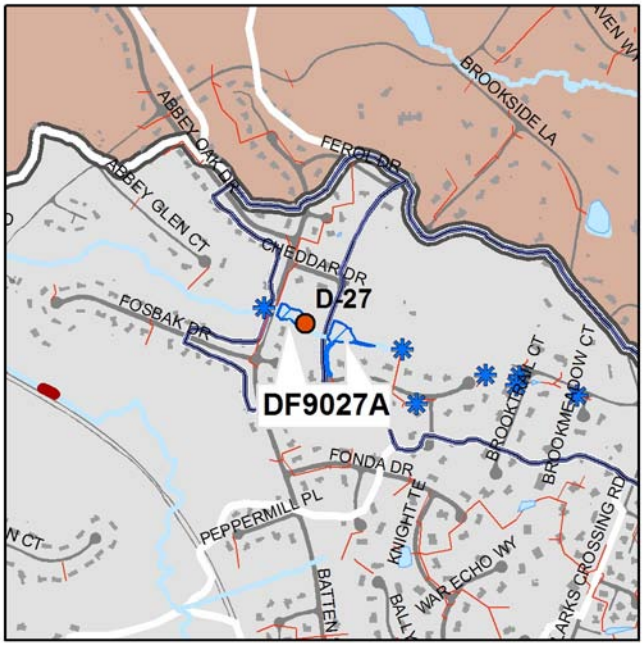
Project Number: DF9027A
Catchment Code: DFPB9501
Candidate Site: D-27

Project Type: Culvert Retrofit
Project Size: 0.5 acres
Treated Area: 104 acres

Project Location: This project would consist of two culvert retrofits at Batten Hollow and Brookhill Roads.

Project Description: This project would use two existing roadway embankments to create detention ponding areas. The primary goal of these retrofits will be to provide storage for channel protection. While water quality is not the primary goal, minor grading and landscaping features (e.g. forebays, micro-pools, vegetation improvements, etc.) would provide some treatment.



Potential Project Benefits:

Streamflow	Retrofits at these two sites would provide approximately 80% of the channel storage volume and help to reduce erosive flows downstream.
Water Quality	Improvements to water quality would be obtained through the reduction in scour forming discharges downstream with some sedimentation and vegetative uptake at the site.

Potential Project Constraints:

Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Forest and wetland impacts are anticipated during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is very good from the roadway
Design / Construction	No significant design or construction issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	$5,000.00	$1,000
Excavation	970	CY	$35.00	$33,950
Impoundment Structure	2	LS	$5,000.00	$10,000
Landscaping	830	SY	$2.50	$2,075
Wetland Planting	280	SY	$2.00	$560
			Base Construction Cost	**$47,585**
			Mobilization (5%)	$2,379
			Subtotal 1	**$49,964**
			Contingency (25%)	$12,491
			Subtotal 2	**$62,455**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$28,105
			Estimated Project Cost	**$91,000**

This project is part of the alternative project group for Regional Pond D-27. See Table 5-2 for the recommended disposition.

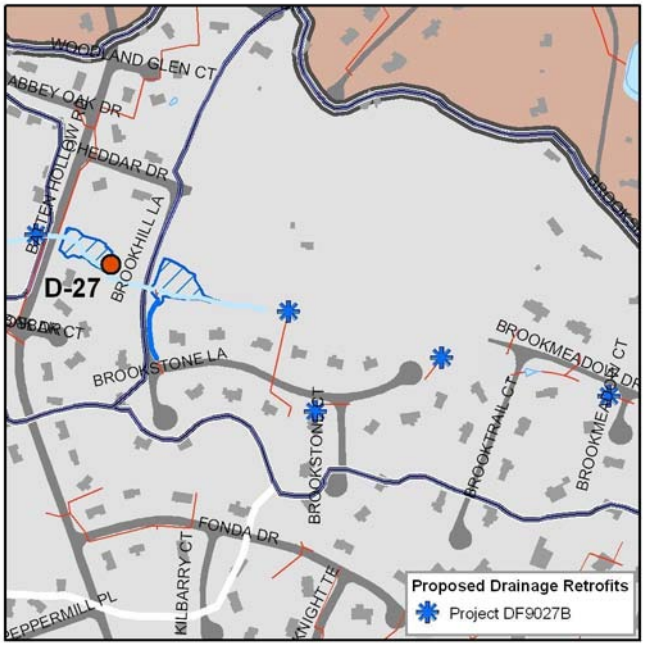
Concept Sketch

Project Number: DF9027B
Catchment Code: DFPB9501
Candidate Site: D-27

Project Type: Drainage Retrofit
Project Size: 233 feet of paved ditch; 5 Outfalls

Project Location: This project is located at various locations throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream. Additionally, paved roadside ditches will be replaced with dry swale systems with an underdrain to provide water quality treatment.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and erosive potential immediately downstream. Swales will reduce both volume and velocity.
Water Quality	Replacing ditches with swales will provide treatment before stormwater reaches the stream system. Water quality will also benefit from the reduction of sediment loads associated from scour at the outfall locations.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified. Design should incorporate check dams or other features to ensure flow velocity is not erosive.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition (Haul Away)	233	LF	$18.00	$4,194
Dry Swale w/ Underdrain	233	LF	$50.00	$11,650
Outfall Protection	5	EA	$8,000.00	$40,000
			Base Construction Cost	**$55,844**
			Mobilization (5%)	$2,792
			Subtotal 1	**$58,636**
			Contingency (25%)	$14,659
			Subtotal 2	**$73,295**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$32,983
			Estimated Project Cost	**$106,000**

This project is part of the alternative project group for Regional Pond D-27. See Table 5-2 for the recommended disposition.

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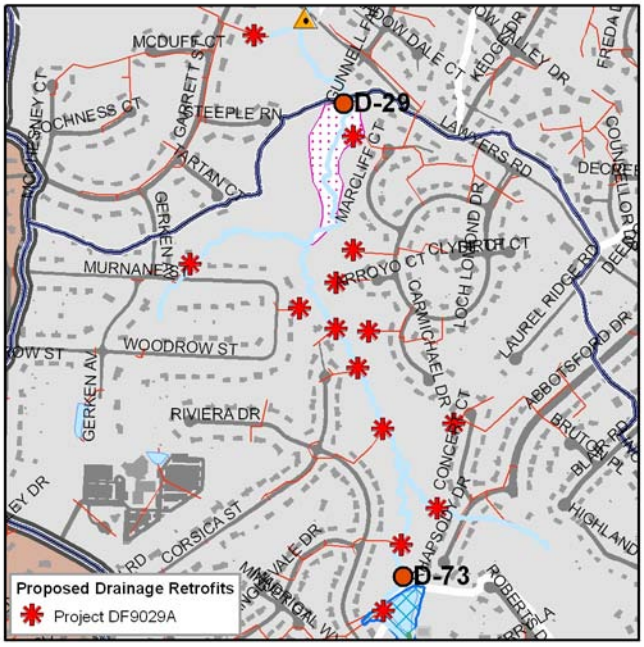
Project Number: DF9029A
Catchment Code: DFPB9802
Candidate Site: D-29

Project Type: Drainage Retrofit
Project Size: 14 Outfalls

Project Location: This project is distributed throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream. Alternatives may include drop structures, plunge pools, larger ditches with larger stone, or some combination.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	14	EA	$8,000.00	$112,000
			Base Construction Cost	**$112,000**
			Mobilization (5%)	$5,600
			Subtotal 1	**$117,600**
			Contingency (25%)	$29,400
			Subtotal 2	**$147,000**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$66,150
			Estimated Project Cost	**$213,000**

This project is part of the alternative project group for Regional Pond D-29. See Table 5-2 for the recommended disposition.

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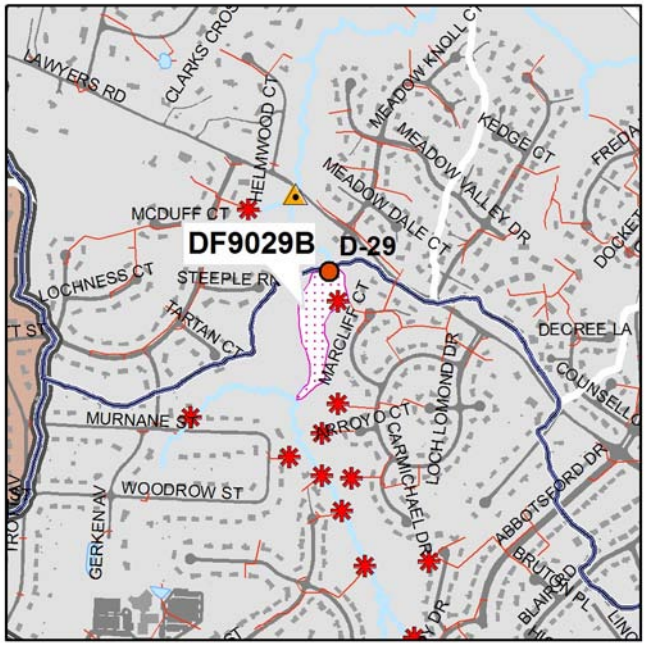
Project Number: DF9029B
Catchment Code: DFPB9802
Candidate Site: D-29

Project Type: New Pond
Project Size: 3.8 acres
Treated Area: 321 acres

Project Location: This project is located on the upstream side of Lawyers Road.

Project Description: This project consists of constructing a new pond on the upstream side of Lawyers Road. This project is focused on the detention of storm flows to provide channel protection to reduce erosive flows downstream. Water quality features should be incorporated into this design to the greatest extent practicable.



Potential Project Benefits:

Streamflow	The project will provide 100% of the channel protection volume for this location.
Water Quality	Some reduction of pollutants will occur with increased settling and vegetative uptake associated with extended detention.

Potential Project Constraints:

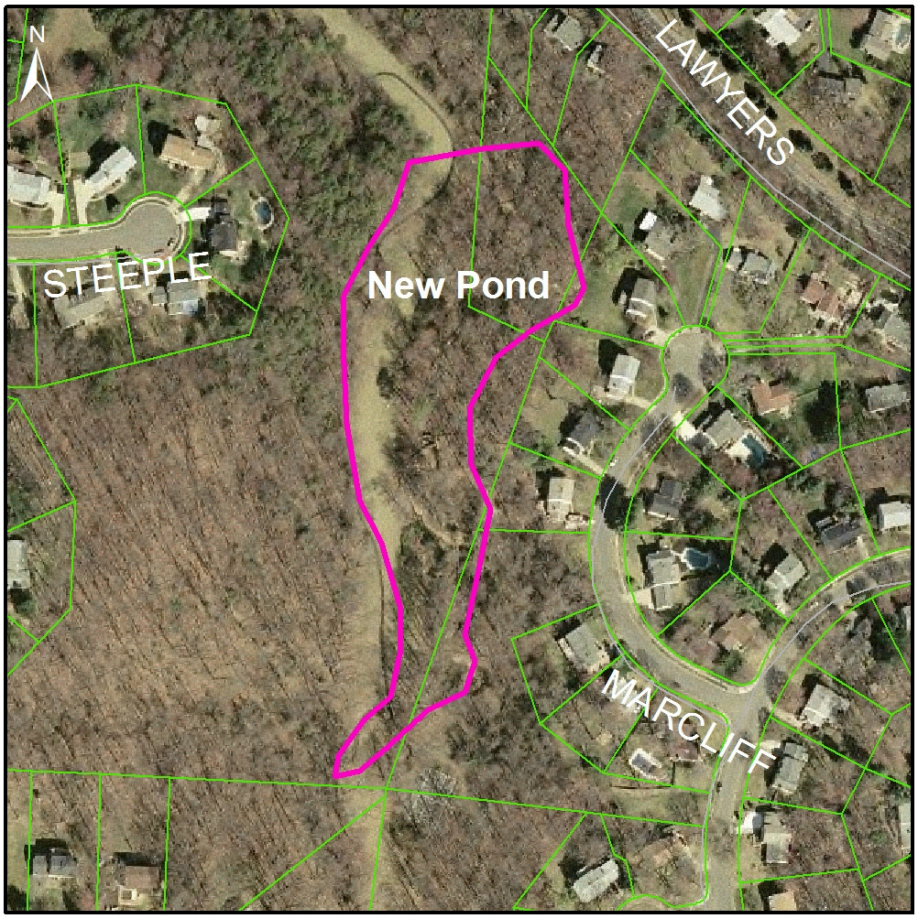
Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Forest and wetland impacts are anticipated during construction. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is more difficult than similar projects, however the site can be reached from Lawyers Road through the floodplain.
Design / Construction	No significant design or construction issues were noted.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$5,000.00	$2,000
Embankment	4,090	CY	$60.00	$245,400
Riser Structure	1	LS	$10,000.00	$10,000
Landscaping	1,830	SY	$2.50	$4,575
			Base Construction Cost	**$261,975**
			Mobilization (5%)	$13,099
			Subtotal 1	**$275,074**
			Contingency (25%)	$68,768
			Subtotal 2	**$343,842**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$154,729
			Estimated Project Cost	**$499,000**

This project is part of the alternative project group for Regional Pond D-29. See Table 5-2 for the recommended disposition.

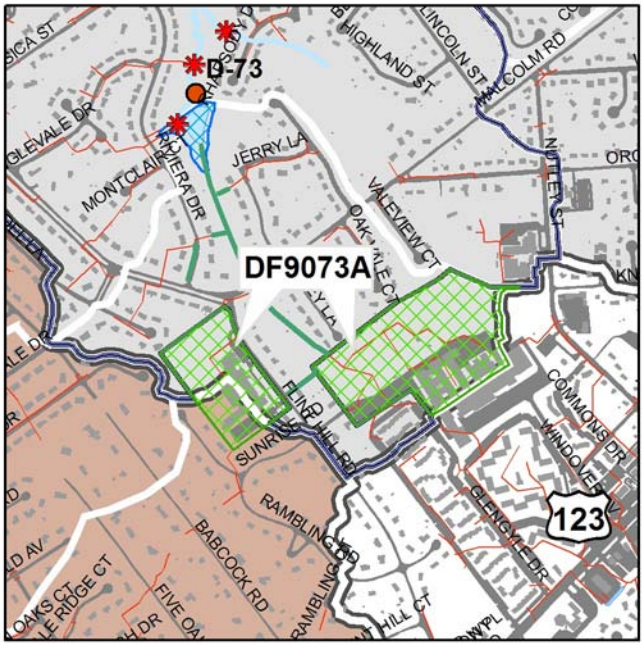
Concept Sketch



Project Number: DF9073A
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: LID Retrofit
Project Size: 0.2 acres
Treated Area: 30 acres

Project Location: Madison High School and Flint Hill Elementary School



Project Description: The project is a retrofit of LID site design and structures to improve the quality of the discharge from these two sites, which predate stormwater management facilities. A LID retrofit approach combining reduction of imperviousness, ponding, swales, and bioretention to mimic natural hydrology would reduce the runoff volume and improve water quality from these public properties. The project could also serve as an excellent teaching tool for staff and students.

Potential Project Benefits:

Streamflow	While designed primarily for water quality, this project would reduce the amount of runoff through reduction of impervious area, infiltration and uptake by vegetation.
Water Quality	This project has been designed to treat 100% of the water quality volume for the site.

Potential Project Constraints:

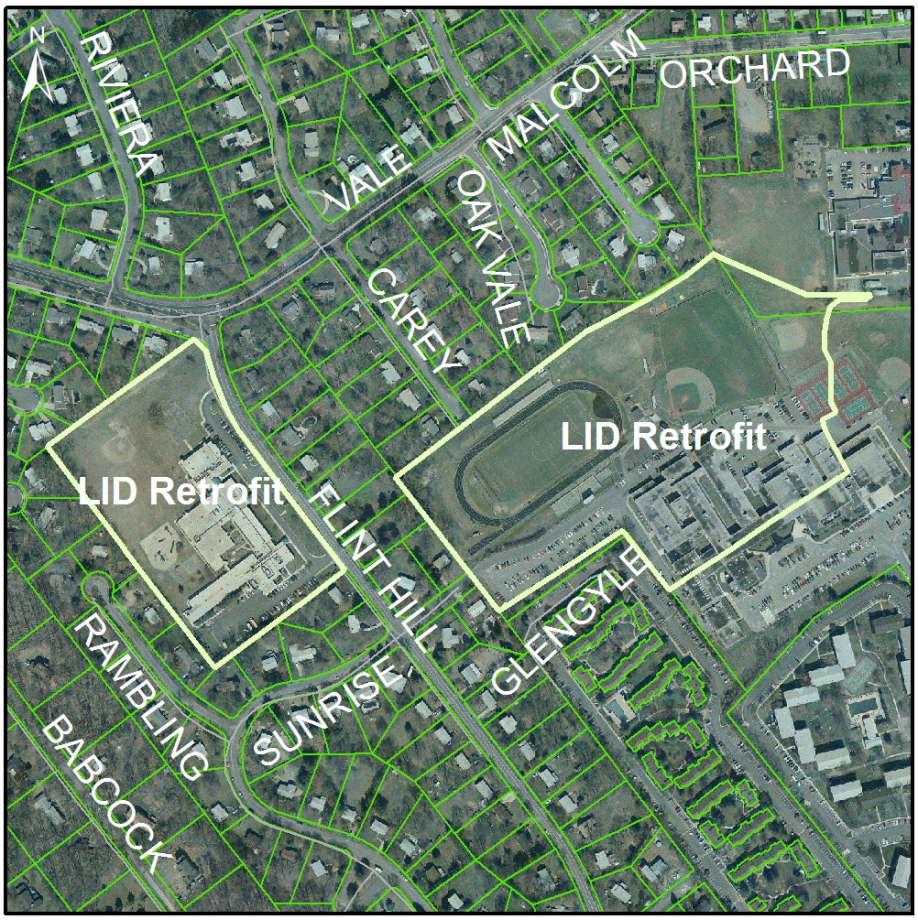
Environmental	No environmental constraints or permitting issues are anticipated.
Facility Access	Access to the site is excellent by public roads and parking areas.
Design / Construction	A holistic LID approach, including disconnection of imperviousness and minimization of runoff, is recommended, rather than an approach relying on treatment systems, since space may be a limiting factor for structural solutions

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	961	SY	$120.00	$115,320
Interpretive Signs	1	LS	$1,000.00	$1,000
			Base Construction Cost	**$116,320**
			Mobilization (5%)	$5,816
			Subtotal 1	**$122,136**
			Contingency (25%)	$30,534
			Subtotal 2	**$152,670**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$68,702
			Estimated Project Cost	**$221,000**

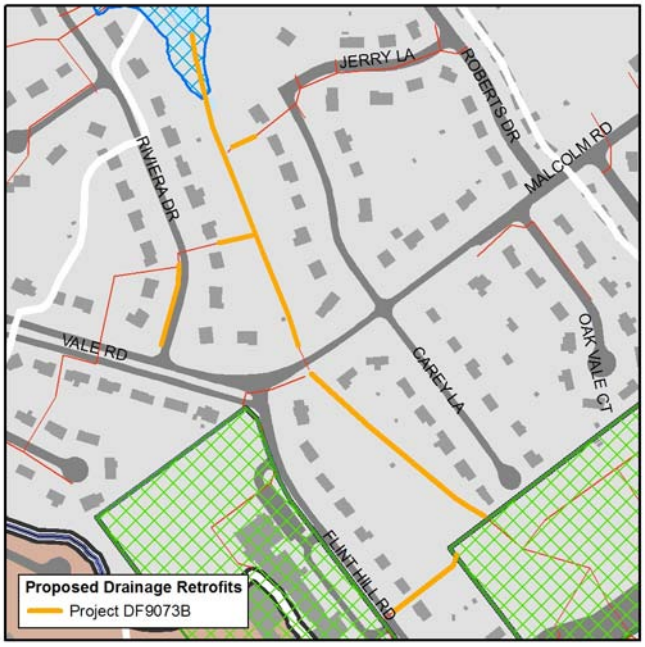
This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

Concept Sketch



Project Number: DF9073B
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: Drainage Retrofit
Project Size: 1,389 LF of concrete ditch, 1,000 LF of armored stream channel



Project Location: Paved stream channel extending from Madison High School through Malcolm Road to a farm pond downstream.

Project Description: The upper end of this reach is a concrete trapezoidal channel. The lower reach is an artificially straightened stream armored with riprap that extends downstream from Malcolm Road to a point at which the streambed is rock. The project is intended to replace both of these drainage systems with more natural drainage. The upstream flume would be removed and replaced with a dry swale. The lower reach would be reconstructed as a natural stream channel with step pools to reduce flow velocity. Riparian buffer should be reestablished where deficient.

Potential Project Benefits:

Streamflow	The dry swale at the head of the reach would be expected to reduce runoff volume through infiltration. The naturalized stream reach would help to reduce velocity.
Water Quality	Water quality improvements would come from filtration from the dry swale and the reduction of sediment loads associated with erosion and scour.

Potential Project Constraints:

Environmental	Permitting and environmental constraints should be minimal for this retrofit. Projects in RPAs may require exceptions or waivers.
Facility Access	Access is very good from the ends of this project.
Design / Construction	The narrow channel constrains design options. Because the stream runs through private property and crosses Malcolm Road coordination with property owners and VDOT would most likely be extensive. Design should incorporate check dams or other features to ensure flow velocity is not erosive.

This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

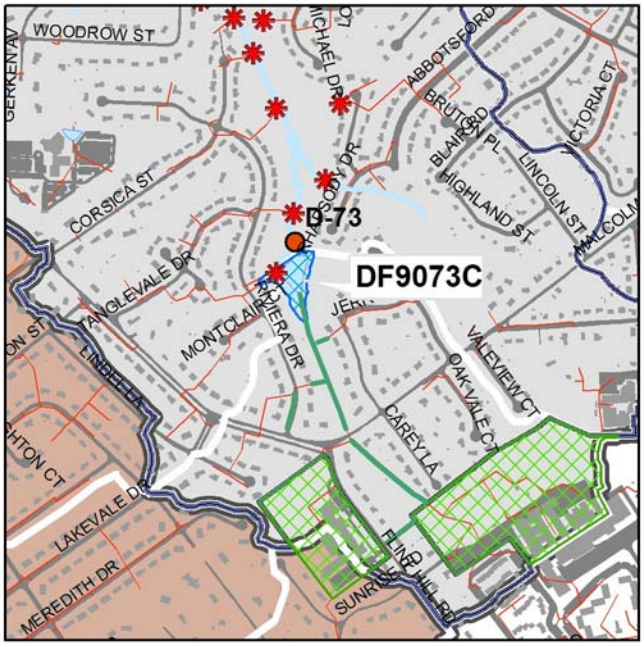
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition (Haul Away)	2389	LF	$18.00	$43,002
Dry Swale w/ Underdrain	1389	LF	$50.00	$69,450
Stream restoration -- step pools	1000	LF	$225.00	$225,000
Buffer restoration	included above	LF	$25.00	$0
Outfall Protection	2	EA	$8,000.00	$16,000
			Base Construction Cost	**$353,452**
			Mobilization (5%)	$17,673
			Subtotal 1	**$371,125**
			Contingency (25%)	$92,781
			Subtotal 2	**$463,906**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$208,758
			Estimated Project Cost	**$673,000**

Project Number: DF9073C
Catchment Code: DFPB9801
Candidate Site: D-73

Project Type: Pond Retrofit
Project Size: 1.9 acres
Treated Area: 39.8 acres

Project Location: Existing farm pond near the intersection of Riviera Drive and Montclair Court.



Project Description: This project will include the retrofit and enhancement of an existing farm pond / marsh adjacent to the existing stream channel of this facility. The existing facility obtains flows from a diversion structure located in the main stem of the drainage for this catchment. The proposed retrofit would consist of reconstructing the diversion structure and providing a riser for outlet control to allow the pond to function as water quality treatment for the first flush.

Potential Project Benefits:

Streamflow	Minor improvements to streamflow are expected through diversion of the flow from smaller storms.
Water Quality	Detention and vegetative uptake of the first flush of stormwater is expected to improve water quality downstream. Approximately 30% of the water quality volume can be provided.

Potential Project Constraints:

Environmental	Environmental permitting issues would be anticipated for any activity in and around a stream corridor. Some wetland impacts are anticipated during construction and a permit from the Corps of Engineers and VDEQ will be required. Projects in RPAs may require exceptions or waivers.
Facility Access	A storm drain easement appears to provide direct access to the site.
Design / Construction	The existing facility is on private land and coordination with the property owner will be necessary. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	$5,000	$1,000.00
Forebay (2 locations)	445	CY	$45.00	$20,025.00
Riser	1	LS	$10,000.00	$10,000.00
Rip Rap Stabilization	40	LF	$50.00	$2,000.00
			Base Construction Cost	**$33,025**
			Mobilization (5%)	$1,651
			Subtotal 1	**$34,676**
			Contingency (25%)	$8,669
			Subtotal 2	**$43,345**
			Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)	$19,505
			Estimated Project Cost	**$63,000**

This project is part of the alternative project group for Regional Pond D-73. See Table 5-2 for the recommended disposition.

Site Photo:

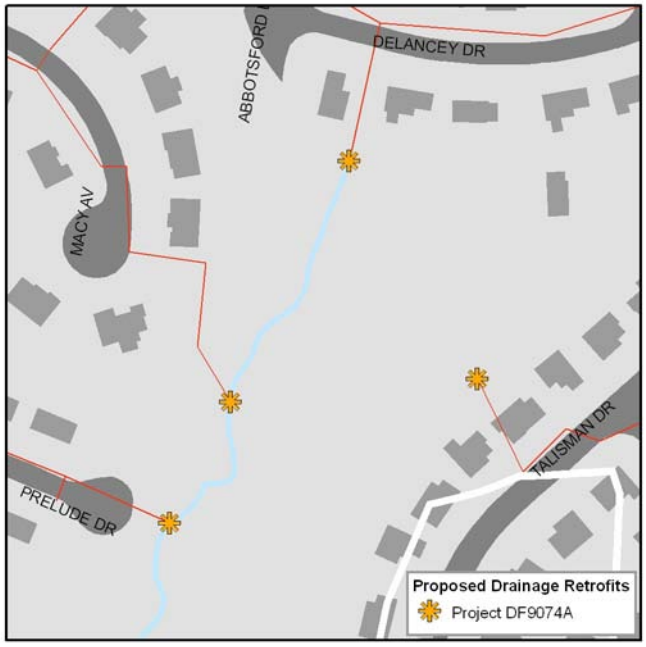
Concept Sketch:

Project Number: DF9074A
Catchment Code: DFPB9901
Candidate Site: D-74

Project Type: Drainage Retrofit
Project Size: 4 Outfalls

Project Location: This project is distributed throughout the catchment.

Project Description: This project consists of reconfiguring outfalls or retrofitting energy dissipation structures to reduce scour and erosion where flows from the storm drainage system enter the stream. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	4	EA	$8,000.00	$32,000
			Base Construction Cost	**$32,000**
			Mobilization (5%)	$1,600
			Subtotal 1	**$33,600**
			Contingency (25%)	$8,400
			Subtotal 2	**$42,000**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$18,900
			Estimated Project Cost	**$61,000**

This project is part of the alternative project group for Regional Pond D-74. See Table 5-2 for the recommended disposition.

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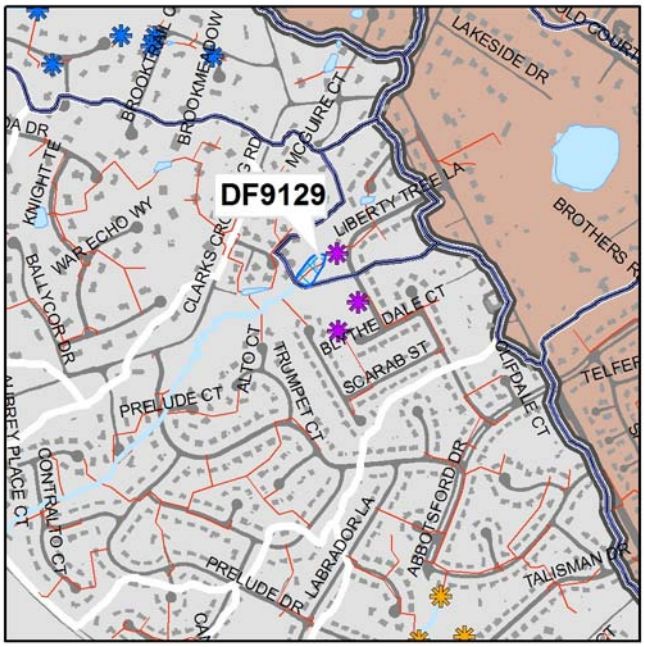
Project Number: DF9129
Catchment Code: DFPB9701
Candidate Site: C29

Project Type: Pond Retrofit
Project Size: 0.6 acres
Treated Area: 16 acres

Project Location: Near Liberty Tree Lane



Project Description: The pond outfall shows signs of excessive flows and the spillway appears to have been inundated frequently. Once these issues have been addressed, installing a new, multi-stage riser and excavating to maximize the available storage space within the facility boundaries is recommended. Grading a flat area at the base of the riser will create a wet marsh that will promote vegetative uptake of nutrients and settling of sediment. Additional water quality components can be incorporated into any ditches or storm drain outfalls that flow into this facility.

Potential Project Benefits:

Streamflow	Approximately 90% of the channel protection volume can be obtained after the recommendations are implemented.
Water Quality	Excavation to create a wetland area will fulfill approximately 80% of the water quality volume. Reduction of erosive flows will also improve water quality downstream.

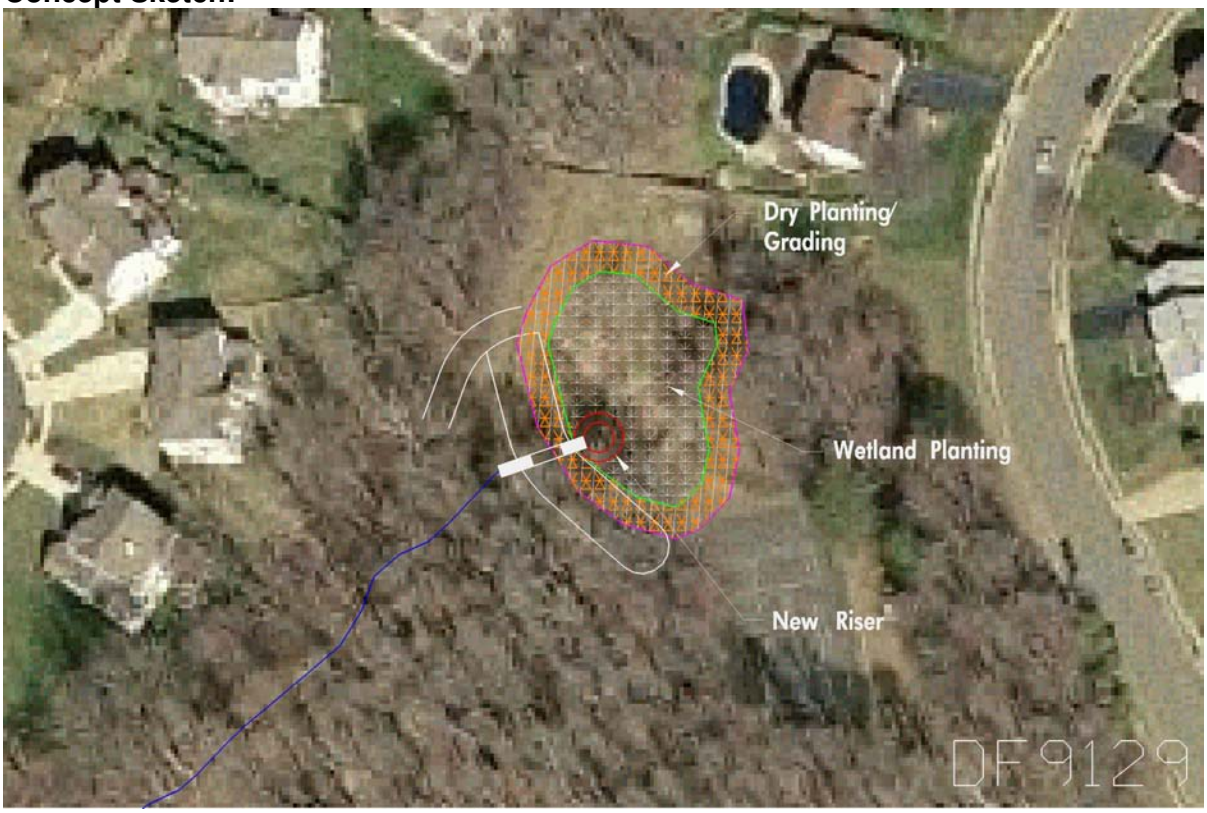
Potential Project Constraints:

Environmental	Permits may be required for in-stream work or wetland mitigation. If so, and a permit from the Corps of Engineers and VDEQ will be obtained. Projects in RPAs may require exceptions or waivers.
Facility Access	Access can be obtained from the roadway.
Design / Construction	Work on the existing embankment, outlet, and spillway and stabilization of the downstream channel is recommended. County staff will coordinate with the facility owner to implement the project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	$5,000	$1,500.00
Grading and Excavation	1188	CY	$30.00	$35,640.00
Riser	1	LS	$10,000.00	$10,000.00
Wetland Planting	777	SY	$2.00	$1,554.00
Dry Landscaping	625	SY	$2.50	$1,562.50
			Base Construction Cost	**$50,257**
			Mobilization (5%)	$2,513
			Subtotal 1	**$52,769**
			Contingency (25%)	$13,192
			Subtotal 2	**$65,962**
			Engineering Design, Surveys, Land Acquisition, Utility Relocations and Permits (45%)	$29,683
			Estimated Project Cost	**$96,000**

Concept Sketch:

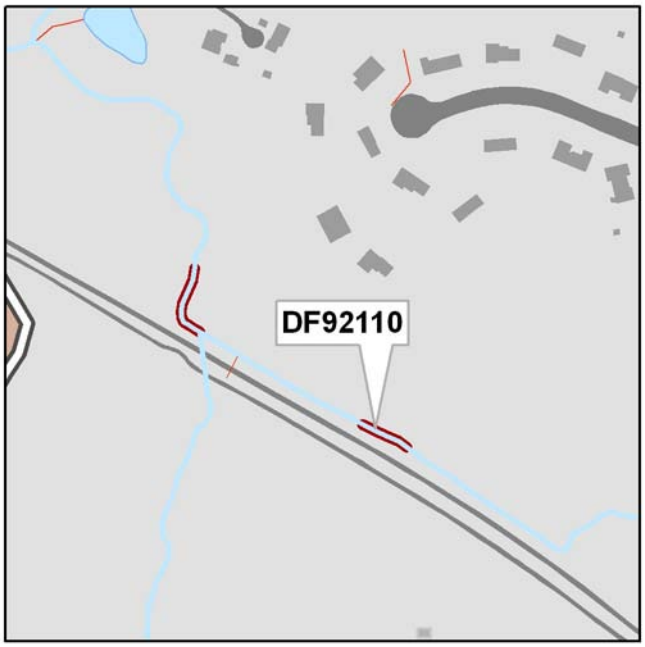


Project Number: DF92110
Catchment Code: DFPB0005
Candidate Site: S110

Project Type: Stream Restoration
Project Size: 242 feet

Project Location: This project is located south of Fosbak Drive adjacent to the W&OD Trail.

Project Description: The streambank has been artificially stabilized adjacent to the original railroad bed and is slightly incised. The proposed restoration would stabilize one reach with imbricated rip-rap to protect the trail, and reconstruct another to provide a pattern, dimension, and profile more consistent with a natural system.



Project Benefits:

Stream Stability	Stabilization with riprap and reconstruction to a more stable pattern will reduce future erosion.
Water Quality	Water quality will be improved by reducing sediment eroded from the streambanks.
Instream Habitat	Creating riffle pool sequences associated with a meandering stream will improve physical habitat conditions.

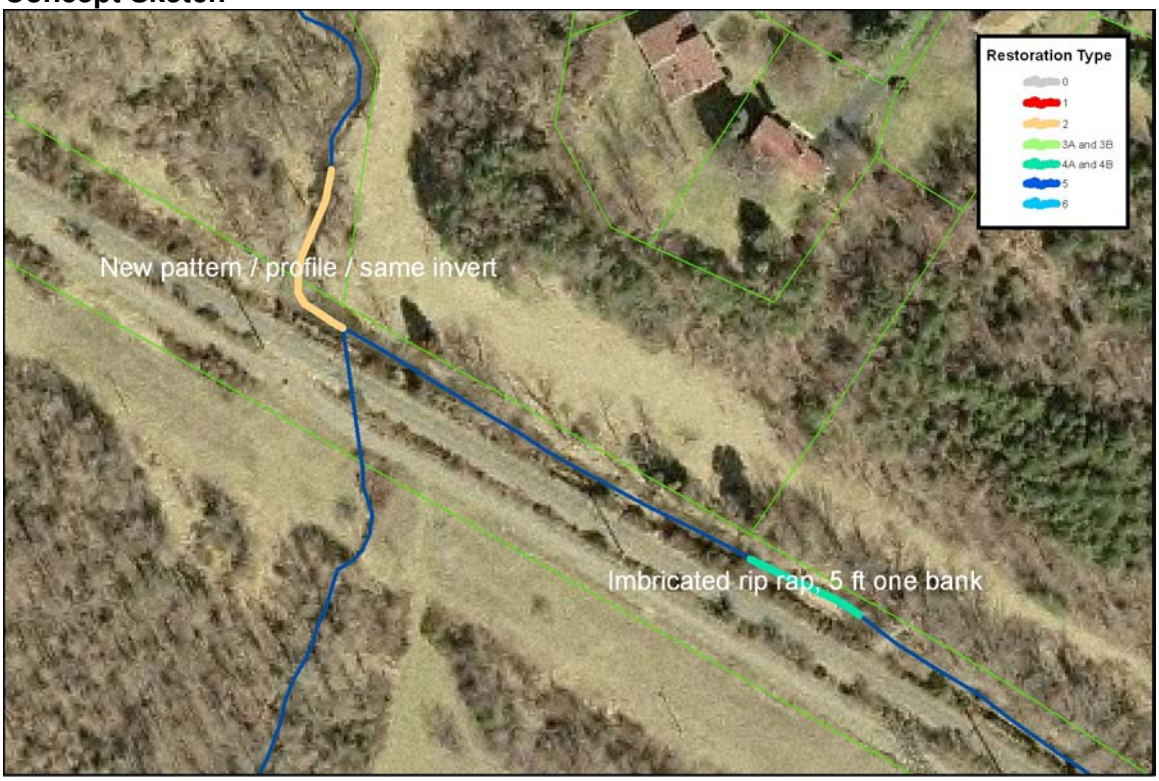
Project Constraints:

Environmental	The site will not require forest clearing. Impacts to jurisdictional wetlands will occur and a permit from the Corps of Engineers and VDEQ will be required. Projects in RPAs may require exceptions or waivers.
Facility Access	Access to this facility will require improved access from the W & OD Trail
Design / Construction	Design efforts should be minimal. General constructability is good. The depth of a sanitary sewer line will have to be investigated to determine the feasibility of constructing the new channel alignment.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Reconstruct new pattern and profile	146	LF	$250.00	$36,500
Stabilize in place -- armoring	96	LF	$225.00	$21,600
Add'l cost, first 500 LF	242	LF	$200.00	$48,400
			Base Construction Cost	**$106,500**
			Mobilization (5%)	$5,325
			Subtotal 1	**$111,825**
			Contingency (25%)	$27,956
			Subtotal 2	**$139,781**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$62,902
			Estimated Project Cost	**$203,000**

Concept Sketch

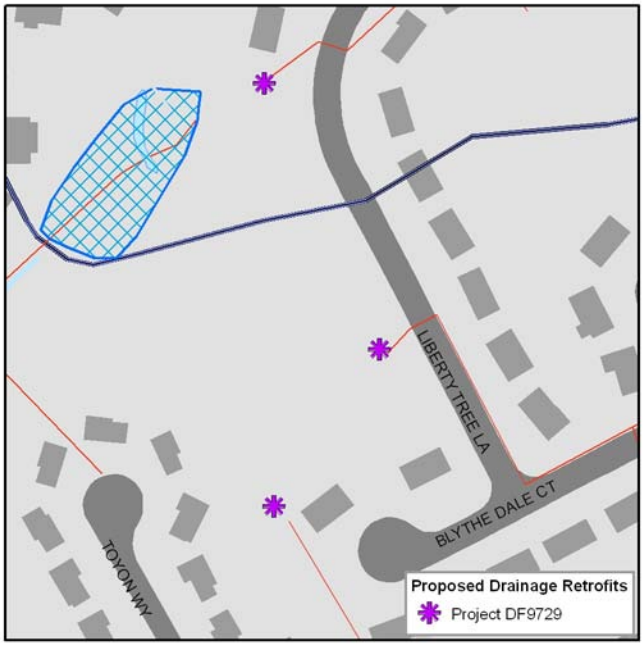


Project Number: DF9729
Catchment Code: DFPB9701
Candidate Site: C29

Project Type: Drainage Retrofit
Project Size: 3 Outfalls

Project Location: Projects are located at three outfalls from existing storm drains. The outfall below Chestnut Farm Drive and Liberty Tree Lane may need particular attention.

Project Description: This project consists of outfall treatments to increase energy dissipation and reduce velocities that are causing scour and erosion. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfalls and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at outfall locations and within the downstream channels. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to these sites can usually be obtained from the roadway and driveways.
Design / Construction	No unusual design or construction issues were identified.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	3	EA	$8,000.00	$24,000
			Base Construction Cost	**$24,000**
			Mobilization (5%)	$1,200
			Subtotal 1	**$25,200**
			Contingency (25%)	$6,300
			Subtotal 2	**$31,500**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$14,175
			Estimated Project Cost	**$46,000**

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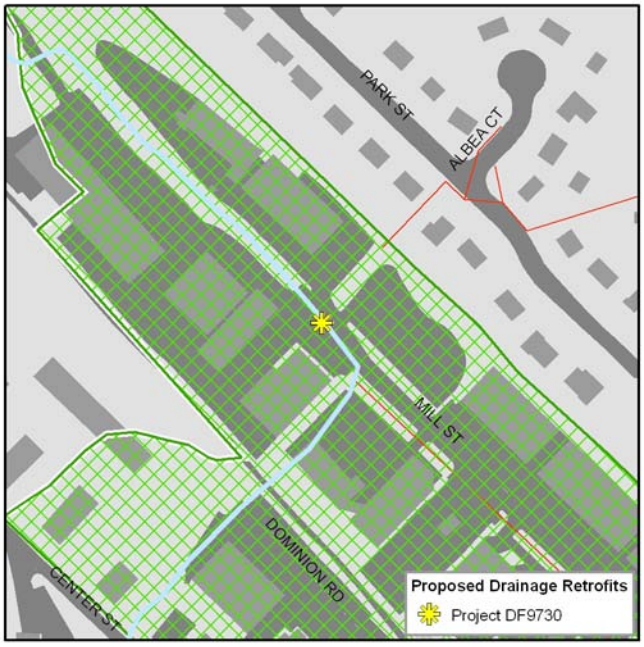
Project Number: DF9730
Catchment Code: DFPB0001
Candidate Site: C30

Project Type: Drainage Retrofit
Project Size: 1 Outfall

Project Location: This project is located at the foot of Mill Street where the major outfall draining the catchment is located.

Project Description: This project consists of improving energy dissipation at the outfall to the storm drain system. Reduction of erosive velocities will reduce the amount of sediment transported downstream.



Potential Project Benefits:

Streamflow	The project will reduce velocity from the outfall and help reduce erosive potential immediately downstream.
Water Quality	Water quality improvements would be associated with the reduction of scour at this outfall location and within the downstream channel. Habitat would be improved by reducing sediment loads from erosion.

Potential Project Constraints:

Environmental	Environmental impacts and permit requirements are not anticipated for this project; however, projects in RPAs may require exceptions or waivers
Facility Access	Access to the site is available from Mill Street.
Design / Construction	Because of size and complexity, the unit price for this project is higher than typical.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Outfall Protection	1	EA	$16,000.00	$16,000
			Base Construction Cost	**$16,000**
			Mobilization (5%)	$400
			Subtotal 1	**$8,400**
			Contingency (25%)	$2,100
			Subtotal 2	**$10,500**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$9,450
			Estimated Project Cost	**$30,000**

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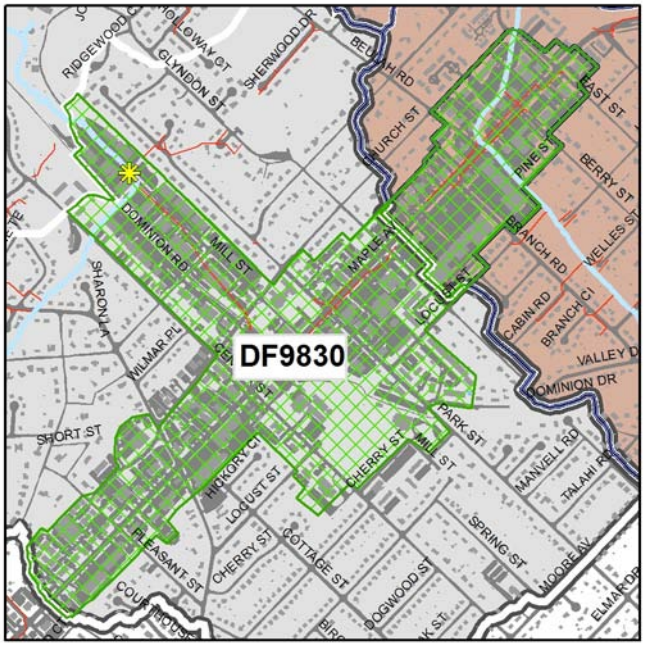
Project Number: DF9830
Catchment Code: DFPB0001
Candidate Site: C30

Project Type: LID Retrofit
Project Size: 1.8 acres
Treated Area: 156.8 acres



Project Location: The area within 1 to 2 blocks on either side of Maple Street in Vienna and within 1 to 2 blocks of the W&OD Trail.

Project Description: This project requires a holistic LID approach to be retrofitted into two areas: the business corridor along Maple Street (Rte. 123), which is built out with commercial properties, and the more industrial area along the W&OD trail. The entire area is almost entirely impervious, and therefore results in high rates of runoff. The LID retrofit could include reduction of imperviousness, inlet filtration, bioretention, rooftop detention, or green roofs. Depending on the individual site characteristics, implementation could be phased via public projects or as redevelopment occurs.

Potential Project Benefits:

Streamflow	The LID approach is expected to reduce runoff volume through infiltration. Minor reductions in peak flow rates could be expected.
Water Quality	The project would treat 100% of the water quality volume, which would provide significant improvements for this drainage area.

Potential Project Constraints:

Environmental	No environmental permitting issues or impacts are anticipated for this project.
Facility Access	For the most part, access in this area is excellent from roads and parking lots.
Design / Construction	This project would require detailed survey and mapping of all utilities, drainage appurtenances and structures. Coordination with private property owners would be necessary in some of the areas.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
LID Structural Control	8,586.0	SY	$120.00	$1,030,320
			Base Construction Cost	**$1,030,320**
			Mobilization (5%)	$51,516
			Subtotal 1	**$1,081,836**
			Contingency (25%)	$270,459
			Subtotal 2	**$1,352,295**
			Engineering, Survey, Land Acquisition, Utility Relocations and Permits (45%)	$608,533
			Estimated Project Cost	**$1,961,000**

Concept Sketch