II. Capital Improvements, Infrastructure Retrofit and Low Impact Development/Best Management Practices

CAPITAL FACILITY IMPROVEMENTS

The Department of Public Works and Environmental Services Stormwater Projects
The Department of Public Works and Environmental Services Constructed 31 stormwater projects in 2005. They were designed to mitigate individual house flooding, alleviate yard flooding, stabilize streams using bioremediation methods, rehabilitate dams and provide stormwater management through the construction of regional detention ponds.

7808 O'Dell Street
Problem: Poor overland relief caused dwelling to flood
Solution: A combination flood wall and overland relief swale

7808 O'Dell Street flood wall.

1012 Dead Run Drive
Problem: Poor overland relief caused dwelling to flood.
Solution: A modification to the storm sewer system and overland relief swale

8704 Winding Way Court
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: A modification to the storm sewer system, berm/sump pump and grading for positive drainage

New stormsewer system, berm/sump pump and grading at 8704 Winding Way Court.

<u>Hayfield Farm Subdivision (Three separate projects)</u>
(7610 Hayfield Road)
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Flood wall/sump pump and grading for positive drainage

(7624 Luton Place)
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Flood berms and grading for positive drainage

7610 Hayfield Road flood wall.

(7626 Luton Place)
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Flood berms and grading for positive drainage

<u>Heming Avenue (Two separate projects)</u>
(5766 Heming)
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Flood wall/sump pump and grading for positive drainage

(5770 Heming)
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Flood wall/sump pump and grading for positive drainage

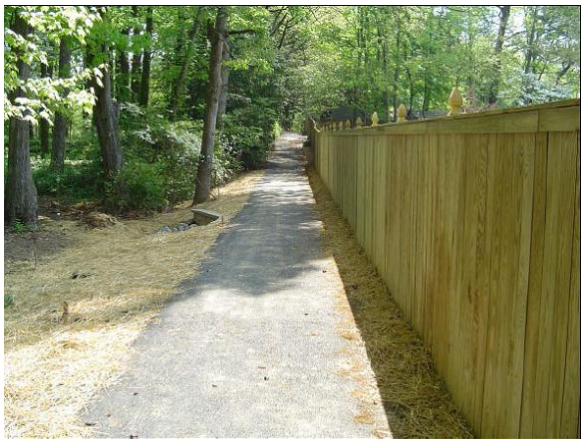
5770 Heming Avenue flood wall.

<u>Gladstone Lane (#1028)</u>
Problem: House flooding caused by inadequate county drainage channel
Solution: Construction of a raised landing and stairwell walls to the basement walkout

<u>Kirby Court</u>
Problem: Absence of a drainage system and poor grading caused dwelling to flood
Solution: A combination flood wall and drainage system was installed

<u>Fenwick Road</u>
Problem: Absence of a drainage system and poor grading caused several dwellings to flood
Solution: A combination of improved grading and the installation of a drainage system

Wheatfield Court
Problem: Absence of a drainage system and poor grading caused dwelling to flood
Solution: A combination flood wall and drainage system was installed



Wheatfield Court floodwall, outside.

Wheatfield Court floodwall, inside.

1903 Cathy Lane
Problem: Poor overland relief and inability of existing storm drain to convey larger storm events caused dwelling to flood
Solution: Overflow piped system installed

1903 Cathy Lane overflow piped system.

Buchanan Street
Problem: Failed pipe system in storm drainage easement causing house flooding
Solution: Replacement of 40 feet of twin six-inch with 12-inch pipe

13074 Autumn Willow Drive
Problem: Failed storm drainage pipe system
Solution: A replacement of a failed storm sewer system

13074 Autumn Willow Drive storm sewer replacement.

Eddys Park
Problem: Failed storm drainage pipe system
Solution: Spot repair of the storm drainage pipe system

Boyett Place
Problem: Failed storm drainage pipes causing surface cave-ins and soil erosion
Solution: Re-line with 150 feet of 27 inch diameter cured-in-place

Bromyard Court
Problem: Failed storm drainage pipes causing surface cave-ins and soil erosion
Solution: Replace and construct 85 feet of storm drainage pipe

Municipal Separate Storm Sewer System Supplemental Sweeping of Parking Lots
Problem: Poor water quality in county streams
Solution: Remove snow chemicals and debris from various parking lots to enhance water quality

Greenmont Court
Problem: Severely eroded stream caused increased sediment loading and steep banks
Solution: Stream restoration using bioengineering was implemented

Reston Section 59 Pond
Problem: Piping of principal spillway and failed dam embankment
Solution: Rehabilitation of dam and outlet works including retrofitting for best management practices

Rehabilitation of Reston Section 59 Pond dam and outlet, including BMP retrofit.

Rehabilitation of Sequoia Lea Drive Pond outlet, including BMP retrofit.

Sequoia Lea Drive Pond
Problem: Piping of principal spillway and failed dam embankment
Solution: Rehabilitation of outlet works including retrofitting for best management practices

Essex Manor Place
Problem: Poor water quality in county streams
Solution: Retrofitting of the facility for best management practices to improve water quality

Noral Place
Problem: Poor water quality in county streams
Solution: Retrofitting of the facility for best management practices to improve water quality

West Ox Regional Pond
Problem: Non-functional outlet and maintenance issue with long-standing water because of debris blockages
Solution: Repair and rehabilitation of weir wall, outlet sluice gate, new trash rack, access road and cat-walk at weir wall

Olley Lane Regional Pond
Problem: Non-functional outlet works causing long standing-water caused by debris blockages
Solution: Construction of a new 25-foot inlet channel, replacement of the outlet structure, and addition of a larger trash/debris rack

Stone Crossing Section 1 DM250
Problem: Repair of non-functional Stormwater Management pond needed
Solution: Retrofit stormwater management pond and wetland

Gatepost Estates Pond #1
Problem: Non-functional Stormwater Management/best management practices and failed dam
Solution: Repair to correct function and add wetlands – this project provided for critical repairs to the existing pond including the installation of clay liner on the upstream and downstream of dam embankments, 70 linear feet of diversion berm in the pond floor, 100 cubic yards of riprap and other related items

Hawthorne Estates DF005
Problem: Non-functional Stormwater Management/best management practices and failed dam
Solution: Repair to correct function and add wetlands

Regional Pond C-41
Regional Pond C-41 was constructed by the developer of Chantilly Crossing via a forthcoming cost sharing arrangement with the county. It is designed as a "wet" pond that incorporates wetland plantings along a graded bench around the perimeter. It provides water quality and quantity control for a 92-acre drainage area.

Regional Pond C-41

Regional Pond H-9

Regional Pond H-9
This facility provides water quality and quantity control for a 100-acre drainage area. The pond includes several sediment forebays and a large tree save area. The pond and accompanying trail serve as an amenity within the Dulles Station at Dulles Corner development. The facility is substantially complete and was constructed by the site developer via a cost sharing arrangement with the county.

The Department of Public Works and Environmental Services Leadership in Energy and Environmental

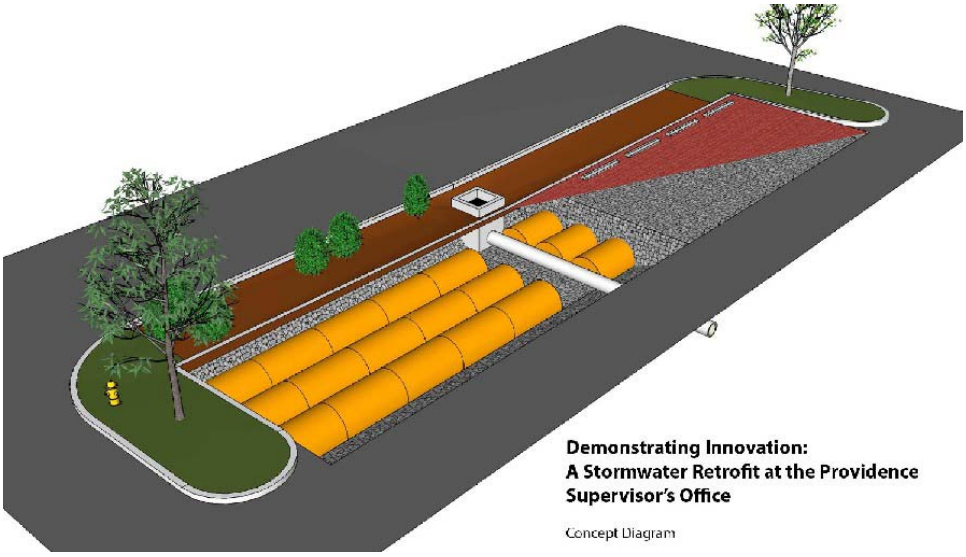
The Department of Public Works and Environmental Services has initiated two pilot projects under the Leadership in Energy and Environmental Design Green Building Program. With the support of the Facilities Management Department and the Fire and Rescue Department, Public Works has undertaken this initiative on the Fairfax Center Fire Station and the Crosspointe Fire Station projects. The goals of the initiative are to gain a better understanding of the environmentally sensitive design concepts that are promoted under the Green Building Program, to educate county agencies on the benefits of the program, and to implement a more environmentally sensitive design on these two projects. At the outset, the goal for the two projects was to attain a Silver Certification under the Leadership in Energy and Environmental Design program. A summary of sustainable design building projects can be found in ***Appendix D***.

The Department of Public Works and Environmental Services has also undertaken a significant initiative to implement innovative low impact development approaches to addressing the stormwater runoff issues on the sites of new and expanded county buildings. Based on the tight and constricted nature of many new and redeveloped sites and based on the desire to provide more environmentally sensitive and aesthetic site development and stormwater facilities, Public Works is continuing to design and implement rain garden-type Best Management Practices facilities for water quality. Public Works is continuing to evaluate the use of other innovative, vegetated stormwater best management practices approaches including infiltration trenches and sand filters, and also promotes the use of other low impact development approaches Environmental Services has completed construction of ten rain gardens at nine different sites that provide stormwater quality for a total of approximately 24 acres of drainage area and 16 acres of imperviousness. It has also implemented, or is in the process of implementing, porous pavement at various sites with a total area of over 10,000 square feet, and has dedicated over five acres for conservation easement area. It is continuing to evaluate additional innovative alternatives for implementing low impact development techniques, including a concerted effort to implement green roof pilot projects. See ***Appendix D*** for a list of facilities.

Demonstrating Innovation: A Stormwater Retrofit at the Providence Supervisor's Office

This low impact development demonstration project is located within the Accotink Creek watershed and has a drainage area of 0.83 acre. In addition to the Providence District Supervisor's Office, the site is also the location of the county's Merrifield Fire Station. The Department of Public Works and Environmental Services and the Northern Virginia Soil and Water Conservation District are partnering in the analysis, design, and construction. The overall complex encompasses a land area of 1.8 acres with approximately 1.44 acres being impervious. The completed project serves as a highly visible demonstration featuring an integrated stormwater management system consisting of a bioretention basin (rain garden), a vegetated roof and permeable pavers. The bioretention basin and permeable pavers with underlying gravel infiltration gallery allow runoff to slowly infiltrate into the surrounding soil. The vegetated roof installation on an existing concrete storage structure serves to reduce rooftop stormwater runoff and provides a comparison to an adjacent storage structure with an impervious roof for future runoff monitoring efforts. The bioretention basin occupies an approximate area of 560 square feet and the permeable pavers an area of 1,550 square feet, with a combined volume of approximately 9,841 cubic feet in the underlying gravel infiltration gallery. The vegetated roof occupies an area of approximately 240 square feet. These three integrated low impact development practices work in harmony to address both water quality and water quantity retrofit goals on the site. They are expected to retain, infiltrate, or filter a significant amount of the stormwater otherwise running off the site.

The raingarden and permeable pavers have an underground bioretention basin.



Sanitary Sewer Extension and Improvement Program

The Department of Public Works and Environmental Services administers the Sanitary Sewer Extension and Improvement Program. The purpose of this program is to provide sanitary sewer service to eligible areas that have been identified by the Department of Health as having non-repairable malfunctioning septic systems. Pollution abatement and addressing public health considerations are achieved by providing sanitary sewer service to these areas. During 2005 two Extension and Improvement projects were completed consisting of 950 linear feet of eight-inch sanitary sewer and providing sanitary sewer connections to seven existing homes.

Fairfax County Park Authority

As part of the park planning process, the Park Authority looks for opportunities during conceptual site planning to recommend low impact stormwater management techniques. During 2005 a site plan was development for Patriot Park which includes low impact development in the development scope for the site. Lake Accotink Park maintains two rain gardens to enhance water quality and educate residents. The Park Authority worked with the Department of Public Works and Environmental Services and the Northern Virginia Soil and Water Conservation District to design five low impact development demonstration facilities which will be built at different parks in 2006, in support of the Board of Supervisors Environmental Improvement Program.

The Park Authority was awarded a 2005 Land Conservation Award in the erosion and sediment control category for work at Lake Fairfax Park. The project was Lake Fairfax Park Core Facilities: Phase I Construction. The scope of work included new accessible marina facilities, boardwalk, stairs and accessible ramps. Work along the lake front utilized a turbidity curtain in conjunction with other Erosion and Sediment controls to prevent disturbed sediment from getting into the lake. The technique proved highly successful and prevented pollution of lake waters.

Also, as in past years, the Park Authority sponsored programs and hosted resident groups to plant or enhance riparian buffers. In addition, the Park Authority partnered with the Department of Public Works and Environmental Services, the Northern Virginia Soil and Water Conservation District Water, and the Virginia Department of Forestry, along with other organizations and many volunteers, to plant over five acres of stream buffer at numerous park sites in support of the Board of Supervisors Environmental Improvement Program. Park Authority staff worked to reduce the amount of mowed turf areas at numerous park sites around the county, concentrating on riparian corridors and lake fronts to promote water quality.

Other significant projects included the renovation of one best management practices facility at Green Spring Gardens; construction of the Stormwater Management pond at Clemyjontri Park that, when finished, will include a wetland forebay; commencement of construction for two bank stabilization projects on Difficult Run upstream of Browns Mill Road and Old Dominion Drive in conjunction with planned stream valley trail improvements for the Cross County Trail; and partnership with the Department of Public Works and Environmental Services to complete planning for an early 2006 construction of the Barnyard Run improvements at Huntley Meadows Park.

The Park Authority completed a large scale stream stabilization project on Difficult Run at Georgetown Pike in November 2005. The project involved the stabilization of over 300 feet of stream bank using a combination of traditional and bioengineering techniques to include root wads, large boulder revetments, coir matting, terracing, rock vanes, vegetated geogrids and a significant number of plantings of native shrubs to stabilize the banks and provide habitat benefits. These structures were installed in order to recreate the natural meander of the channel, while stabilizing the toe and banks. This area also provided trail connectivity between the existing gravel parking lot, the trail segment upstream, and Great Falls National Park. A feeder stream entering the project under Georgetown Pike now drops into a plunge pool to reduce velocity and let sediment fall out before entering Difficult Run. The project also saved one of

the most highly used public parking areas for trail access and a segment of the Cross County Trail before it enters Great Falls National Park.

INFRASTRUCTURE RETROFIT

In 2005, seven stormwater management ponds, serving a drainage area greater than 80 acres, were rehabilitated and/or retrofitted. Rehabilitations consisted of repair, replacement, or modification of the facility to meet or exceed safety and functional requirements and to extend the service life of each facility. Retrofits employed the use of shallow wetland marshes to enhance nutrient uptake and provide an increase in water absorption and transpiration. A secondary effect of wetland marshes and naturally vegetated pond floors is the creation of habitat for wildlife.

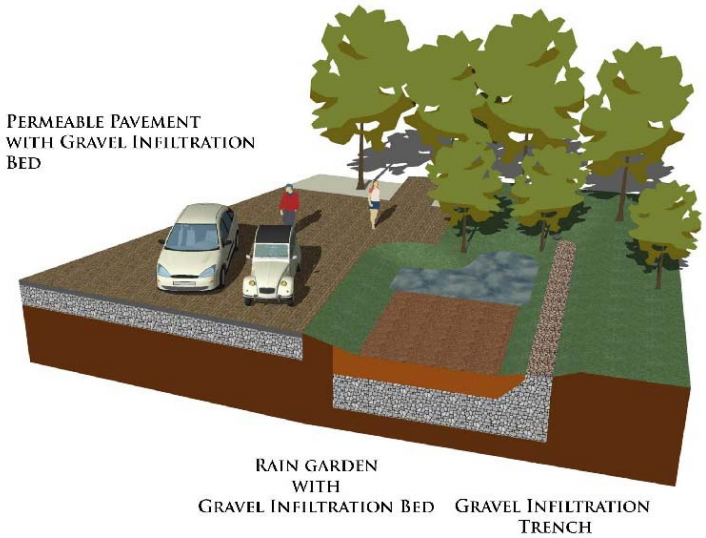
In addition, two regional stormwater management facilities were completed during 2005 providing Best Management Practice for 60 acres and controlling stormwater runoff from 192 acres of land. There were an additional twelve regional facilities in the design plan stage in 2005.

LOW IMPACT DEVELOPMENT/BEST MANAGEMENT PRACTICES IN FAIRFAX COUNTY

A brief description of recently completed private projects or projects currently in planning and design that include Low Impact Development techniques:

Tinner Hill Cultural Center

The top of Tinner Hill, along the Fairfax County and City of Falls Church border, is being developed to commemorate the historic founding of the first rural branch of the NAACP in the nation. To honor the original importance of water to this historic community and to protect the current residents of the hill who live below this small county-owned site, the project will include eight separate low impact development design techniques to contain, reuse, and infiltrate up to the 100-year storm event. Assisted by county stormwater planners and the Northern Virginia Soil and the Water Conservation District and with the help of a the Department of Conservation and Recreation state grant through the Northern Virginia Regional Commission, the Tinner Hill Heritage Foundation will develop "The Drinking Gourd Trail" to lead visitors past each of the low impact development designs, each with narrative signage.



This site will become a primary county demonstration site to display low impact development practices that all developers and landowners can use on any size property. The design techniques include a vegetated roof, rain garden, permeable pavers, grass pavers, vegetated swale, infiltration trench, above- and below-ground cisterns, and a "carriage road-style" driveway. For further information call (703) 241-4109 or visit www.tinnerhill.org

Tinner Hill Cultural Center—"The Drinking Gourd Trail"
The trail leads visitors past each of the LID designs, each with narrative signage.

Northern Virginia Soil and Water Conservation District Low Impact Development Research

During 2004, the Northern Virginia Soil and Water Conservation District and ATR Associates, with the help of a grant from the Department of Conservation and Recreation, conducted research and analysis, developed a plan, and made recommendations for incorporating low impact development practices into the stormwater management plan for a 55-acre site at the former Lorton Prison as it is being re-developed into the Lorton Workhouse Arts Center. Working in collaboration with a stakeholders group, the Lorton Arts Foundation and its consulting engineers and landscape architects, and county staff, the Northern Virginia Soil and Water Conservation District and ATR conducted a comprehensive feasibility study and developed a plan for specific recommendations and an accompanying design report. Factors considered during the study and in making the recommendations include the hydrologic regime and rainfall intensity of the region, amount of impervious surface, soil infiltration capability, and opportunities within each sub-watershed for capturing stormwater and increasing the groundwater contribution through infiltration. At the same time, it was important to maintain the historical and architectural integrity of the site. The major practices recommended were bio-

Three feet of biofilter media were spread over the pea gravel.

retention filters and swales, porous pavers, underground detention, and rain gardens. During 2005, the Department of Planning and Zoning and the Northern Virginia Soil and Water Conservation District worked with the Lorton Arts Foundation and its design engineers and landscape architects to determine what recommended practices will be integrated into the final plan. In advance of the re-development project, one practice, a rain garden, was installed near a building facing a major road. The heavy equipment work was done by the Department of Public Works and Environmental Services. Once the re-development is completed, an education and information program will highlight all the low impact development practices, and will include a permanent display at the on-site museum**.**

The rain garden was completed with plants.

Northern Virginia Soil and Water Conservation District Infiltration studies

Infiltration studies were conducted for the soils at 16 sites in the county. These tests aid in the design and location of infiltration practices such as rain gardens. Some of the sites were the Providence District Office parking lot, Tinner Hill site, Lorton Arts Foundation site, St. Louis Church in the Little Hunting Creek watershed, and seven sites in county parks.

Northern Virginia Regional Commission *Best Management Practices Handbook*

The Northern Virginia Regional Commission is beginning an effort to revise the 1992 edition of the Northern Virginia best management practices Handbook. Research and technology has grown over the last ten years regarding stormwater management and best management practice design. The current handbook does not always reflect today's stormwater management trends. The Best Management Practices Handbook is a widely used resource for Fairfax County planners and public works staff. The Northern Virginia Regional Commission will coordinate with local jurisdictions to seek input and coalesce the broad spectrum of interests to revise the manual to reflect the current state of stormwater management. A work plan has been developed with emphasis on: 1) Updating the current Northern Virginia best management practices Handbook; 2) Appending appropriate chapters to cover new best management practices and low impact development practices; 3) Developing a process for continuing updates of the handbook and addition of practices that may not yet be ready for adoption; and 4) Assembling a team of hydrological modeling experts to investigate the need to develop new techniques that will better evaluate the effectiveness of low impact development. A Steering Committee, which includes the director of Public Works for Fairfax County, is providing guidance and oversight.

Yorktowne Square

The rain garden at the Yorktowne Square Condominium has performed well since installation in 2004; the area drains within five hours after a storm and the vegetation (all native) is thriving. It was designed by the Northern Virginia Soil and Water Conservation District to overcome an existing drainage problem within the community and treats runoff from 0.56 acres of rooftops, parking lots, and lawns.

In 2005, the 5,000-square-foot green roof at Yorktowne Square Condominium won the Green Roofs for Healthy Cities excellence award for design in the extensive residential category. Built in 2004, it was one of the first, if not the first, retrofitted green roof in the state. There were 8,400 sedums planted on the roof (*Sedum album, Sedum sexangular,* and *Sedum reflexum*). Within one year, the vegetated cover more than doubled. The roof continues to function well, both for water tightness and reduction of stormwater runoff from the roof.

In 2004 the green roof was just beginning to grow.

In 2005 the plants were already well established.