,000.00	$15,500.00
Grading and Excavation	CY	340	$35.00	$11,900.00
Earthen Berm	CY	24	$35.00	$840.00
RipRap Stabilization	SY	50	$100.00	$5,000.00
			Initial Project Costs	**$40,880**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,044.00
Erosion and Sediment Control: 10% of project costs				$4,088.00
			Base Construction Costs	**$47,012.00**
			Mobilization (5%)	$2,350.60
			Subtotal 1	**$49,362.60**
			Contingency (25%)	$12,340.65
			Subtotal 2	**$61,703.25**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$27,766.46
			Total Costs	**$89,469.71**
			Estimated Project Costs	***$90,000.00***

HC9013D & HC9013P

Description: Add rock to drainage channels for energy dissipation of erosive flows.

Project Area Map

HC9013D & HC9013P Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Construct New Channel	LF	460	$200.00	$92,000.00
Additional Cost (first 500LF)	LF	50	$200.00	$10,000.00
			Initial Project Costs	**$102,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$5,100.00
Ancillary Items: 5% of project cost				$5,100.00
Erosion and Sediment Control: 10% of project costs				$10,200.00
			Base Construction Costs	**$122,400.00**
			Mobilization (5%)	$6,120.00
			Subtotal 1	**$128,520.00**
			Contingency (25%)	$32,130.00
			Subtotal 2	**$160,650.00**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$72,292.50
			Total Costs	**$232,942.50**
			Estimated Project Costs	***$233,000.00***

HC9013F

Description: Retrofit dry pond 0116DP to extended detention dry pond, install new outlet structure and allow basin to naturalize.

Project Area Map

HC9013F Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	70	$40.00	$2,800.00
Plantings	AC	0.18	$25,000.00	$4,500.00
Clear and Grub	AC	0.18	$8,500.00	$1,530.00
Grading and Excavation	CY	850	$35.00	$29,750.00
Embankment	CY	10	$50.00	$500.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$53,080.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,654.00
Erosion and Sediment Control: 10% of project costs				$5,308.00
			Base Construction Costs	**$61,042.00**
			Mobilization (5%)	$3,052.10
			Subtotal 1	**$64,094.10**
			Contingency (25%)	$16,023.53
			Subtotal 2	**$80,117.63**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$36,052.93
			Total Costs	**$116,170.56**
			Estimated Project Costs	***$117,000.00***

HC9013G

Description: Retrofit an existing non-stormwater wet pond to a stormwater wet pond. Draw down water level, install appropriate outlet structure and plant emergent vegetation

Project Area Map

HC9013G *Costs:*

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	160	$40.00	$6,400.00
Plantings	AC	0.49	$25,000.00	$12,250.00
Clear and Grub	AC	0.97	$8,500.00	$8,245.00
Grading and Excavation	CY	4700	$35.00	$164,500.00
Outflow Pipe	LF	20	$125.00	$2,500.00
Structural BMP Retrofit (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$203,895.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$10,194.75
Erosion and Sediment Control: 10% of project costs				$20,389.50
			Base Construction Costs	**$234,479.25**
			Mobilization (5%)	$11,723.96
			Subtotal 1	**$246,203.21**
			Contingency (25%)	$61,550.80
			Subtotal 2	**$307,754.02**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$138,489.31
			Total Costs	**$446,243.32**
			Estimated Project Costs	***$447,000.00***

HC9013H & HC9013R

Description: Construct two new constructed wetlands and restore riparian buffers. Add rocks to channel for energy dissipation.

Project Area Map

HC9013H & HC9013R Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	25	$40.00	$1,000.00
Plantings	AC	0.12	$25,000.00	$3,000.00
Construct New Channel	LF	145	$200.00	$29,000.00
Additional Cost (first 500LF)	LF	100	$200.00	$20,000.00
			Initial Project Costs	**$53,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,650.00
Erosion and Sediment Control: 10% of project costs				$5,300.00
			Base Construction Costs	**$60,950.00**
			Mobilization (5%)	$3,047.50
			Subtotal 1	**$63,997.50**
			Contingency (25%)	$15,999.38
			Subtotal 2	**$79,996.88**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$35,998.59
			Total Costs	**$115,995.47**
			Estimated Project Costs	***$116,000.00***

HC9013K

Description: Retrofit existing non-stormwater wet pond to a stormwater wet pond. Draw down water level, install appropriate outlet structure and plant emergent vegetation along shorelines.

Project Area Map

HC9013K Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	360	$40.00	$14,400.00
Plantings	AC	0.99	$25,000.00	$24,750.00
Clear and Grub	AC	0.99	$8,500.00	$8,415.00
Grading and Excavation	CY	4768	$35.00	$166,880.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$235,445**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$11,772.25
Erosion and Sediment Control: 10% of project costs				$23,544.50

Base Construction Costs	**$270,761.75**
Mobilization (5%)	$13,538.09
Subtotal 1	**$284,299.84**
Contingency (25%)	$71,074.96
Subtotal 2	**$355,374.80**
Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$159,918.66
Total Costs	**$515,293.46**
Estimated Project Costs	***$516,000.00***

HC9013L

Description: Install a new constructed wetland at pipe outfall; add rocks to channel and vegetation to banks.

Project Area Map

HC9013L Costs:

Item	Units	Quantity	Unit Cost	Total
Organic Compost Soil Amendment	CY	10	$40.00	$400.00
Plantings	AC	0.05	$25,000.00	$1,250.00
Construct New Channel	LF	125	$200.00	$25,000.00
Additional Cost (first 500LF)	LF	100	$200.00	$20,000.00
			Initial Project Costs	**$46,650.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,332.50
Erosion and Sediment Control: 10% of project costs				$4,665.00
			Base Construction Costs	**$53,647.50**
			Mobilization (5%)	$2,682.38
			Subtotal 1	**$56,329.88**
			Contingency (25%)	$14,082.47
			Subtotal 2	**$70,412.34**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$31,685.55
			Total Costs	**$102,097.90**
			Estimated Project Costs	***$103,000.00***

HC9102 New Stormwater Pond

Address:	13650 Legacy Circle
Location:	Legacy Circle & Sunrise Valley Drive
Land Owner:	Private
PIN:	0154-01-0022D3, 0154-01-0022E
Control Type	Quality/Quantity
Drainage Area	40 acres
Receiving Waters	Horsepen Run

Description: An existing swale with wetland vegetation is a prime location for a new enhanced extended detention dry pond with minimal grading required for low marsh areas and berm along tennis courts.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. The project is located on private land and a storm drainage easement will be necessary. Accessibility is excellent from Sunrise Valley Drive and adjacent parking lots. It is unlikely that this project will cause tree impacts. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	57	$40.00	$2,280.00
Plantings	AC	0.28	$25,000.00	$7,000.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	456	$35.00	$15,960.00
Earthen Berm	CY	59	$35.00	$2,065.00
Access Road	SY	100	$25.00	$2,500.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	100	$200.00	$20,000.00
			Initial Project Costs	**$65,655.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,282.75
Erosion and Sediment Control: 10% of project costs				$6,565.50
			Base Construction Costs	**$75,503.25**
			Mobilization (5%)	$3,775.16
			Subtotal 1	**$79,278.41**
			Contingency (25%)	$19,819.60
			Subtotal 2	**$99,098.02**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$44,594.11
			Total Costs	**$143,692.12**
			Estimated Project Costs	***$150,000.00***

HC9106 Stormwater Pond Retrofit

Address:	2554 Centreville Road
Location:	Frying Pan Road & Centreville Road
Land Owner:	State/County/Private
PIN:	0242-01-0008, 0251-01-0002A
Control Type	Quality/Quantity
Drainage Area	67 acres
Receiving Waters	Frying Pan Branch

Description: The current outlet structure for dry pond 1288DP is a large five foot culvert. The pond will be improved by adding a box weir to the culvert with a low flow orifice, regrading the bottom of the pond for more capacity and replanting with native vegetation.

Project Area Map

Project Benefits: This detention basin retrofit project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. This project will also increase the storage capacity of the existing pond, and the improved outlet structure will allow for a more controlled stormwater discharge to enhance the performance of the basin.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. This is an existing County facility. Parts of the project are located on a conservation easement, sanitary sewer easement, and utility right-of-way. Part of the project is located on a storm drainage easement, this may need to be enlarged. Accessibility is excellent from Centreville Road and Frying Pan Road and there is an access easement. Tree impacts are expected. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	173	$40.00	$6,920.00
Plantings	AC	0.74	$25,000.00	$18,500.00
Clear and Grub	AC	0.37	$8,500.00	$3,145.00
Grading and Excavation	CY	2500	$35.00	$87,500.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$137,315.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,865.75
Erosion and Sediment Control: 10% of project costs				$13,731.50
			Base Construction Costs	**$157,912.25**
			Mobilization (5%)	$7,895.61
			Subtotal 1	**$165,807.86**
			Contingency (25%)	$41,451.97
			Subtotal 2	**$207,259.83**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$93,266.92
			Total Costs	**$300,526.75**
			Estimated Project Costs	***$310,000.00***

HC9107 New Stormwater Pond

Address:	900 Palmer Drive
Location:	Palmer Drive & Dogwood Court
Land Owner:	Local
PIN:	0161-19-D1
Control Type	Quality/Quantity
Drainage Area	32 acres
Receiving Waters	Merrybrook Run

Description: The community around Arkansas Ave. and Palmer Dr. does not have existing stormwater controls. Construct new enhanced extended detention dry basin with marsh areas to collect stormwater runoff conveyed in storm sewers and swale outlet to stream channel.

Project Area Map

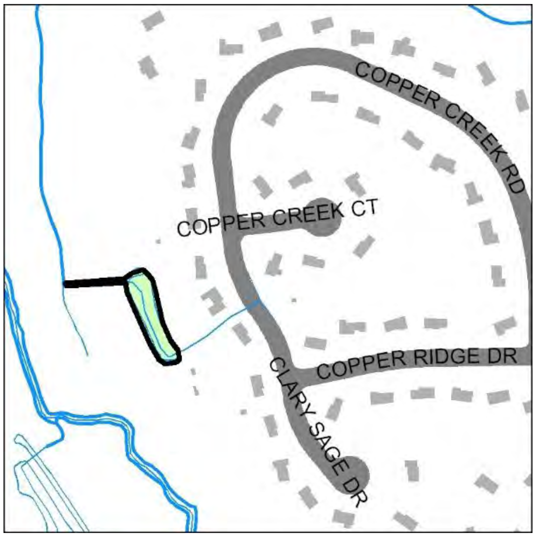
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. The project is located on Town of Herndon property and a county storm drainage easement will be necessary. Accessibility is excellent from Palmer Drive. No tree impacts are expected. The basin must be deep enough to intercept piped storm sewers.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	65	$40.00	$2,600.00
Plantings	AC	0.16	$25,000.00	$4,000.00
Grading and Excavation	CY	1500	$35.00	$52,500.00
Embankment	CY	300	$50.00	$15,000.00
Structural BMP and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
New Storm Pipe (Med)	LF	30	$200.00	$6,000.00
			Initial Project Costs	**$95,100.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,755.00
Erosion and Sediment Control: 10% of project costs				$9,510.00
			Base Construction Costs	**$109,365.00**
			Mobilization (5%)	$5,468.25
			Subtotal 1	**$114,833.25**
			Contingency (25%)	$28,708.31
			Subtotal 2	**$143,541.56**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$64,593.70
			Total Costs	**$208,135.27**
			Estimated Project Costs	***$210,000.00***

HC9108 Stormwater Pond Retrofit



Address:	2742 Copper Creek Road
Location:	Near Copper Creek Road & Copper Creek Court
Land Owner:	County/Park
PIN:	0242-04-A
Control Type	Quantity/Quality
Drainage Area	10 acres
Receiving Waters	Horsepen Run

Description: Retrofit existing dry pond 0426DP to an enhanced extended detention dry pond to improve quantity and quality functions. Improve and repair erosion to the inlet and downstream channel.

Project Area Map

Project Benefits: This detention basin retrofit project will improve water quality by removing an estimated 0.76 tons/yr of total suspended solids, 29 lbs/yr of nitrogen, and four lbs/yr of phosphorus. Additionally, these projects will reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. This is an existing County facility within a stormdrainage easement located on County park land. Access is good from Copper Creek Road, however an access easement may be required. Minimal tree impacts are expected. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	40	$40.00	$1,600.00
Plantings	AC	0.20	$25,000.00	$5,000.00
Grading and Excavation	CY	1300	$35.00	$45,500.00
Clear and Grub	AC	0.10	$8,500.00	$850.00
Embankment	CY	15	$50.00	$750.00
RipRap Stabilization	SY	73	$100.00	$7,300.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Outflow Pipe	LF	80	$125.00	$10,000.00
			Initial Project Costs	**$81,000.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,050.00
Erosion and Sediment Control: 10% of project costs				$8,100.00
			Base Construction Costs	**$93,150.00**
			Mobilization (5%)	$4,657.50
			Subtotal 1	**$97,807.50**
			Contingency (25%)	$24,451.88
			Subtotal 2	**$122,259.38**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$55,016.72
			Total Costs	**$177,276.09**
			Estimated Project Costs	***$180,000.00***

HC9109 Stormwater Pond Retrofit

Address:	2486 Masons Ferry Drive
Location:	Between Coppermine Road, Thomas Jefferson Drive & Masons Ferry Drive
Land Owner:	Private
PIN:	0163-01-0037A
Control Type	Quality/Quantity
Drainage Area	39 acres
Receiving Waters	Frying Pan Branch

Description: Retrofit existing dry pond (0406DP) to an enhanced extended dry detention basin to improve quality and quantity treatment. Remove concrete trickle ditch, create a forebay at each inlet, install marsh areas and retrofit the outlet structure for extended detention.

Project Area Map

Project Benefits: This detention basin retrofit project will help to reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. Removal of the trickle ditch will help to reduce stormwater velocities and may allow for some infiltration.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This is an existing stormwater facility on private land, a County storm drainage easement will be necessary. Accessibility is excellent from Masons Ferry Drive. No tree impacts are anticipated. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	158	$40.00	$6,320.00
Plantings	AC	0.78	$25,000.00	$19,500.00
Grading and Excavation	CY	3789	$35.00	$132,615.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$178,835.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$8,941.75
Erosion and Sediment Control: 10% of project costs				$17,883.50
			Base Construction Costs	**$205,660.25**
			Mobilization (5%)	$10,283.01
			Subtotal 1	**$215,943.26**
			Contingency (25%)	$53,985.82
			Subtotal 2	**$269,929.08**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$121,468.09
			Total Costs	**$391,397.16**
			Estimated Project Costs	***$400,000.00***

HC9110 New Stormwater Pond

Address:	409 Maple Court
Location:	Herndon Parkway & Campbell Way
Land Owner:	Private
PIN:	0162-21-C
Control Type	Quality/Quantity
Drainage Area	10 acres
Receiving Waters	Merrybrook Run

Description: The community around Palmer Drive does not have existing stormwater controls. Daylight piped storm sewers and construct new enhanced extended detention dry basin below new outfall.

Project Area Map

Project Benefits: This project will help to improve water quality by removing an estimated seven lbs/yr of nitrogen and two lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This project is located on private property and a storm drainage easement will be necessary. Accessibility is excellent from Herndon Parkway. No tree impacts are anticipated. The basin must be deep enough to intercept piped storm sewers.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	60	$40.00	$2,400.00
Plantings	AC	0.28	$25,000.00	$7,000.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	1344	$35.00	$47,040.00
Access Road	SY	110	$25.00	$2,750.00
Structural BMP and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
New Storm Pipe (Low)	LF	25	$100.00	$2,500.00
Embankment	CY	8	$50.00	$400.00
			Initial Project Costs	**$72,515.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,625.75
Erosion and Sediment Control: 10% of project costs				$7,251.50
			Base Construction Costs	**$83,392.25**
			Mobilization (5%)	$4,169.61
			Subtotal 1	**$87,561.86**
			Contingency (25%)	$21,890.47
			Subtotal 2	**$109,452.33**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$49,253.55
			Total Costs	**$158,705.88**
			Estimated Project Costs	***$160,000.00***

HC9114 Stormwater Pond Retrofit

Address:	2350 Woodland Pond Lane
Location:	Fox Mill Road & Cabin Creek Road
Land Owner:	Private
PIN:	0163-01-0025D1
Control Type	Quality/Quantity
Drainage Area	68 acres
Receiving Waters	Frying Pan Branch

Description: Retrofit existing dry pond (1416DP) to an enhanced extended dry detention basin to improve quality and quantity treatment. Install a forebay north of the walking path, re-grade the basin bottom with a meander and marsh areas and install a proper outlet structure.

Project Area Map

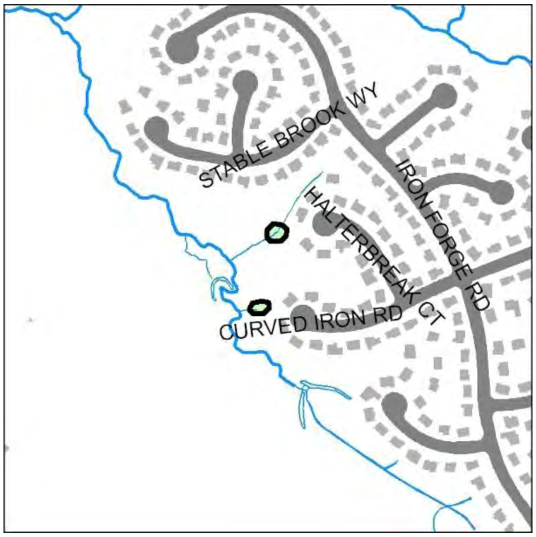
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, provide for evaporation and evapotranspiration, and improve wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Part of the project is located on or adjacent to a sanitary sewer easement, a storm drainage easement and restrictive planting easement. An additional or expanded storm drainage easement may be necessary. Accessibility is excellent from Fox Mill Road, Sunrise Valley Drive, and adjacent parking lots. No tree impacts are anticipated. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	359	$40.00	$14,360.00
Plantings	AC	1.78	$25,000.00	$44,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	2150	$35.00	$75,250.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$154,135.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$7,706.75
Erosion and Sediment Control: 10% of project costs				$15,413.50
			Base Construction Costs	**$177,255.25**
			Mobilization (5%)	$8,862.76
			Subtotal 1	**$186,118.01**
			Contingency (25%)	$46,529.50
			Subtotal 2	**$232,647.52**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$104,691.38
			Total Costs	**$337,338.90**
			Estimated Project Costs	***$340,000.00***

HC9116 New Stormwater Pond



Address:	13136 Curved Iron Road
Location:	Near Halterbreak Court & Curved Iron Road culs-de sac
Land Owner:	Park
PIN:	0251-14-F, 0251-14-G
Control Type	Quality
Drainage Area	16 acres
Receiving Waters	Frying Pan Branch

Description: Sycamore Ridge area does not have existing stormwater controls. The drainage channels show signs of erosion. Construct new pocket wetlands at outfalls to slow stormwater and increase nutrient uptake. Repair drainage channels with rock and vegetation.

Project Area Map

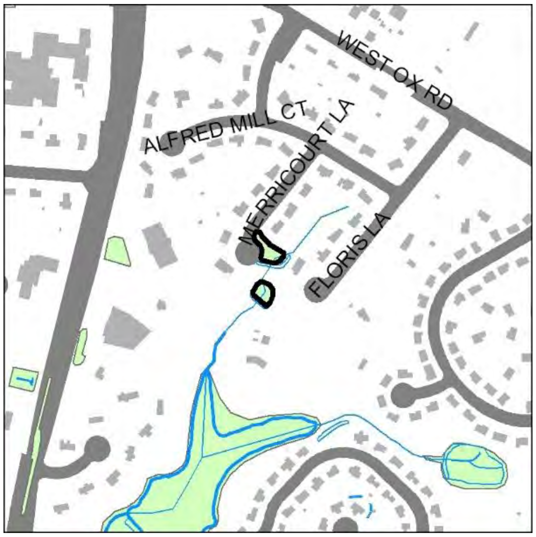
Project Benefits: This project will improve water quality by removing an estimated one ton/yr of total suspended solids, 31 lbs/yr of nitrogen, and six lbs/yr of phosphorus. The pocket wetlands will reduce stormwater peak flows, reduce sediment and nutrient loadings, and provide for evaporation, evapotranspiration and wildlife habitat. Stabilization of the drainage channels will reduce sediment loadings.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. The project is located on County park land and storm drainage easements may be necessary. Accessibility is excellent from Curved Iron Road and Halterbreak Court culs-de-sac. Tree impacts are anticipated. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	85	$40.00	$3,400.00
Plantings	AC	0.21	$25,000.00	$5,250.00
Clear and Grub	AC	0.21	$8,500.00	$1,785.00
Grading and Excavation	CY	200	$35.00	$7,000.00
Construct New Channel	LF	200	$200.00	$40,000.00
Additional Cost (first 500LF)	LF	200	$200.00	$40,000.00
			Initial Project Costs	**$97,435.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,871.75
Erosion and Sediment Control: 10% of project costs				$9,743.50
			Base Construction Costs	**$112,050.25**
			Mobilization (5%)	$5,602.51
			Subtotal 1	**$117,652.76**
			Contingency (25%)	$29,413.19
			Subtotal 2	**$147,065.95**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$66,179.68
			Total Costs	**$213,245.63**
			Estimated Project Costs	***$220,000.00***

HC9118 Stormwater Pond Retrofit



Address:	2714 Floris Lane
Location:	Between Floris Lane & Merricourt Lane culs-de-sac
Land Owner:	Private
PIN:	0251-04-0008B, 0251-16-B
Control Type	Quality/Quantity
Drainage Area	27 acres
Receiving Waters	Horsepen Run

Description: Existing dry basins (0803DP and unnamed dry basin) provide only water quantity control. The basins will be improved to enhanced extended dry detention basins by retrofitting existing or installing new outlet structures and planting native vegetation.

Project Area Map

Project Benefits: These detention basin retrofit projects will improve water quality by removing an estimated one ton/yr of total suspended solids, 19 lbs/yr of nitrogen, and four lbs/yr of phosphorus. Additionally, these projects will reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. These basins are existing stormwater facilities located on private land, storm drainage easements will be necessary. Accessibility is excellent from Merricourt Lane and Floris Lane. No tree impacts are anticipated. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	70	$40.00	$2,800.00
Plantings	AC	0.34	$25,000.00	$8,500.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	200	$35.00	$7,000.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	40	$125.00	$5,000.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$51,700.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,585.00
Erosion and Sediment Control: 10% of project costs				$5,170.00
			Base Construction Costs	**$59,455.00**
			Mobilization (5%)	$2,972.75
			Subtotal 1	**$62,427.75**
			Contingency (25%)	$15,606.94
			Subtotal 2	**$78,034.69**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$35,115.61
			Total Costs	**$113,150.30**
			Estimated Project Costs	***$120,000.00***

HC9119 Stormwater Pond Retrofit

Address:	2322 Colts Brook Drive
Location:	Colts Brook Drive & Fox Mill Road
Land Owner:	County
PIN:	0164-091B-A
Control Type	Quality/Quantity
Drainage Area	35 acres
Receiving Waters	Frying Pan Branch

Description: Existing dry pond (0610DP) provides only water quantity control. Improve basin to an enhanced extended detention dry basin, disconnect three upstream outfalls, install two small forebays and an outlet structure.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. Removing the concrete trickle ditches will help to slow stormwater velocities and possibly promote infiltration. A small park area with educational signage can be integrated along the walking path.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This is an existing County facility and is located within a storm drainage easement on private land, the storm drainage easement may need to be enlarged. Accessibility is excellent from Colts Brook Drive or Fox Mill Road. There are no tree impacts or significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	316	$40.00	$12,640.00
Plantings	AC	1.57	$25,000.00	$39,250.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	3790	$35.00	$132,650.00
Embankment	CY	12	$50.00	$600.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$204,165.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$10,208.25
Erosion and Sediment Control: 10% of project costs				$20,416.50
			Base Construction Costs	**$234,789.75**
			Mobilization (5%)	$11,739.49
			Subtotal 1	**$246,529.24**
			Contingency (25%)	$61,632.31
			Subtotal 2	**$308,161.55**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$138,672.70
			Total Costs	**$446,834.24**
			Estimated Project Costs	***$450,000.00***

HC9121 Stormwater Pond Retrofit, BMP/LID

Address:	2800 Centreville Road
Location:	Centreville Road & Lake Shore Drive
Land Owner:	State/Park/Private
PIN:	0251-01-0027A, 0251-01-0034D, 0251-01-0035, 0251-01-0037
Control Type	Quality/Quantity
Drainage Area	23 acres
Receiving Waters	Horsepen Run

Description: Three existing dry ponds (VDOT29068, DP0015, DP0015) provide only water quantity control. Improve basins with water quality controls and remove concrete trickle ditches. Install vegetated swales in road dividers.

Project Area Map

Project Benefits: By retrofitting these three dry detention basins, sediment and nutrient loadings will be reduced and water quality in downstream waterbodies will be improved. Additionally, peak stormwater flows for storms up to a 10-year event will be reduced, evapotranspiration will be increased and wildlife habitat will be created.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Projects in RPAs may require exceptions. There are two existing stormwater facilities on private land and one existing VDOT facility on County park land. The vegetated swales are located within the Centreville Road right-of-way. Storm drainage easements will be necessary. Accessibility is excellent from Centreville Road. No tree impacts or significant construction issues are anticipated.

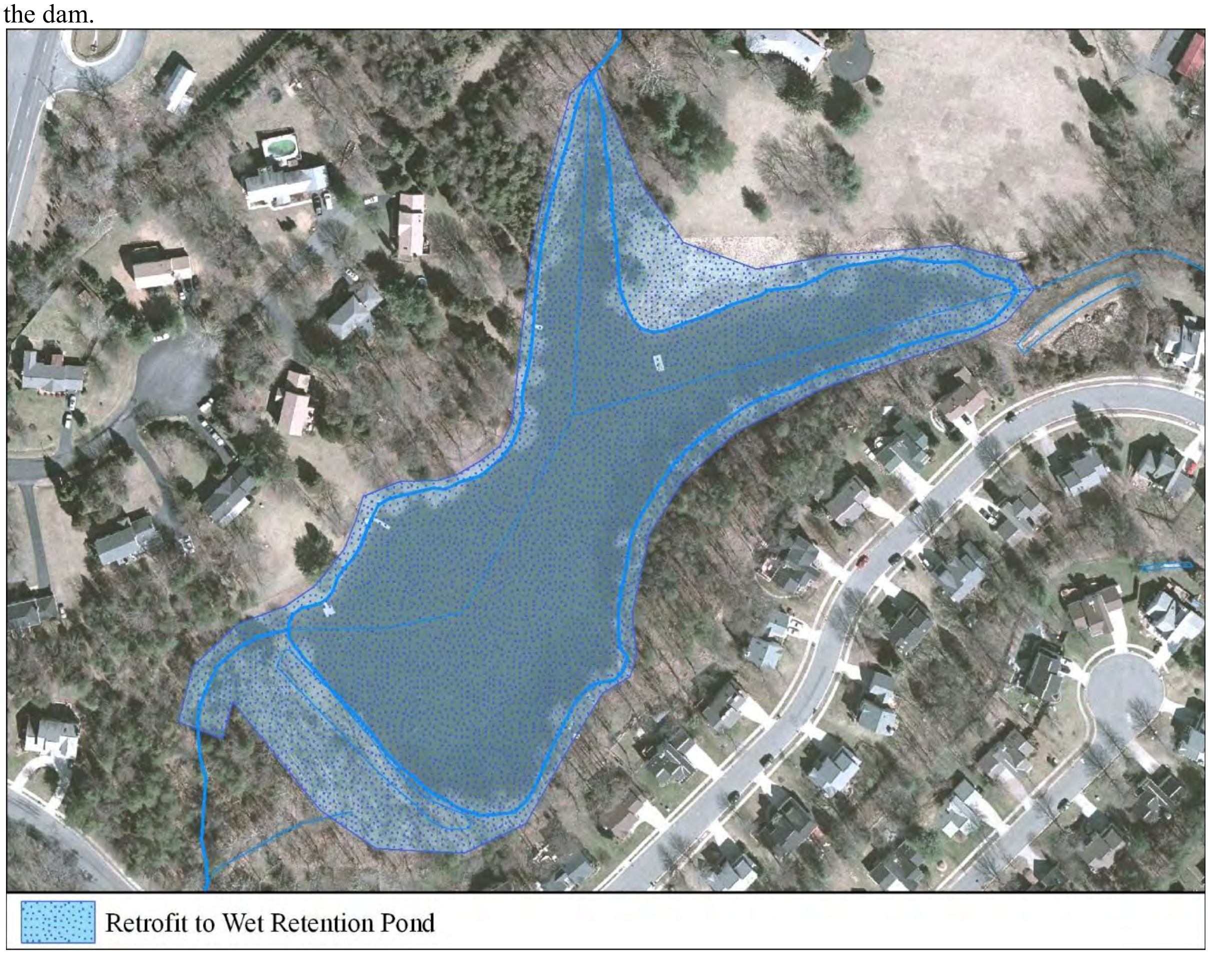
Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	925	$50.00	$46,250.00
Organic Compost Soil Amendment	CY	641	$40.00	$25,640.00
Plantings	AC	1.55	$25,000.00	$38,750.00
Clear and Grub	AC	0.33	$8,500.00	$2,805.00
Grading and Excavation	CY	2689	$35.00	$94,115.00
Embankment	CY	41	$50.00	$2,050.00
Outflow Pipe	LF	110	$125.00	$13,750.00
RipRap Stabilization	SY	30	$100.00	$3,000.00
Structural BMP Retrofit and Incidentals (Low)	LS	4	$10,000.00	$40,000.00
			Initial Project Costs	**$266,360.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$13,318.00
Erosion and Sediment Control: 10% of project costs				$26,636.00
			Base Construction Costs	**$306,314.00**
			Mobilization (5%)	$15,315.70
			Subtotal 1	**$321,629.70**
			Contingency (25%)	$80,407.43
			Subtotal 2	**$402,037.13**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$180,916.71
			Total Costs	**$582,953.83**
			Estimated Project Costs	***$590,000.00***

HC9122 Stormwater Pond Retrofit

Address:	2711 Floris Lane
Location:	Lake Shore Drive & Running Pump Lane
Land Owner:	Private
PIN:	0251-04-0008B, 0251-04-0009A, 0251-06-B, 0253-08-C,
Control Type	Quality/Quantity
Drainage Area	93 acres
Receiving Waters	Horsepen Run

Description: Retrofit existing non-stormwater pond (FM0014) to a stormwater wet pond. Draw down water level slightly to provide additional storage, instal a proper outlet structure, vegetate banks and investigate and repair a seep in the dam.



Project Area Map

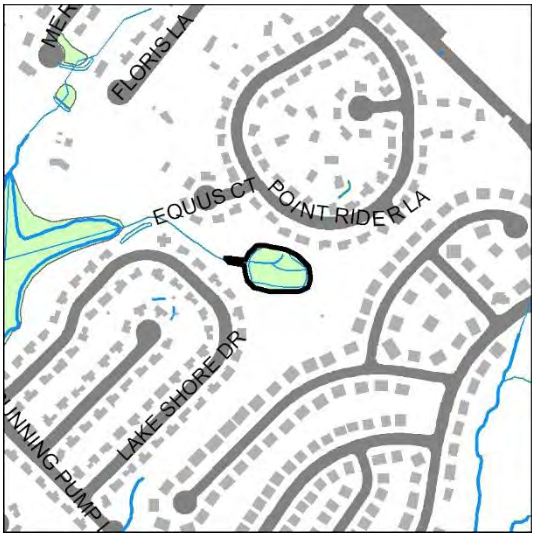
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, increase storage volume, eliminate an existing seep in the dam of the pond, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a pond, wetland, or on a dam. Projects in RPAs may require exceptions. This is a privately owned pond. A storm drainage easement will be necessary. Accessibility is good from Lake Shore Drive. Tree impacts are anticipated. There are no significant construction issues anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	20	$40.00	$800.00
Plantings	AC	0.1	$25,000.00	$2,500.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	100	$35.00	$3,500.00
Embankment	CY	20	$50.00	$1,000.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$29,400.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$1,470.00
Erosion and Sediment Control: 10% of project costs				$2,940.00
			Base Construction Costs	**$33,810.00**
			Mobilization (5%)	$1,690.50
			Subtotal 1	**$35,500.50**
			Contingency (25%)	$8,875.13
			Subtotal 2	**$44,375.63**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$19,969.03
			Total Costs	**$64,344.66**
			Estimated Project Costs	***$70,000.00***

HC9123 Stormwater Pond Retrofit



Address:	13348 Point Rider Lane
Location:	Near Point Rider Lane & Equus Court
Land Owner:	County
PIN:	0251-07-B
Control Type	Quality/Quantity
Drainage Area	25 acres
Receiving Waters	Horsepen Run

Description: Retrofit existing dry pond (0196DP) to an enhanced extended dry detention basin by removing a concrete trickle ditch, adding an outlet structure, restoring the downstream channel with vegetation and restoring access to the site.

Project Area Map

Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, provide for evapotranspiration and wildlife habitat, and stabilize existing stream banks. Additionally, removing the concrete trickle ditch will help to slow stormwater velocities and promote infiltration.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This is an existing County facility located within a storm drainage easement on private land, the storm drainage easement may need to be enlarged. Accessibility is good from Point Rider Lane between two parcels. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	225	$40.00	$9,000.00
Plantings	AC	1.1	$25,000.00	$27,500.00
Grading and Excavation	CY	231	$35.00	$8,085.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$64,635.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,231.75
Erosion and Sediment Control: 10% of project costs				$6,463.50
			Base Construction Costs	**$74,330.25**
			Mobilization (5%)	$3,716.51
			Subtotal 1	**$78,046.76**
			Contingency (25%)	$19,511.69
			Subtotal 2	**$97,558.45**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$43,901.30
			Total Costs	**$141,459.76**
			Estimated Project Costs	***$150,000.00***

HC9126 Stormwater Pond Retrofit

Address:	13076 Monterey Estates Drive
Location:	Monterey Estates Drive & West Ox Road
Land Owner:	County
PIN:	0251-12-A
Control Type	Quality/Quantity
Drainage Area	7 acres
Receiving Waters	Horsepen Run

Description: Existing dry pond (0562DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, enlarge size for more capacity, install a forebay to catch sediment and install an outlet structure.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated one ton/yr of total suspended solids, five lbs/yr of nitrogen, and one lb/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10 year event, provide for more storage volume, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This is an existing County facility located within a storm drainage easement on private land. Accessibility is excellent from West Ox Road. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	57	$40.00	$2,280.00
Plantings	AC	0.28	$25,000.00	$7,000.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	1367	$35.00	$47,845.00
Embankment	CY	16	$50.00	$800.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$78,600.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,930.00
Erosion and Sediment Control: 10% of project costs				$7,860.00
			Base Construction Costs	**$90,390.00**
			Mobilization (5%)	$4,519.50
			Subtotal 1	**$94,909.50**
			Contingency (25%)	$23,727.38
			Subtotal 2	**$118,636.88**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$53,386.59
			Total Costs	**$172,023.47**
			Estimated Project Costs	***$180,000.00***

HC9127 Stormwater Pond Retrofit

Address:	2641 Meadow Hall Drive
Location:	Near Meadow Hall Drive & New Carson Drive
Land Owner:	County/Private
PIN:	0251-05-B, 0251-12-B
Control Type	Quality/Quantity
Drainage Area	19 acres
Receiving Waters	Frying Pan Branch

Description: Existing dry ponds (0563DP and 0631DP) provide only water quantity control. Improve basins to enhanced extended dry detention basins with marsh areas including the removal of a concrete trickle ditch and the installation of proper outlet structures.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated one ton/yr of total suspended solids, 25 lbs/yr of nitrogen, and four lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. By removing the concrete trickle ditches and naturalizing stream channels, stormwater velocities will be reduced.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. 0563DP is an existing County facility located within a storm drainage easement. A storm drainage easement will be necessary for 0631DP, which is located next to a Colonial Gas easement on private land. Accessibility to 0563DP is excellent from Meadow Hall Drive. Accessibility to 0631DP is excellent via the gas easement from either Monterey Estates Drive or New Austin Court. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	235	$40.00	$9,400.00
Plantings	AC	1.16	$25,000.00	$29,000.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	200	$35.00	$7,000.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	40	$125.00	$5,000.00
RipRap Stabilization	SY	22	$100.00	$2,200.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$79,200.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,960.00
Erosion and Sediment Control: 10% of project costs				$7,920.00
			Base Construction Costs	**$91,080.00**
			Mobilization (5%)	$4,554.00
			Subtotal 1	**$95,634.00**
			Contingency (25%)	$23,908.50
			Subtotal 2	**$119,542.50**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$53,794.13
			Total Costs	**$173,336.63**
			Estimated Project Costs	***$180,000.00***

HC9128 Stormwater Pond Retrofit

Address:	3001Centreville Road
Location:	Korean Orthodox Presbyterian Church, Mclearen Road & Centreville Road
Land Owner:	Private
PIN:	0253-01-0014
Control Type	Quality/Quantity
Drainage Area	29 acres
Receiving Waters	Horsepen Run

Description: The Korean Orthodox Presbyterian dry pond (no StormNet ID) provides only water quantity control. Improve basin to an enhanced extended dry detention basin including the removal of a concrete trickle ditch and the addition of an outlet structure.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated nine tons/yr of total suspended solids, 50 lbs/yr of nitrogen, and 10 lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Stormwater velocities will be reduced by removing concrete trickle ditches and naturalizing channels.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. A storm drainage easement will be necessary. Accessibility is excellent from the Korean Orthodox Presbyterian driveway or Centreville Road. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	278	$40.00	$11,120.00
Plantings	AC	1.38	$25,000.00	$34,500.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	3339	$35.00	$116,865.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	100	$125.00	$12,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$192,060.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$9,603.00
Erosion and Sediment Control: 10% of project costs				$19,206.00
			Base Construction Costs	**$220,869.00**
			Mobilization (5%)	$11,043.45
			Subtotal 1	**$231,912.45**
			Contingency (25%)	$57,978.11
			Subtotal 2	**$289,890.56**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$130,450.75
			Total Costs	**$420,341.32**
			Estimated Project Costs	***$430,000.00***

HC9129 Stormwater Pond Retrofit, BMP/LID

Address:	13142 New Parkland Drive
Location:	West Ox Road & New Parkland Drive
Land Owner:	County/State
PIN:	0253-09-A
Control Type	Quality/Quantity
Drainage Area	40 acres
Receiving Waters	Horsepen Run

Description: Improve existing dry pond (0568DP) to an enhanced extended dry detention basin with marsh areas, install a natural low flow channel and retrofit outlet structure. Concrete swales will be removed/vegetated and educational signage will be installed.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated two tons/yr of total suspended solids, 38 lbs/yr of nitrogen, and eight lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Removing the concrete trickle ditch will reduce stormwater velocities and naturalizing the ditches will improve wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This is an existing County facility located within a storm drainage easement and adjacent to a Colonial Gas easement. Vegetated swales are located within the West Ox Road right-of-way and will require a storm drainage easement. Accessibility is excellent from West Ox Road, the Colonial Gas easement, or a storm drainage easement off of Cockerill Farm Lane. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	440	$50.00	$22,000.00
Organic Compost Soil Amendment	CY	300	$40.00	$12,000.00
Plantings	AC	1.49	$25,000.00	$37,250.00
Clear and Grub	AC	0.75	$8,500.00	$6,375.00
Grading and Excavation	CY	3600	$35.00	$126,000.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$222,975.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$11,148.75
Erosion and Sediment Control: 10% of project costs				$22,297.50
			Base Construction Costs	**$256,421.25**
			Mobilization (5%)	$12,821.06
			Subtotal 1	**$269,242.31**
			Contingency (25%)	$67,310.58
			Subtotal 2	**$336,552.89**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$151,448.80
			Total Costs	**$488,001.69**
			Estimated Project Costs	***$490,000.00***

HC9132 Stormwater Pond Retrofit

Address:	3029 McMaster Court
Location:	Highland Mews Subdivision, Hutumn Court & Highland Mews Court
Land Owner:	Private
PIN:	0253-10-C1
Control Type	Quality/Quantity
Drainage Area	23.3 acres
Receiving Waters	Horsepen Run

Description: Highland Mews existing dry pond (1055DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, remove concrete trickle ditch, install an outlet structure and install riprap at outfalls for energy dissipation.

Project Area Map

Project Benefits: This project will improve water quality be reducing an estimated one ton/yr of total suspended solids, 25 lbs/yr of nitrogen, and four lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Removing the concrete trickle ditch will reduce stormwater velocities and naturalizing the ditches will improve wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This is an existing stormwater facility located on private land. A storm drainage easement will be necessary. Accessibility is excellent from Highland Mews Court. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	136	$40.00	$5,440.00
Plantings	AC	0.67	$25,000.00	$16,750.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	1633	$35.00	$57,155.00
Embankment	CY	8	$50.00	$400.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	22	$100.00	$2,200.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$95,295.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,764.75
Erosion and Sediment Control: 10% of project costs				$9,529.50
			Base Construction Costs	**$109,589.25**
			Mobilization (5%)	$5,479.46
			Subtotal 1	**$115,068.71**
			Contingency (25%)	$28,767.18
			Subtotal 2	**$143,835.89**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$64,726.15
			Total Costs	**$208,562.04**
			Estimated Project Costs	***$210,000.00***

HC9133 Stormwater Pond Retrofit, BMP/LID, Stream Restoration

Address:	2914 Mother Well Court
Location:	Near Glen Taylor Lane & Mother Well Court
Land Owner:	Park/Private
PIN:	0253-04-P, 0253-09-R, 0253-04-N, 0253-04-R, 0253-04-Q, 0253-04-0710
Control Type	Quantity/Quality
Drainage Area	N/A
Receiving Waters	Cedar Run

Description: Retrofit existing dry pond (no StormNet ID) to enhanced extended dry detention basin including removal of paved ditch and intercepting additional upstream drainage. Improve channel downstream with energy dissipating structures and replace upstream paved ditches with vegetated swales.

Project Area Map

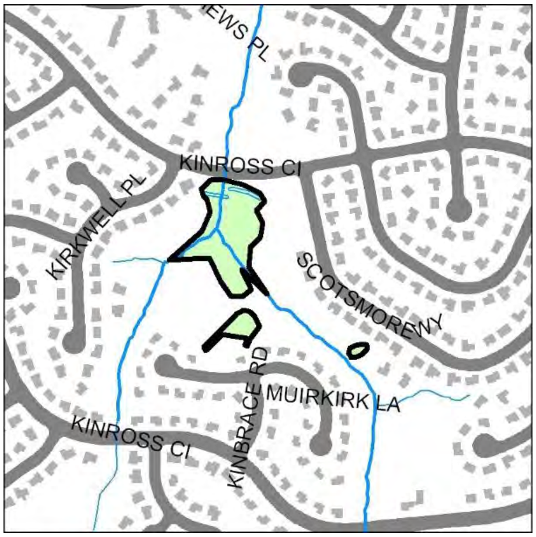
Project Benefits: This project will improve water quality be reducing an estimated two tons/yr of total suspended solids, 42 lbs/yr of nitrogen, and nine lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat. Removing the concrete trickle ditch will reduce stormwater velocities and naturalizing the ditches will improve wildlife habitat. Installing energy dissipating structures will reduce downstream impacts.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. The stormwater pond retrofit and vegetated swales are located on private lands within an AT&T easement, the downstream channel improvement is located within County park land. Storm drainage easements will be necessary. Accessibility is good from Mother Well Ct or the AT&T easement. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Clear and Grub	AC	0.23	$8,500.00	$1,955.00
Grading and Excavation	CY	2150	$35.00	$75,250.00
Plantings	AC	0.43	$25,000.00	$10,750.00
Organic Compost Soil Amendment	CY	90	$40.00	$3,600.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
Embankment	CY	15	$50.00	$750.00
Outflow Pipe	LF	100	$125.00	$12,500.00
RipRap Stabilization	SY	30	$100.00	$3,000.00
Vegetated Swale	SY	105	$50.00	$5,250.00
Change Channel Type – Step Pools	LF	300	$40.00	$12,000.00
			Initial Project Costs	**$140,055.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$7,002.75
Erosion and Sediment Control: 10% of project costs				$14,005.50
			Base Construction Costs	**$161,063.25**
			Mobilization (5%)	$8,053.16
			Subtotal 1	**$169,116.41**
			Contingency (25%)	$42,279.10
			Subtotal 2	**$211,395.52**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$95,127.98
			Total Costs	**$306,523.50**
			Estimated Project Costs	***$310,000.00***

HC9134 Stormwater Pond Retrofit, BMP/LID



Address:	13377 Scotsmore Way
Location:	Kinross Circle & Scotsmore Way
Land Owner:	Private
PIN:	0351-02-G
Control Type	Quality/Quantity
Drainage Area	236 acres
Receiving Waters	Horsepen Run

Description: Chantilly Highlands community does not have existing stormwater controls. Improve regional pond H-19 (0747DP) by adding a box weir to detain water and naturalize. Install small forebays at each outfall and naturalize swales to a new bioretention basin.

Project Area Map

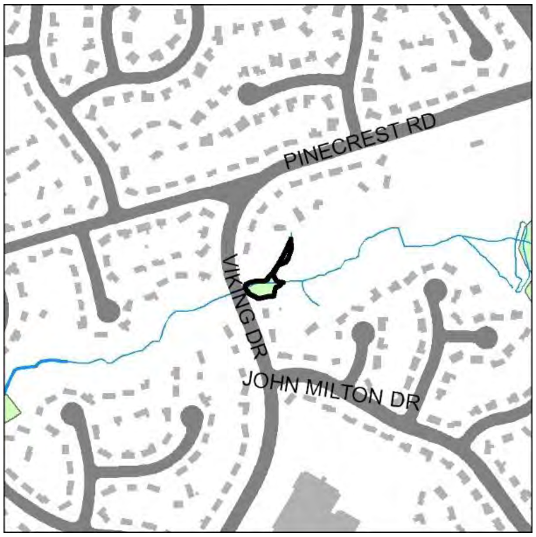
Project Benefits: This project will improve water quality by removing an estimated three tons/yr of total suspended solids, 161 lbs/yr of nitrogen, and 25 lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event, increase storage, and provide for evapotranspiration and wildlife habitat. Removing the concrete trickle ditch will reduce stormwater velocities and naturalizing the ditches will improve wildlife habitat. The new forebays will trap incoming sediments. The bioretention basin will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and provide wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. 0747DP is an existing stormwater facility on private land. Storm drainage easements will be necessary. Accessibility is excellent for HC9134A&B from Kinross Circle or Muirkirk Lane. HC9134C access may be difficult, as it is surrounded by residential parcels and the stream. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	378	$150.00	$56,700.00
Organic Compost Soil Amendment	CY	275	$40.00	$11,000.00
Plantings	AC	1.03	$25,000.00	$25,750.00
Clear and Grub	AC	0.33	$8,500.00	$2,805.00
Grading and Excavation	CY	400	$35.00	$14,000.00
Embankment	CY	22	$50.00	$1,100.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	20	$100.00	$2,000.00
Structural BMP Retrofit and Incidentals (High)	LS	1	$20,000.00	$20,000.00
			Initial Project Costs	**$137,105.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,855.25
Erosion and Sediment Control: 10% of project costs				$13,710.50
			Base Construction Costs	**$157,670.75**
			Mobilization (5%)	$7,883.54
			Subtotal 1	**$165,554.29**
			Contingency (25%)	$41,388.57
			Subtotal 2	**$206,942.86**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$93,124.29
			Total Costs	**$300,067.15**
			Estimated Project Costs	***$310,000.00***

HC9136 Stormwater Pond Retrofit



Address:	2587 Viking Drive
Location:	Near Viking Drive & Pinecrest Road
Land Owner:	Private
PIN:	0252-06-H
Control Type	Quality/Quantity
Drainage Area	176 acres
Receiving Waters	Horsepen Run

Description: Fox Mill Estates' existing dry pond provides only water quantity control. Improve basin to a constructed wetland. Enlarge basin, install a low v-notch weir as an outlet structure, install a fence and educational signage.

Project Area Map

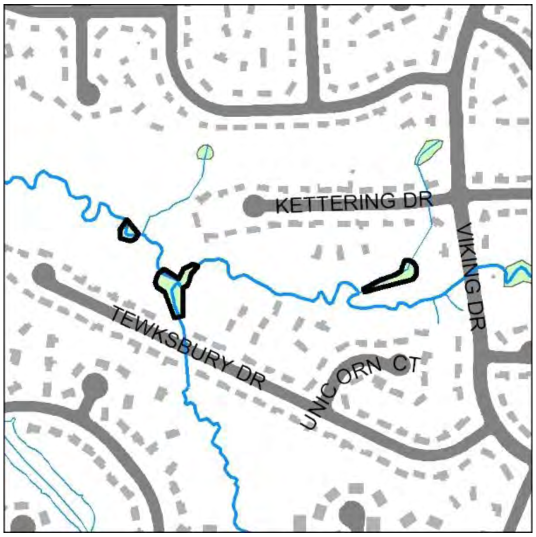
Project Benefits: This project will improve water quality by removing an estimated 38 lbs/yr of nitrogen and six lbs/yr of phosphorus. The constructed wetland will reduce stormwater peak flows and provide for evaporation, evapotranspiration and wildlife habitat. The educational signage will explain how the constructed wetland works to improve water quality and manage stormwater.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This is an existing stormwater facility on private land and will require a storm drainage easement. Accessibility is excellent from Viking Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	86	$40.00	$3,440.00
Plantings	AC	0.21	$25,000.00	$5,250.00
Clear and Grub	AC	0.21	$8,500.00	$1,785.00
Grading and Excavation	CY	1033	$35.00	$36,155.00
Embankment	CY	11	$50.00	$550.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$65,780.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$3,289.00
Erosion and Sediment Control: 10% of project costs				$6,578.00
			Base Construction Costs	**$75,647.00**
			Mobilization (5%)	$3,782.35
			Subtotal 1	**$79,429.35**
			Contingency (25%)	$19,857.34
			Subtotal 2	**$99,286.69**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$44,679.01
			Total Costs	**$143,965.70**
			Estimated Project Costs	***$150,000.00***

HC9137 Stream Restoration, New Stormwater Pond



Address:	12846 Tewksbury Drive
Location:	Between Tewksbury Drive & Kettering Drive
Land Owner:	Private
PIN:	0254-02-A, 0254-02-C
Control Type	Quality
Drainage Area	433 acres
Receiving Waters	Horsepen Run

Description: Fox Mill Estates does not have existing stormwater controls. Install three constructed wetlands, redirect and meander channels, and restore streambank with grading, boulder toe and vegetation. Restore the riparian vegetated buffer.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated 28 tons/yr of total suspended solids, 76 lbs/yr of nitrogen, and 23 lbs/yr of phosphorus. The constructed wetlands will reduce stormwater peak flows, allow for evaporation and evapotranspiration, and provide for wildlife habitat. Streambank stabilization measures will eliminate a direct source of sediments. A restored riparian buffer will help to lower stream temperatures, provided for evapotranspiration and improve wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. Storm drainage easements will be necessary. Accessibility is good from Tewksbury Drive and Viking Drive, though not always close by. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	193	$40.00	$7,720.00
Plantings	AC	0.77	$25,000.00	$19,250.00
Grading and Excavation	CY	1148	$35.00	$40,180.00
RipRap Stabilization	SY	10	$100.00	$1,000.00
Construct New Channel	LF	300	$200.00	$60,000.00
Additional Cost (first 500LF)	LF	300	$200.00	$60,000.00
Clear and Grub (Stream)	AC	0.77	$10,000.00	$7,700.00
			Initial Project Costs	**$195,850.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$9,792.50
Erosion and Sediment Control: 10% of project costs				$19,585.00
			Base Construction Costs	**$225,227.50**
			Mobilization (5%)	$11,261.38
			Subtotal 1	**$236,488.88**
			Contingency (25%)	$59,122.22
			Subtotal 2	**$295,611.09**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$133,024.99
			Total Costs	**$428,636.09**
			Estimated Project Costs	***$430,000.00***

HC9140 Stormwater Pond Retrofit

Address:	2558 Huntington Drive
Location:	Huntington Drive cul-de-sac
Land Owner:	Private
PIN:	0252-10-G
Control Type	Quality/Quantity
Drainage Area	104 acres
Receiving Waters	Horsepen Run

Description: Fox Mill Estates' existing dry pond (0243DP) provides only water quantity control. Improve basin to an enhanced extended dry detention basin, install outlet structure, raise the emergency spillway and naturalize the basin.

Project Area Map

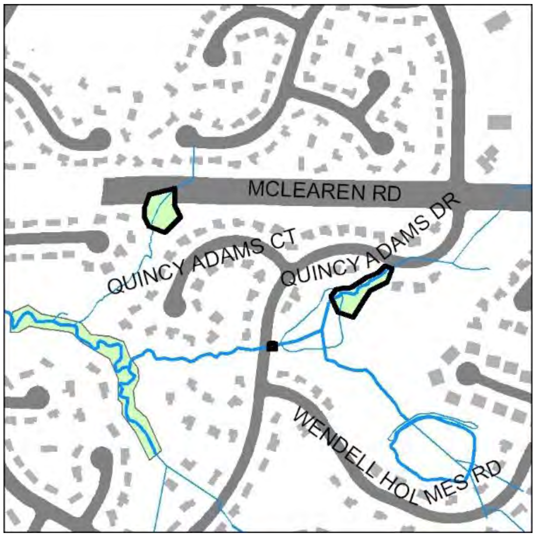
Project Benefits: This project will improve water quality by removing an estimated 52 lbs/yr of nitrogen and seven lbs/yr of phosphorus. This project will also reduce peak stormwater flows for storms up to a 10-year event and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This is an existing stormwater facility on private land a storm drainage easement will be necessary. Accessibility is excellent from Huntington Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	218	$40.00	$8,720.00
Plantings	AC	1.08	$25,000.00	$27,000.00
Clear and Grub	AC	0.05	$8,500.00	$425.00
Grading and Excavation	CY	2622	$35.00	$91,770.00
Embankment	CY	44	$50.00	$2,200.00
Outflow Pipe	LF	80	$125.00	$10,000.00
RipRap Stabilization	SY	50	$100.00	$5,000.00
Structural BMP Retrofit and Incidentals (High)	LS	1	$20,000.00	$20,000.00
			Initial Project Costs	**$165,115.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$8,255.75
Erosion and Sediment Control: 10% of project costs				$16,511.50
			Base Construction Costs	**$189,882.25**
			Mobilization (5%)	$9,494.11
			Subtotal 1	**$199,376.36**
			Contingency (25%)	$49,844.09
			Subtotal 2	**$249,220.45**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$112,149.20
			Total Costs	**$361,369.66**
			Estimated Project Costs	***$370,000.00***

HC9142 Stormwater Pond Retrofit, New Stormwater Pond



Address:	2627 Quincy Adams Drive
Location:	Quincy Adams Drive & Quincy Adams Court
Land Owner:	Private
PIN:	0254-08-A, 0254-08-B
Control Type	Quality/Quantity
Drainage Area	110 acres
Receiving Waters	Horsepen Run

Description: Existing dry pond (0176DP) provides only water quantity control and upper edge of pond is eroding. Install forebay in eroded area and retrofit outlet structure, without disturbing existing pond bottom with high quality wetland vegetation. Install constructed wetland near Kettering Drive and install riprap in channel below outfall.

Project Area Map

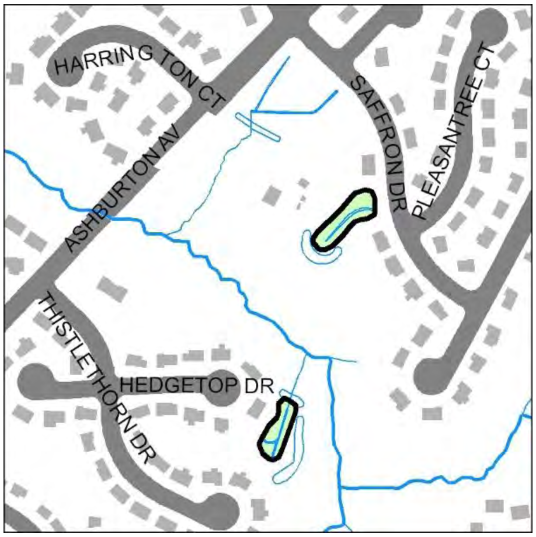
Project Benefits: This project will improve water quality by removing an estimated 16 tons/yr of total suspended solids, 58 lbs/yr of nitrogen, and 15 lbs/yr of phosphorus. This project will also reduce stormwater peak flows and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. 0176DP is an existing stormwater facility on private land. Storm drainage easements will be necessary. Accessibility to pond retrofit is excellent from Quincy Adams Drive or the Transco Gas easement. Accessibility to constructed wetland, which is partially located on a right-of-way, may be difficult as it is mostly surrounded by residential properties; nearest access is right-of-way from Quincy Adams Drive or Viking Drive. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	***Units***	***Quantity***	***Unit Cost***	***Total***
Organic Compost Soil Amendment	CY	201	$40.00	$8,040.00
Plantings	AC	0.74	$25,000.00	$18,500.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	300	$35.00	$10,500.00
Embankment	CY	22	$50.00	$1,100.00
Outflow Pipe	LF	30	$125.00	$3,750.00
RipRap Stabilization	SY	15	$100.00	$1,500.00
Construct New Channel	LF	100	$200.00	$20,000.00
Additional Cost (first 500LF)	LF	100	$200.00	$20,000.00
Structural BMP Retrofit and Incidentals (Med)	LS	1	$15,000.00	$15,000.00
			Initial Project Costs	**$99,240.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$4,962.00
Erosion and Sediment Control: 10% of project costs				$9,924.00
			Base Construction Costs	**$114,126.00**
			Mobilization (5%)	$5,706.30
			Subtotal 1	**$119,832.30**
			Contingency (25%)	$29,958.08
			Subtotal 2	**$149,790.38**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$67,405.67
			Total Costs	**$217,196.04**
			Estimated Project Costs	***$220,000.00***

HC9143 Stormwater Pond Retrofit



Address:	12901 Hedgetop Drive
Location:	Off of Ashburton Avenue, near Thistlethorn Drive & Saffron Drive
Land Owner:	County
PIN:	0352-14-A, 0352-14-A1
Control Type	Quantity/Quality
Drainage Area	29.6
Receiving Waters	Cedar Run

Description: Existing dry ponds 1001DP and 1116DP provide only water quantity control. Retrofit basins to enhanced extended detention basins to improve quality and quantity treatment. Remove concrete channels, raise outlet structure, and repair erosion at outfalls.

Project Area Map

Project Benefits: This project will improve water quality by removing an estimated three tons/yr of total suspended solids, 55 lbs/yr of nitrogen, and 10 lbs/yr of phosphorus. This project will also reduce stormwater peak flows and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. 1001DP and 1116DP are existing County facilities located in storm drainage easements on private land. Accessibility to 1001DP is excellent from Saffron Drive. Accessibility to 1116DP is good from Hedgetop Drive. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	100	$40.00	$4,000.00
Plantings	AC	0.50	$25,000.00	$12,500.00
Grading and Excavation	CY	2500	$35.00	$87,500.00
Clear and Grub	AC	0.20	$8,500.00	$1,700.00
Embankment	CY	25	$50.00	$1,250.00
Structural BMP and Incidentals (Low)	LS	2	$10,000.00	$20,000.00
RipRap Stabilization	SY	35	$100.00	$3,500.00
Outflow Pipe	LF	60	$125.00	$7,500.00
			Initial Project Costs	**$137,950.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,897.50
Erosion and Sediment Control: 10% of project costs				$13,795.00
			Base Construction Costs	**$158,642.50**
			Mobilization (5%)	$7,932.13
			Subtotal 1	**$166,574.63**
			Contingency (25%)	$41,643.66
			Subtotal 2	**$208,218.28**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$93,698.23
			Total Costs	**$301,916.51**
			Estimated Project Costs	***$310,000.00***

HC9149 New Stormwater Pond

Address:	2824 Chasbarb Court
Location:	Chasbarb Terrace & Chasbarb Court
Land Owner:	Private
PIN:	0254-02-0037, 0254-11-K
Control Type	Quality
Drainage Area	45 acres
Receiving Waters	Horsepen Run

Description: Remove existing concrete channel between Chasbarb Terrace and Viking Drive and vegetate. Install check dams in the channel for energy dissipation and install a constructed wetland in the lower portion of the channel.

Project Area Map

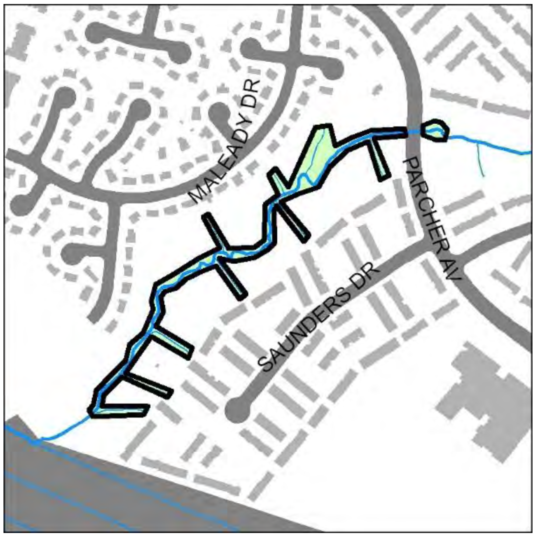
Project Benefits: This project will improve water quality by removing an estimated 17 tons/yr of total suspended solids, 46 lbs/yr of nitrogen, and 14 lbs/yr of phosphorus. This project will also reduce stormwater peak flows, promote infiltration, and provide for evapotranspiration and wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. This project is located partially in a Transco Gas easement and on private property. A storm drainage easement will be necessary. Accessibility is excellent from Viking Drive and Chasbarb Terrace. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	143	$40.00	$5,720.00
Plantings	AC	0.71	$25,000.00	$17,750.00
Grading and Excavation	CY	241	$35.00	$8,435.00
Construct New Channel	LF	220	$200.00	$44,000.00
Additional Cost (first 500LF)	LF	220	$200.00	$44,000.00
Clear and Grub (Stream)	AC	0.1	$10,000.00	$1,000.00
			Initial Project Costs	**$120,905.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$6,045.25
Erosion and Sediment Control: 10% of project costs				$12,090.50
			Base Construction Costs	**$139,040.75**
			Mobilization (5%)	$6,952.04
			Subtotal 1	**$145,992.79**
			Contingency (25%)	$36,498.20
			Subtotal 2	**$182,490.98**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$82,120.94
			Total Costs	**$264,611.93**
			Estimated Project Costs	***$270,000.00***

HC9200 Stream Restoration, Culvert Retrofit



Address:	13351 Parcher Avenue
Location:	Near Parcher Avenue & Monaghan Drive, next to the Reflection Lake pool
Land Owner:	Private
PIN:	0161-08-C, 0161-08-G, 0161-08-H, 0161-13-K, 0161-14-N
Control Type	Quality
Drainage Area	265 acres
Receiving Waters	Horsepen Run

Description: Horsepen Creek streambanks are eroded and incised in a park-like area below Parcher Avenue. Retrofit culvert with micro pool above Parcher Ave. and install small basin below athletic court to control stormwater flows. Re-grade and stabilize stream banks, vegetate stone drainage channels and install check dams, restore buffer and install educational signage.

Project Area Map

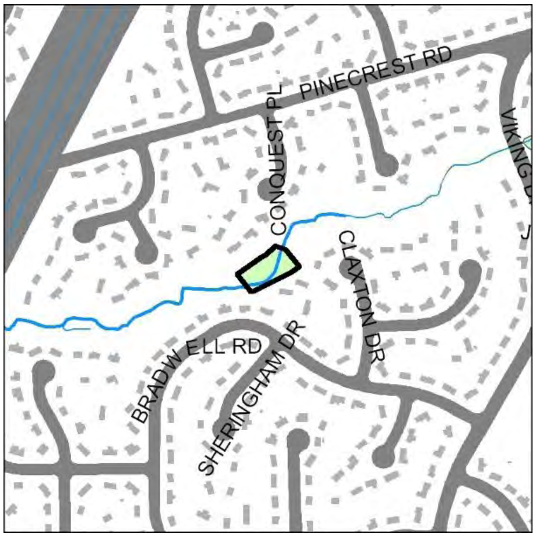
Project Benefits: This new pond will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, reduce peak stormwater flows for storms up to a 10-year event, and provide for evapotranspiration and wildlife habitat. Stabilizing streambanks will reduce sediment loading and improve wildlife habitat. Restoring the riparian buffer will help to slow down stormwater velocities, improve water quality, reduce stream temperatures and improve wildlife habitat. Installing check dams will reduce stormwater peak flows, improve water quality and promote infiltration.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. WP0219 is an existing stormwater facility located on private land. Storm drainage easements will be necessary. Accessibility is good from Parcher Avenue, Maleady Drive, Farougi Court, Apgar Place, and nearby parking lots (though not always close by). Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	240	$40.00	$9,600.00
Plantings	AC	1.35	$25,000.00	$33,750.00
Clear and Grub	AC	0.16	$8,500.00	$1,360.00
Grading and Excavation	CY	978	$35.00	$34,230.00
Earthen Berm	CY	50	$35.00	$1,750.00
Construct New Channel	LF	1975	$200.00	$395,000.00
Clear and Grub (Stream)	AC	0.91	$10,000.00	$9,100.00
			Initial Project Costs	**$484,790.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$24,239.50
Erosion and Sediment Control: 10% of project costs				$48,479.00
			Base Construction Costs	**$557,508.50**
			Mobilization (5%)	$27,875.43
			Subtotal 1	**$585,383.93**
			Contingency (25%)	$146,345.98
			Subtotal 2	**$731,729.91**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$329,278.46
			Total Costs	**$1,061,008.36**
			Estimated Project Costs	***$1,070,000.00***

HC9201 Stream Restoration



Address:	2604 Claxton Drive
Location:	Between Claxton Drive & Conquest Place culs-de-sac
Land Owner:	Private
PIN:	0254-02-J
Control Type	Quality
Drainage Area	267 acres
Receiving Waters	Horsepen Run

Description: The Fox Mill Estates community does not have existing stormwater controls. Regrade eroded streambanks and vegetate with floodplain vegetation. Restore channel with several rock vanes.

Project Area Map

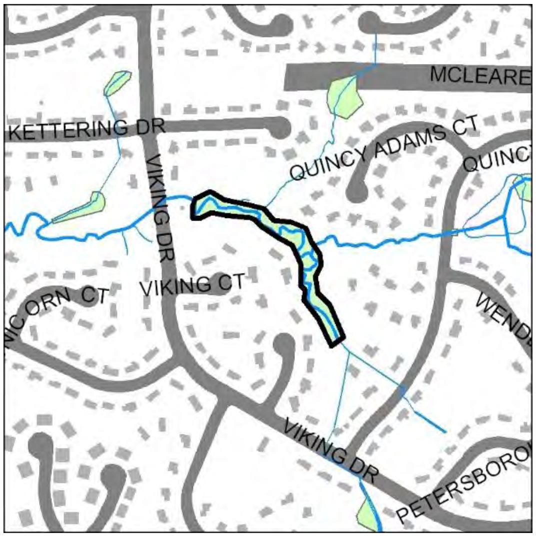
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality in downstream waterbodies, stabilize streambanks, and improve both terrestrial and aquatic wildlife habitats.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. Accessibility may be difficult, as the project is surrounded by residential properties. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	125	$40.00	$5,000.00
Plantings	AC	0.63	$25,000.00	$15,750.00
Construct New Channel	LF	200	$200.00	$40,000.00
Additional Cost (first 500LF)	LF	200	$200.00	$40,000.00
Clear and Grub (Stream)	AC	0.1	$10,000.00	$1,000.00
			Initial Project Costs	**$101,750.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$5,087.50
Erosion and Sediment Control: 10% of project costs				$10,175.00
			Base Construction Costs	**$117,012.50**
			Mobilization (5%)	$5,850.63
			Subtotal 1	**$122,863.13**
			Contingency (25%)	$30,715.78
			Subtotal 2	**$153,578.91**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$69,110.51
			Total Costs	**$222,689.41**
			Estimated Project Costs	***$230,000.00***

HC9202 Stream Restoration



Address:	2783 Prince Harold Court
Location:	Between Quincy Adams Court, Viking Court & Prince Harold Court culs-de-sac
Land Owner:	Private
PIN:	0254-02-B, 0254-08-A
Control Type	Quality
Drainage Area	238 acres
Receiving Waters	Horsepen Run

Description: This area has significant erosion. Regrade streambanks to connect to the floodplain and vegetate with floodplain vegetation. Install check dams to dissipate energy.

Project Area Map

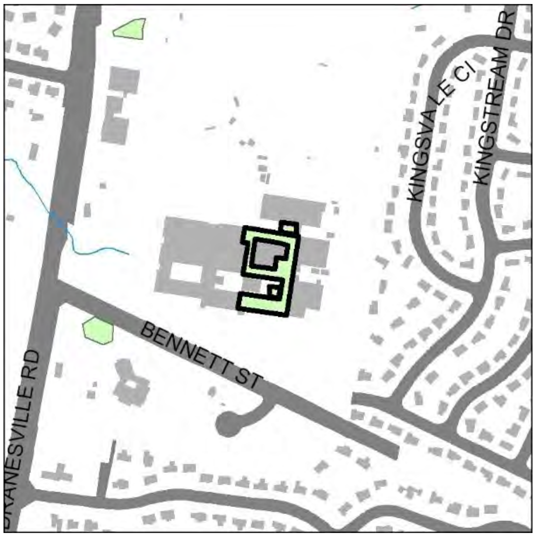
Project Benefits: This project will reduce sediment and nutrient loadings, improve water quality, stabilize stream banks and improve the floodplain.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. Additional permitting may be required for a project within a stream or wetland. Projects in RPAs may require exceptions. Accessibility is good from Viking Drive and Prince Harold Court, though not always close by. Tree impacts are expected. No significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Organic Compost Soil Amendment	CY	430	$40.00	$17,200.00
Plantings	AC	2.13	$25,000.00	$53,250.00
RipRap Stabilization	SY	100	$100.00	$10,000.00
Construct New Channel	LF	1160	$200.00	$232,000.00
Additional Cost (first 500LF)	LF	500	$200.00	$100,000.00
Clear and Grub (Stream)	AC	2.13	$10,000.00	$21,300.00
			Initial Project Costs	**$433,750.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$21,687.50
Erosion and Sediment Control: 10% of project costs				$43,375.00
			Base Construction Costs	**$498,812.50**
			Mobilization (5%)	$24,940.63
			Subtotal 1	**$523,753.13**
			Contingency (25%)	$130,938.28
			Subtotal 2	**$654,691.41**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$294,611.13
			Total Costs	**$949,302.54**
			Estimated Project Costs	***$950,000.00***

HC9500 BMP/LID



Address:	13665 Stratford Glen Place
Location:	Wellesley Subdivision, Stratford Glen Place
Land Owner:	Private
PIN:	0154-03-C
Control Type	Quality
Drainage Area	9 acres
Receiving Waters	Horsepen Run

Description: Install rain garden at the entrance of Sutters Mill Drive with curb cuts in the existing curbing. Regrade and vegetate existing basin bottom. Cut existing outlet pipe and fit with a raised yard drain outlet structure.

Project Area Map

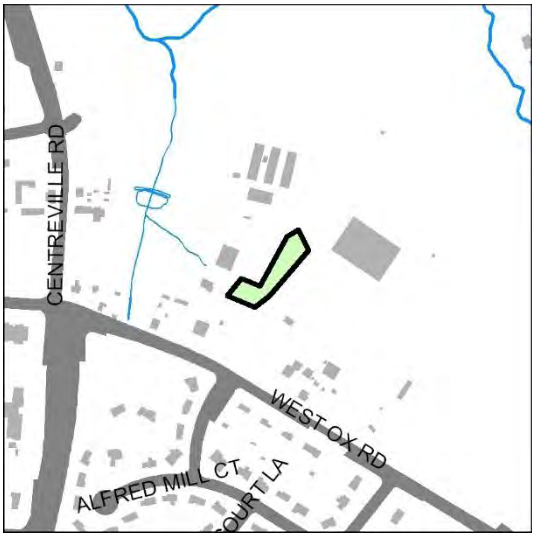
Project Benefits: This project will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This project is partially located on a Dominion Electric easement and on private land. A storm drainage easement will be necessary. Accessibility is excellent from River Birch Road, Stratford Glen Place, Saint Johns Wood Place. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Bioretention Filters & Basin	SY	511	$150.00	$76,650.00
Organic Compost Soil Amendment	CY	142	$40.00	$5,680.00
Plantings	AC	0.25	$25,000.00	$6,250.00
Clear and Grub	AC	0.1	$8,500.00	$850.00
Grading and Excavation	CY	200	$35.00	$7,000.00
Embankment	CY	8	$50.00	$400.00
Outflow Pipe	LF	20	$125.00	$2,500.00
RipRap Stabilization	SY	11	$100.00	$1,100.00
Structural BMP Retrofit and Incidentals (Low)	LS	1	$10,000.00	$10,000.00
			Initial Project Costs	**$110,430.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$5,521.50
Erosion and Sediment Control: 10% of project costs				$11,043.00
			Base Construction Costs	**$126,994.50**
			Mobilization (5%)	$6,349.73
			Subtotal 1	**$133,344.23**
			Contingency (25%)	$33,336.06
			Subtotal 2	**$166,680.28**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$75,006.13
			Total Costs	**$241,686.41**
			Estimated Project Costs	***$250,000.00***

HC9503 BMP/LID



Address:	2717 West Ox Road
Location:	Frying Pan Park/Kidwell Farm
Land Owner:	Park
PIN:	0251-01-0009
Control Type	Quality
Drainage Area	9 acres
Receiving Waters	Frying Pan Branch

Description: Frying Pan Park/Kidwell Farm does not have existing stormwater controls. Install vegetated swale along east side of horse ring to intercept overland flow from parking lot and divert to new bioretention area south of horse ring. Install educational signage.

Project Area Map

Project Benefits: This project will reduce stormwater peak flows, reduce sediment and nutrient loadings, improve water quality, promote infiltration, and provide for evapotranspiration and wildlife habitat. In addition, the new bioretention area will reduce stormwater peak flows for small storm events, reduce stormwater runoff volumes by promoting infiltration and evapotranspiration, and provide for wildlife habitat.

Project Design Considerations: Minimal environmental permitting requirements are anticipated. This project is located in a County park. A storm drainage easement will be necessary. Accessibility is excellent from the parking lot off of West Ox Road. No tree impacts or significant construction issues are anticipated.

Costs:

Item	*Units*	*Quantity*	*Unit Cost*	*Total*
Vegetated Swale	SY	478	$50.00	$23,900.00
Organic Compost Soil Amendment	CY	101	$40.00	$4,040.00
Plantings	AC	0.5	$25,000.00	$12,500.00
			Initial Project Costs	**$40,440.00**
Plantings: 5% of project costs (unless incl. as line item)				$0.00
Ancillary Items: 5% of project cost				$2,022.00
Erosion and Sediment Control: 10% of project costs				$4,044.00
			Base Construction Costs	**$46,506.00**
			Mobilization (5%)	$2,325.30
			Subtotal 1	**$48,831.30**
			Contingency (25%)	$12,207.83
			Subtotal 2	**$61,039.13**
			Engineering Design, Surveys, Land Acquisition, Utility Relocation and Permits (45%)	$27,467.61
			Total Costs	**$88,506.73**
			Estimated Project Costs	***$90,000.00***

6.0 Benefits of Plan Implementation

There are numerous watershed restoration strategies that may have a significant impact on the overall health and quality of the Sugarland Run and Horsepen Creek watersheds. In order to quantify the costs and benefits of implementing the watershed restoration strategies discussed in previous sections, additional analyses were required. This section discusses and summarizes the results of the pollutant load, hydrologic and hydraulic modeling used in the development of the watershed management plans to quantify any reductions in pollutant loading, total stormwater runoff volumes, peak rate of runoff and the extent of flooding. A summary of cost estimates and an analysis of the costs and benefits of the project plan are also discussed.

6.1 Stormwater Models

As discussed in Section 2, modeling is a way to mathematically predict and spatially represent what will occur during a given rainfall event. Hydrologic and hydraulic models are the two types of models that are used to achieve this. *Hydrologic models* take into account the particular rainfall event of interest, the physical nature of the land area where the rainfall occurs, and how quickly the resulting stormwater runoff drains a given land area. Hydrologic models can describe both the quantity of stormwater runoff and resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that are transported by the runoff. *Hydraulic models* are used to evaluate the effect the stormwater runoff from a particular rainfall event has on both man-made and natural systems. These models can predict both the ability man-made culverts/channels have in conveying stormwater runoff and the spatial extent of potential flooding.

Hydrologic and hydraulic models were created for three distinct scenarios as listed below:

- Existing conditions
- Future conditions without projects
- Future conditions with projects

For *Existing Conditions*, the models simulated the condition of the watersheds at the time the models were created by incorporating information on land use, soils, existing stormwater management and best management practice facilities, previous stream and watershed assessments, and actual field reconnaissance and site visits. The *Future Conditions without Projects* scenario simulated future conditions based on countywide future land use and development, derived from the county's comprehensive plan and build-out predictions. As the name implies, the *Future Conditions without Projects* models do not contain any of the watershed restoration strategies or projects identified in this plan. The *Future Conditions with Projects* scenario simulates the implementation of the projects discussed in the previous sections. The *Future Conditions with Projects* scenario uses the *Future Conditions without Projects* models as a base on which proposed restoration strategies are added and evaluated. Comparison of modeling results from these three scenarios yielded pollutant loading and stormwater runoff reductions discussed below. Detailed information on the setup and calibration of the STEPL pollution models, SWMM hydrologic models and HEC-RAS hydraulic models can be found in Technical Memo 3.6 in Appendix B.

6.2 Analysis of Stormwater Modeling Results

Results of the modeling efforts were compiled and analyzed to determine pollutant load and flow reductions. The reduction in values shown and discussed below indicates the overall benefits of implementing the restoration strategies described within the plan.

6.2.1 Sugarland Run

Tables 6.1 and 6.2 below summarize the results of the pollutant and hydrologic models in terms of pollutant loading and stormwater flow reductions for the Sugarland Run Watershed. All values were normalized to the drainage area to allow for direct and accurate comparisons. Runoff volume and peak flow values were obtained from SWMM hydrologic models and were calculated cumulatively. In other words, flows were summed from upstream to downstream and were divided by the total contributing drainage area. Total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP) values were obtained from the results of the STEPL pollutant models. These values were calculated based on the individual land area contributions and may not increase from upstream to downstream.

Table 6.1
Sugarland Run Pollutant Loading and Flow Reductions by WMA

WMA	Area (ac)	Scenario[3]	Runoff Volume (in/yr)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
			2 Year	10 Year	2 Year	10 Year			
Folly Lick WMA	1,814	Existing Condition	2,086.37	4,742.46	0.240	0.546	259.16	6.068	0.927
		Future Without Projects	3,707.16	7,567.42	0.426	0.870	263.22	6.198	0.943
		Future With 10-yr Projects	3,674.52	7,510.86	0.423	0.864	258.29	6.116	0.930
		Reduction (10-year Plan)	-1%	-1%	-1%	-1%	-2%	-1%	-1%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	250.32	6.03	0.91
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-5%	-3%	-3%
Headwaters WMA	1,391	Existing Condition	3,772.97	7,239.01	0.434	0.833	258.99	7.239	0.974
		Future Without Projects	3,756.78	7,209.14	0.432	0.829	259.32	7.252	0.976
		Future With 10-yr Projects	3,550.03	6,825.42	0.408	0.785	254.50	7.081	0.956
		Reduction (10-year Plan)	-6%	-5%	-6%	-5%	-2%	-2%	-2%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	254.504	7.081	0.956
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-2%	-2%	-2%
Lower Sugarland WMA	3,743	Existing Condition	543.58	1,297.11	0.063	0.149	97.73	2.399	0.352
		Future Without Projects	581.80	1,402.64	0.067	0.161	98.00	2.424	0.356
		Future With 10-yr Projects	550.30	1,357.72	0.063	0.156	95.06	2.380	0.348
		Reduction (10-year Plan)	-5%	-3%	-5%	-3%	-3%	-2%	-2%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	93.27	2.36	0.34
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-5%	-3%	-4%

Table 6.1 Sugarland Run Pollutant Loading and Flow Reductions by WMA									
WMA	**Area (ac)**	**Scenario[3]**	**Runoff Volume (in/yr)[1]**		**Peak Flow (cfs/ac)[1]**		**TSS (lb/ac/yr)[2]**	**TN (lb/ac/yr)[2]**	**TP (lb/ac/yr)[2]**
			2 Year	**10 Year**	**2 Year**	**10 Year**			
Lower Middle Sugarland WMA	3,503	Existing Condition	296.59	627.33	0.034	0.072	188.88	4.509	0.669
		Future Without Projects	356.95	800.81	0.041	0.092	191.04	4.586	0.678
		Future With 10-yr Projects	351.46	792.84	0.040	0.091	185.93	4.522	0.666
		Reduction (10-year Plan)	-2%	-1%	-2%	-1%	-3%	-1%	-2%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	179.62	4.46	0.65
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-6%	-3%	-4%
Potomac WMA[4]	1,053	Existing Condition	1,649.94	3,824.07	0.190	0.440	74.65	1.473	0.226
		Future Without Projects	1,649.94	3,824.07	0.190	0.440	74.66	1.474	0.226
		Future With 10-yr Projects	1,649.94	3,824.17	0.190	0.440	74.64	1.473	0.226
		Reduction (10-year Plan)	0%	0%	0%	0%	0%	0%	0%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	74.64	1.47	0.23
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0%	0%	0%
Upper Sugarland WMA	928	Existing Condition	3,398.88	6,772.61	0.391	0.779	386.02	9.049	1.236
		Future Without Projects	3,584.49	7,039.15	0.412	0.810	408.79	9.605	1.296
		Future With 10-yr Projects	3,363.16	6,688.95	0.387	0.769	389.12	9.341	1.257
		Reduction (10-year Plan)	-6%	-5%	-6%	-5%	-5%	-3%	-3%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	372.26	9.17	1.23
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-9%	-4%	-5%
Upper Middle Sugarland WMA	1,975	Existing Condition	2,121.30	4,394.20	0.244	0.505	258.78	6.699	0.967
		Future Without Projects	2,413.53	5,142.53	0.278	0.592	261.31	6.741	0.971
		Future With 10-yr Projects	2,286.22	4,854.19	0.263	0.558	235.88	6.429	0.918
		Reduction (10-year Plan)	-5%	-6%	-5%	-6%	-10%	-5%	-6%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	229.29	6.36	0.91
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-12%	-6%	-7%

[1] Flow is cumulative.
[2] Loads are representative of individual land area contributions.
[3] 25-year projects were not evaluated in the hydrologic model.
[4] No projects were proposed in this WMA.

Table 6.2 Sugarland Run Overall Pollutant Loading and Flow Reductions									
Watershed	Area (ac)	Scenario[3]	Runoff Volume (in/yr)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)
			2 Year	10 Year	2 Year	10 Year			
Sugarland Run	14,407	Existing Condition	613.11	1,447.72	0.071	0.167	198.83	4.850	0.702
		Future Without Projects	649.40	1,550.05	0.075	0.178	202.51	4.952	0.714
		Future With 10-yr Projects	619.74	1,506.90	0.071	0.173	194.18	4.835	0.695
		Reduction (10-year Plan)	-5%	-3%	-5%	-3%	-4%	-2%	-3%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	188.65	4.78	0.68
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-7%	-4%	-4%

[1] Flow is cumulative.
[2] 25-year projects were not evaluated in the hydrologic model.

Based on modeling results, implementation of the restoration strategies and projects described in the 10-year plan will result in reductions in stormwater runoff flows and pollutant loads. The values shown in these tables have all been normalized to the drainage area and the reductions shown here indicate reductions per unit area. The model results show the greatest reductions in WMAs further upstream such as the Headwaters, Upper Sugarland and Upper Middle Sugarland WMAs where stormwater management generally has the greatest effect and where projects have been prioritized. WMAs where no projects or restoration strategies are proposed such as Potomac WMA, which is located completely within Loudoun County, are shown in Table 6.1 above without any reductions or increases in pollutant loadings or stormwater flow.

6.2.2 Horsepen Creek

Tables 6.3 and 6.4 below summarize the results of the pollutant and hydrologic models in terms of pollutant loading and stormwater flow reductions for the Horsepen Creek Watershed. All values were normalized to the drainage area to allow for direct and accurate comparisons. Runoff volume and peak flow values were obtained from SWMM hydrologic models and were calculated cumulatively. In other words, flows were summed from upstream to downstream and were divided by the total contributing drainage area. Total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP) values were obtained from the results of the STEPL pollutant models. These values were calculated based on the individual land area contributions and may not increase from upstream to downstream.

Table 6.3 Horsepen Creek Pollutant Loading and Flow Reductions by WMA									
WMA	**Area (ac)**	**Scenario[3]**	**Runoff Volume (in/yr)[1]**		**Peak Flow (cfs/ac)[1]**		**TSS (lb/ac/yr)[2]**	**TN (lb/ac/yr)[2]**	**TP (lb/ac/yr)[2]**
			2 Year	**10 Year**	**2 Year**	**10 Year**			
Cedar Run WMA	782	Existing Condition	2,470.81	5,342.51	0.284	0.615	264.86	6.11	0.924
		Future Without Projects	2,497.59	5,393.07	0.287	0.620	265.79	6.14	0.928
		Future With 10-yr Projects	2,270.70	5,002.40	0.261	0.575	225.25	5.77	0.849
		Reduction (10-year Plan)	-9%	-7%	-9%	-7%	-15%	-6%	-9%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	212.69	5.66	0.82
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-20%	-8%	-11%
Frying Pan WMA	1,130	Existing Condition	1,893.41	4,060.69	0.218	0.467	232.42	6.68	0.954
		Future Without Projects	2,523.19	5,297.10	0.290	0.609	243.22	6.96	0.990
		Future With 10-yr Projects	2,164.66	4,591.34	0.249	0.528	225.31	6.73	0.953
		Reduction (10-year Plan)	-14%	-13%	-14%	-13%	-7%	-3%	-4%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	224.95	6.73	0.95
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-8%	-3%	-4%
Indian Creek WMA[4]	2,066	Existing Condition	1,883.67	4,184.63	0.217	0.481	139.27	3.49	0.495
		Future Without Projects	1,883.51	4,184.26	0.217	0.481	139.27	3.49	0.495
		Future With 10-yr Projects	1,883.51	4,184.26	0.217	0.481	139.27	3.49	0.495
		Reduction (10-year Plan)	0%	0%	0%	0%	0%	0%	0%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	139.27	3.49	0.50
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0%	0%	0%
Lower Horsepen WMA[4]	3,190	Existing Condition	1,176.07	2,625.44	0.135	0.302	278.98	5.00	0.607
		Future Without Projects	1,342.96	2,972.98	0.154	0.342	278.98	5.00	0.607
		Future With 10-yr Projects	1,327.85	2,925.21	0.153	0.336	278.98	5.00	0.607
		Reduction (10-year Plan)	-1%	-2%	-1%	-2%	0%	0%	0%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	278.98	5.00	0.61
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0%	0%	0%
Lower Middle Horsepen WMA	1,186	Existing Condition	1,174.06	2,715.91	0.136	0.315	369.06	8.23	1.249
		Future Without Projects	1,533.81	3,301.16	0.178	0.383	375.40	8.44	1.277
		Future With 10-yr Projects	1,506.72	3,164.54	0.175	0.367	349.10	8.08	1.220
		Reduction (10-year Plan)	-2%	-4%	-2%	-4%	-7%	-4%	-4%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	344.10	8.07	1.21

Table 6.3 Horsepen Creek Pollutant Loading and Flow Reductions by WMA									
WMA	**Area (ac)**	**Scenario[3]**	**Runoff Volume (in/yr)[1]**		**Peak Flow (cfs/ac)[1]**		**TSS (lb/ac/yr)[2]**	**TN (lb/ac/yr)[2]**	**TP (lb/ac/yr)[2]**
			2 Year	**10 Year**	**2 Year**	**10 Year**			
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-8%	-4%	-5%
Merrybrook WMA	967	Existing Condition	3,518.40	6,938.40	0.405	0.798	118.66	4.75	0.707
		Future Without Projects	4,655.22	8,571.15	0.535	0.986	130.53	5.42	0.782
		Future With 10-yr Projects	4,542.89	8,404.31	0.523	0.967	129.54	5.40	0.776
		Reduction (10-year Plan)	-2%	-2%	-2%	-2%	-1%	0%	-1%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	128.40	5.36	0.77
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-2%	-1%	-1%
Middle Horsepen WMA	953	Existing Condition	1,040.98	2,784.46	0.120	0.320	260.25	5.70	0.707
		Future Without Projects	1,155.55	2,905.34	0.133	0.334	327.62	7.25	0.859
		Future With 10-yr Projects	1,087.15	2,855.62	0.125	0.328	323.05	7.04	0.837
		Reduction (10-year Plan)	-6%	-2%	-6%	-2%	-1%	-3%	-3%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	289.88	6.79	0.80
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-12%	-6%	-7%
Stallion WMA[4]	2,394	Existing Condition	1,150.72	2,571.28	0.132	0.296	132.50	2.31	0.292
		Future Without Projects	1,150.72	2,571.28	0.132	0.296	132.50	2.31	0.292
		Future With 10-yr Projects	1,150.72	2,571.28	0.132	0.296	132.50	2.31	0.292
		Reduction (10-year Plan)	0%	0%	0%	0%	0%	0%	0%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	132.50	2.31	0.29
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	0%	0%	0%
Upper Horsepen WMA	1,929	Existing Condition	1,089.50	3,050.78	0.125	0.351	180.09	4.800	0.694
		Future Without Projects	1,110.70	3,092.65	0.128	0.356	182.94	4.876	0.702
		Future With 10-yr Projects	1,024.87	3,034.59	0.118	0.349	133.24	4.575	0.642
		Reduction (10-year Plan)	-8%	-2%	-8%	-2%	-27%	-6%	-9%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	132.25	4.58	0.64
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-28%	-6%	-9%

[1] Flow is cumulative.
[2] Loads are representative of individual land area contributions.
[3] 25-year projects were not evaluated in the hydrologic model.
[4] No projects were proposed in this WMA.

Table 6.4 Horsepen Creek Overall Pollutant Loading and Flow Reductions									
Watershed	Area (ac)	Scenario[3]	Runoff Volume (in/yr)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)	TN (lb/ac/yr)	TP (lb/ac/yr)
			2 Year	10 Year	2 Year	10 Year			
Horsepen Creek	14,597	Existing Condition	1,176.07	2,625.44	0.135	0.302	213.24	4.80	0.660
		Future Without Projects	1,342.96	2,972.98	0.154	0.342	220.20	4.99	0.682
		Future With 10-yr Projects	1,327.85	2,925.21	0.153	0.336	207.57	4.87	0.660
		Reduction (10-year Plan)	-1%	-2%	-1%	-2%	-6%	-2%	-3%
		Future With 0-25 yr Projects	N/A	N/A	N/A	N/A	204.09	4.85	0.66
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	-7%	-3%	-4%

[1] Flow is cumulative.
[2] 25-year projects were not evaluated in the hydrologic model.

Based on modeling results, implementation of the restoration strategies and projects described in the 10-year plan will result in reductions in stormwater runoff flows and pollutant loads. The values shown in these tables have all been normalized to the drainage area and the reductions shown here indicate reductions per unit area.

The model results show the greatest reductions in WMAs further upstream such as the Cedar Run, Frying Pan and Upper Horsepen WMAs where stormwater management generally has the greatest effect and where projects have been prioritized. WMAs where no projects or restoration strategies are implemented such as the Indian Creek and Stallion WMAs, which are both located completely within Loudoun County, are shown in Table 6.3 above without any reductions or increases in pollutant loadings or stormwater flow. Lower Horsepen WMA is also located completely within Loudoun County and no projects are proposed within its boundaries. STEPL results for pollutant loadings show no reductions or increases; however the flow values do indicate a reduction. Stormwater flow values were calculated cumulatively as described previously. Since Lower Horsepen WMA is the downstream most WMA in the Horsepen Run watershed and located on the main stem of Horsepen Run, the flow values shown in Table 6.3 for this WMA reflect flow reductions for the entire Horsepen Run watershed.

6.3 Project Costs and Benefits Analysis

An integral element to evaluating the benefits of restoration strategies and projects is associated costs. Cost estimates were calculated for all structural projects detailed in previous sections. Detailed cost estimates, as shown on the project fact sheets, were determined for structural projects in the 0-10 year implementation phase. The total costs of implementing projects in this phase were calculated to be approximately $17 million and $12.6 million for the Sugarland Run and Horsepen Creek watersheds, respectively. Associated costs for structural projects in the 11-25 year phase were roughly approximated based on the overall costs associated with similar projects in the 10 year implementation plan. Cost estimates were not calculated for non-structural projects, because non-structural projects do not require traditional construction measures to be implemented and may be programmatic in nature.

In addition to the calculation of cost estimates for projects listed in the implementation plan, a cost benefit analysis was also performed. The project cost distribution for all projects listed in the 10-year implementation plan was evaluated. The evaluation of the project cost distribution allowed for a determination of outliers within the lists of projects. These outliers could be projects that were significantly more or less expensive than other projects in the lists. These projects were further scrutinized and evaluated to determine if they should remain in the 10-year list. Outliers determined to be kept in the list were evaluated separately from the other projects in the 10-year list. A cost to benefit ratio was calculated based on the subwatershed ranking composite score and the projects' associated costs. Using the cost to benefit ratio, all structural projects in the 10-year implementation plan were reordered based on this analysis.

6.4 Overall Costs and Benefits of Plan Implementation

The stormwater modeling and costs and benefits analysis described in this section demonstrates the value of the projects and restoration strategies discussed within the plan. The overall cost of implementing all the projects on the 10-year list is $30 million. Implementation of all projects and restoration strategies in the 10-year priority list will result in significant overall reductions in stormwater flows and pollutant loads. Stormwater runoff volume from the 2-year and 10-year storm events would decrease by 2% or 45 inches per year and 91 inches per year, respectively. The peak flow rate would also decrease by 2%, resulting in a reduction of 0.005 CFS per acre for the 2-year storm event and 0.010 CFS per acre for the 10-year storm event. Total suspended solids would be reduced by 5% overall or 21 pounds per acre per year. Total nitrogen would be reduced by 2% or 0.24 pounds per acre per year, and total phosphorus would be reduced by 3% or 0.04 pounds per acre per year.

Implementation of all projects within the plan, including projects in the 25-year implementation plan will result in additional reductions in stormwater flows and pollutant loads. Total suspended solids would be reduced by 7 percent overall or 30 pounds per acre per year. Total nitrogen would be reduced by 3 percent or 0.32 pounds per acre per year, and total phosphorus would be reduced by 4 percent or 0.06 pounds per acre per year.

7.0 Glossary and Acronyms

Acre – A measure of land equating to 43,560 square feet.

Aquatic Habitat – The wetlands, streams, lakes, ponds, estuaries and streamside (riparian) environments where aquatic organisms (e.g., fish, benthic macroinvertebrates) live and reproduce; includes the water, soils, vegetation and other physical substrate (rocks, sediment) upon and within which the organisms occur.

Benthic Macroinvertebrate – An aquatic animal lacking a backbone and generally visible to the unaided eye.

Best Management Practice (BMP) – A structural or nonstructural practice that is designed to minimize the impacts of changes in land use on surface and groundwater systems. Structural best management practices refer to basins or facilities engineered for the purpose of reducing the pollutant load in stormwater runoff, such as bioretention, constructed stormwater wetlands, etc. Nonstructural best management practices refer to land use or development practices that are determined to be effective in minimizing the impact on receiving stream systems such as the preservation of open space and stream buffers, disconnection of impervious surfaces, etc.

Bioengineering – Combines biological (live plants) and engineering (structural) methods to provide a streambank stabilization method that performs natural stream functions without habitat destruction.

Bioretention System (Rain Garden) – A stormwater BMP consisting of a shallow surface depression planted with native vegetation to capture, treat and infiltrate stormwater.

Channel Evolution Model (CEM) – The geomorphologic assessment of the incised stream channels developed by Schumm et. al.

Channel – A natural or manmade waterway.

Check Dam – A structure placed within a swale or other stormwater facility to slow the stormwater flow rate and create small, temporary ponding areas.

Confluence – The joining point where two or more stream create a combined, larger stream.

Constructed Stormwater Wetland – A stormwater management facility consisting of shallow pools constructed to replicate natural wetland ecosystems, designed to enhance the water quality of stormwater runoff.

Department of Public Works and Environmental Services (DPWES) – Fairfax County, VA, department in charge of public works, utilities, building permits, land use and development, stormwater, wastewater, recycling and other environmental services.

Design Storm – A selected rainfall hyetograph of specified amount, intensity, duration and frequency that is used as a basin for design.

Detention – The temporary impoundment or holding of stormwater runoff.

Ecosystem – All the component organisms of a community and their environment that together form an interacting system.

Environmental Protection Agency (EPA) – United States federal agency responsible for safeguarding and managing a region's natural resources and quality of life.

Erosion - is the natural process by which a stream channel adjusts to changes within its watershed. Increased development within a watershed can accelerate the erosion process, resulting in the loss of residential yards, threatened infrastructure, siltation of aquatic habitat and decreased water quality.

Extended Detention (ED) Basin – A stormwater management facility that temporarily stores stormwater runoff and discharges it at a slower rate through a hydraulic outlet structure.

Federal Emergency Management Agency (FEMA) – United States federal agency responsible for disaster mitigation, preparedness, response, recovery and education, including flood maps.

Floodplain - Area of land on each side of a stream channel that is inundated periodically by flood waters; important zone for dissipating the energy of peak storm flow discharges and for storing waters that otherwise might damage in-stream habitat and/or cause downstream flood damage; typically includes high-quality riparian habitat (if undisturbed); waters flowing in incised (down-cut) streams may not be able to access the adjacent floodplain area to dissipate the volume and energy of higher storm flow events.

Geographic Information System (GIS) – A method of overlaying spatial land and land use data of different kinds. The data are referenced to a set of geographical coordinates and encoded in a computer software system. GIS is used by many localities to map utilities and sewer lines and to delineate zoning areas.

Geomorphology – A science that deals with the land and submarine relief features of the earth's surface.

Grassed Swale – see *Vegetated Swale*

Headcut – The geomorphologic incision of the stream due to the hydraulic effect of a channel from head forces. One example is the accelerated cutting of a stream due to a manmade or natural constriction where water velocities are increased substantially. Another example is the outlet of a dam, where extreme velocities can occur due to the high static head forces created by the build-up of water from the dam structure.

Headwater – The source of a stream or watershed.

Hydrologic Engineering Centers River Analysis System (HEC-RAS) – A hydraulic model used to simulate the hydraulics of water flow through natural and/or manmade channels and rivers.

Hot Spot – A problem area that may contain significant stressors or pollutant sources that can affect watershed conditions within the immediate subwatershed and may be having an impact on downstream areas.

Hydraulics – The physical science and technology of the static and dynamic behavior of fluids.

Hydrograph – A plot showing the rate of discharge, depth, or velocity of flow versus time for a given point on a stream or drainage system.

Hydrology – The science of dealing with the distribution and movement of water.

Hyetograph – A graph of time distribution of rainfall over a watershed.

Index of Biotic Integrity (IBI) – A biological index, which includes macroinvertebrate population indices, fish taxa richness and percent impervious calculations, that is designed to provide a general water quality evaluation of a stream or watershed.

Indicator – A physical marker used to assess the condition of the environment, as an early-warning signal of changes in the environment and to diagnose causes of ecological problems.

Impervious Surface – A surface composed of any material that significantly impedes or prevents natural infiltration of water into the soil. Impervious surfaces include, but are not limited to, roofs, buildings, streets, parking areas, any concrete, asphalt, or compacted gravel surface.

Low-Impact Development (LID) – A comprehensive land planning and engineering design approach with the goal of maximizing the amount of natural features and vegetation at a site, in order to allow stormwater to be infiltrated on site and recharge the groundwater rather than being conveyed to detention facilities or storm sewers.

Metric - An analytical benchmark that responds in a predictable way to increasing human, climatic or other environmental stress, and can be used to help compare watersheds.

Modeling - Use of conceptual and/or computer models to simulate the response (e.g., pollutant loading to streams) of a natural system (e.g., watershed) to various management scenarios; useful in assessing which types of watershed protection techniques will yield the greatest benefit to water quality, habitat, or flooding conditions, and in determining which locations within the watershed are optimal for such practices or project sites.

Municipal Separate Storm Sewer System (MS4) Permit – Fairfax County stormwater permit that requires the creation of watershed management plans to facilitate compliance with the Clean Water Act.

Open Space – The area within the boundaries of a lot that is intended to provide light and air, and is designed for either scenic or recreational purposes. Open space shall, in general, be available for entry and use by residents or occupants of the development. Open space may include, but is not limited to, lawns, decorative planting, walkways, recreation areas, playgrounds, undisturbed natural areas and wooded areas.

Peak Discharge – The maximum rate of flow at an associated point within a given rainfall event or channel condition.

Perennial Stream – A body of water that normally flows year-round in a defined channel or bed, and is capable, in the absence of pollution or other manmade stream disturbances, of supporting bottom-dwelling aquatic animals.

Pipes - carry water from various sources to a stream. Because of this, the discharge may contain pollutants such as oil from roadway runoff, sewage, nutrients from lawn fertilization, etc. The high volume and flow delivered to the stream, particularly during storm events, can result in erosion of the stream channel and banks.

Rain Barrel – A stormwater BMP consisting of a large container designed to capture and store rainwater from roofs. The rainwater can then be used to water gardens and lawns, and is prevented from becoming surface runoff.

Rain Garden – see *Bioretention System*

Redevelopment – The substantial alteration, rehabilitation, or rebuilding of a property for residential, commercial, industrial, or other purposes.

Regional Ponds – Large ponds that may serve as stormwater facilities for entire regions.

Resource Protection Area (RPA) – Vegetated riparian buffer areas, which include land within a major floodplain and land within 100 feet of a water body. These buffer areas are important in the reduction of sediments, nutrients, as well as the other adverse effects of human activities, which could potentially degrade these systems and those downstream.

Restoration - The re-establishment of wetlands or stream hydrology and wetlands vegetation into an area where wetland conditions (or stable streambank and stream channel conditions) have been lost.

Retention – The permanent storage of stormwater.

Retrofit – The modification of stormwater management systems through the construction and/or enhancement of wet ponds, wetland plantings, or other best management practices designed to improve water quality.

Return Period – The average length of time between events having the same volume and duration. If a storm has a one percent chance of occurring in any given year, then it has a return period of 100 years.

Riparian Buffer - An area adjacent to a stream, wetland, or shoreline where development activities (e.g., buildings, logging) are typically restricted or prohibited; may be managed as streamside (riparian) zones where undisturbed vegetation and soils act as filters of pollutants in stormwater runoff; buffer zone widths vary depending on state and local rules, but are typically a minimum of 25 to 50 feet on each side of perennial streams.

Road Crossings - Structures that span the width of a stream, usually road or foot bridges. The structures constrict the flow within a stream which can result in detrimental effects including erosion, flooding and decreased water quality. In addition, structures may block fish and wildlife passage preventing migration to feeding/spawning areas.

Runoff – The portion of precipitation, snow melt, or irrigation water that runs off the land into surface waters.

Spreadsheet Tool for Estimating Pollutant Load (STEPL) – A modeling tool used to determine pollutant loads and load reductions for the watershed planning effort.

Stream Protection Strategy (SPS) – Fairfax County program that focused on developing and prioritizing stream protection and restoration strategies.

Stormflow – The portion of stream flow that is due to stormwater runoff.

Stormwater Management – Programs designed to maintain or return the quality and quantity of stormwater runoff to pre-development levels.

Stormwater (or Stormwater Runoff) – Excess precipitation that is not retained by vegetation, surface depressions, or infiltration, and therefore collects on the surface and drains into a surface water body.

Stormwater Management Facility – A device that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow.

Storm Water Management Model (SWMM) – A stormwater modeling technique developed by the US Environmental Protection Agency (EPA) as a design and planning tool for stormwater runoff.

Stormwater Planning Division (SWPD) – Division of the Fairfax County Department of Public Works and Environmental Services.

Stream Restoration – The reestablishment of the general structure, function and dynamic, but self-sustaining, behavior of the ecosystem.

Subwatershed – A subdivision of a watershed used for planning and management purposes, usually ranges in size from 100 to 300 acres.

Tree Cover – The area directly beneath the crown and within the drip line of a tree.

Total Maximum Daily Load (TMDL) – A tool for establishing the allowable loadings of a given pollutant in a surface water resource to meet predetermined water quality standards.

U.S. Army Corps of Engineers (USACE) – The federal agency responsible for investigating, developing and maintaining the nation's water-related environmental resources.

Vegetated or Grassed Swale – A broad and shallow channel vegetated with erosion resistant and flood-tolerant vegetation. The purpose of this BMP is to convey and slow down stormwater in order to enhance water quality through sedimentation and filtration.

Virginia Pollutant Discharge Elimination System (VPDES) – Virginia state permitting regulations that determine the location and amount of pollutant discharges to land and water resources.

Watercourse – A stream with incised channel (bed and banks) over which water are conveyed.

Watershed – A defined land area drained by a river, stream, or drainage way, or system of connecting rivers, streams, or drainage ways such that all surface water within the area flows through a single outlet.

Watershed Advisory Group (WAG) – Group of watershed stakeholders, including watershed community members and professional agency representatives, involved with preparing the watershed management plan.

Watershed Management Area (WMA) – A subdivision of a watershed used for planning and management purposes, usually four square miles in size.

Watershed Planning - The development of basin wide Watershed Restoration Plans; planning typically includes (1) an assessment of watershed conditions and functional impacts at progressively smaller scales of study, and (2) the development of land use management strategies and optimal watershed restoration, enhancement and protection/preservation projects designed to address the identified watershed needs & opportunities.

Wetland - Habitats where the influence of surface water or groundwater has resulted in the development of plant or animal communities adapted to aquatic or intermittently wet conditions. Wetlands include tidal flats, shallow sub-tidal areas, swamps, marshes, wet meadows, bogs and similar areas.

8.0 References

Center for Watershed Protection. (2007). *Urban Subwatershed Restoration Manual 3: Urban Stormwater Retrofit Practices, 1.0*, 46.

Center for Watershed Protection. (2001). *Urban Stream Restoration Practices*. Retrieved from http://www.stormwatercenter.net/Slideshows/restoration_files/frame.htm

CH2MHILL. (2005). *Fairfax County Stream Physical Assessment*. Prepared for the Fairfax County Department of Public Works and Environmental Services.

Fairfax County, VA. (2010). *Fairfax County, Virginia*. Retrieved from http://www.fairfaxcounty.gov/news/images/green_roof_structure.jpg

Fairfax County, VA. (2001). *Fairfax County Stream Protection Strategy Baseline Study*. Retrieved from http://www.fairfaxcounty.gov/dpwes/environmental/sps_pdf.htm

Fairfax County Department of Public Works and Environmental Services, Department of Planning and Zoning, and Department of Transportation. (2006). *Infill and Residential Development Study*.

Finch, L. (2006). "Donaldson run undergoes stream restoration." *The Arlington environment*. Arlingtonians for a Clean Environment. Retrieved from http://www.arlingtonenvironment.org/newsletter/spring06.htm

Northern Virginia Soil & Water Conservation District. (2010). "Rain Barrel Workshops." *Fairfax County, Virginia.* Retrieved from http://www.fairfaxcounty.gov/nvswcd/rainbarrels.htm

Reston Association. (n.d.) *The Northern Virginia Stream Restoration Bank*. Retrieved from http://reston.wetlandstudies.com/Graphics/Reaches/SnakedenR2/Post2.htm

Reston Association. (n.d.) *The Northern Virginia Stream Restoration Bank*. Retrieved from http://reston.wetlandstudies.com/Graphics/Reaches/SnakedenR3/Post18.htm

Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation. (1999). *Virginia Stormwater Management Handbook, First Edition, Volume 1*. Retrieved from http://www.dcr.virginia.gov/soil_and_water/ stormwat.shtml#vswmhnbk

Virginia Department of Forestry. (2008). *Riparian Forest Buffers: Forests on the Water's Edge*. VDOF P00140. Retrieved from http://www.dof.virginia.gov/wq/resources/ pub-rfb-forests-on-waters-edge.pdf

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Appendix A: Watershed Workbook

The watershed workbook is a reader-friendly document that is designed to provide the residents and stakeholders of the Sugarland Run and Horsepen Creek watersheds with information about their watersheds. The watershed workbook describes the watershed study methodology and summarizes the County-wide goals and objectives. The watershed workbook characterizes the existing state of the watersheds and describes the various methods and tools used in the evaluation of all the watershed management areas within the Sugarland Run and Horsepen Creek watersheds. The watershed workbook is a draft document that contains the information and modeling results available at the time and has not been updated or finalized.

Appendix B: Technical Documents

i. Subwatershed Strategies

Technical Memo 3.2 describes how initial strategies were developed for Sugarland Run and Horsepen Creek watersheds. The memo discusses the characterization of subwatershed improvement, stream restoration, and regional pond alternative strategies. The memo also describes how based on these strategies priority subwatersheds were identified and potential candidate restoration projects were selected.

ii. Prioritization

Technical Memo 3.4/3.5 describes how potential candidate projects were evaluated and the final list of projects incorporated in the watershed management plan was selected. The memo describes how candidate projects were investigated in the field to evaluate the scope, feasibility, and benefits of each candidate project. The memo also discusses the procedure by which candidate structural projects were evaluated and ranked.

iii. Modeling description

Technical Memo 3.6 describes the selection of projects to be further evaluated with hydrologic and hydraulic models. The memo discusses this assessment of potential impacts and discusses if objectives were met by implementing the modeled projects. The memo summarizes the setup, calibration and results of the hydrologic and hydraulic modeling performed. Results from the final STEPL pollution model were also summarized in this memo.

Appendix C: Public Involvement

Summaries of the initial community workshop and each of the five Watershed Advisory Group (WAG) meetings that were held through the watershed management plan development process are included in Appendix C.

i. October 30, 2008
ii. December 10, 2008
iii. March 3, 2009
iv. June 3, 2009
v. March 9, 2010
vi. July 21, 2010