


*Appendix F*

***Post-Construction Stormwater  
Management in New and Redevelopment***


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Watershed & Stormwater Management • Webcast Series



**Retrofitting Existing Stormwater Ponds & Basins**

Watershed & Stormwater Management • Webcast Series

**Welcome to the Webcast**

- **Continuing Education Credits** – We are offering PDHs for our watershed and stormwater management webcast series. A registered attendee must watch the entire webcast to be eligible to earn the CEU. A pdf Certificate of Completion will be sent out after webcast to the person who registered for the webcast. The varying nature of certification requirements for each state means we cannot guarantee that CEU's will be awarded and it is up to the individual to determine if CEU's or PDH's will be awarded based on the policies of their local certifying board. Email [webcast@cwpa.org](mailto:webcast@cwpa.org) with questions.
- **Resources** – After the webcast, we will email a resources sheet, speaker contact information, and the presentation.

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**To Adjust How the Slides Appear on Your Screen** – To make the slide area larger, go to Full Screen under the Meeting Tab.

**To Answer a Poll Question** – Polling questions appear during the webcast. To answer a poll question, click on the radio button to the left of your answer and click submit. Do not type your answer in the chat box.

**To Ask a Question** – The right corner of the screen contains a Q&A chat box. Type your question in the box and click on the send question icon to submit it. We will try to answer as many questions as possible during and after the webcast.



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**Webcast Team**



Jedd Anderson,  
Vice President, Head Environmental Resources Department,  
Christopher Burke Engineering





Dave Hirschman  
Program Director  
Center for Watershed Protection



Matthew Meyers  
Chief, Watershed Project Implementation Branch  
Stormwater Planning Division  
Fairfax County DPWES





Reid Christianson, PhD  
Water Resources Engineer  
Center for Watershed Protection


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### POLL QUESTION #1

How many people are participating today in the webcast at your location?

- a) Just me
- b) 2 to 5
- c) 6 to 10
- d) More than 10


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### POLL QUESTION #2



I work for a

- Phase I community
- Phase II community
- Municipality
- State government
- Federal government
- Private consultant
- Nonprofit organization
- University
- Other (tell us in the chat box)


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### Webcast Outline

- Introduction (Dave)
- Different Approaches for Pond Retrofits (Reid)
- Main Street/Northside Park Flood Control AND RESTORATION Project (Jedd)
- Watershed Restoration: Pond Retrofits in Fairfax County (Matt)
- Conclusions and Resources


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### Types of Retrofits

- New Retrofits
- Retrofits of Existing Ponds & Basins

**Drivers**

- TMDLs
- Permitting/Mitigation
- Flood Control
- Aesthetics, Community Benefits, Maintenance
- Other?

**CENTER FOR WATERSHED PROTECTION**

## NEW RETROFITS

**CENTER FOR WATERSHED PROTECTION ASSOCIATION**






**CENTER FOR WATERSHED PROTECTION**



1. Drainage Area (D.A.)
2. Impervious D.A.
3. Top Surface Area
4. Available Head
5. Considerations for Ponding Depth, Side Slopes & Bottom Surface Area

**CENTER FOR WATERSHED PROTECTION**

## RETROFITTING EXISTING PONDS/BASINS

**CENTER FOR WATERSHED PROTECTION ASSOCIATION**


1. **Conversions:** Change Treatment Mechanism
2. **Enhancements:** Enhance Existing Treatment Mechanism
3. **Restoration:** Restore Capacity



**CENTER FOR WATERSHED PROTECTION**

## 1. CONVERSION

**CENTER FOR WATERSHED PROTECTION ASSOCIATION**



DRY POND
CONSTRUCTED WETLAND



CENTER FOR WATERSHED PROTECTION

CENTER FOR WATERSHED PROTECTION ASSOCIATION

### Adding Bioretention/Filtering to Ponds

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CENTER FOR WATERSHED PROTECTION

## 2. ENHANCEMENT

CENTER FOR WATERSHED PROTECTION ASSOCIATION

ADD FOREBAY OR MULTIPLE CELLS

INCREASE FLOW PATH

**INCREASE FLOW PATH, HYDRAULIC RETENTION TIME**

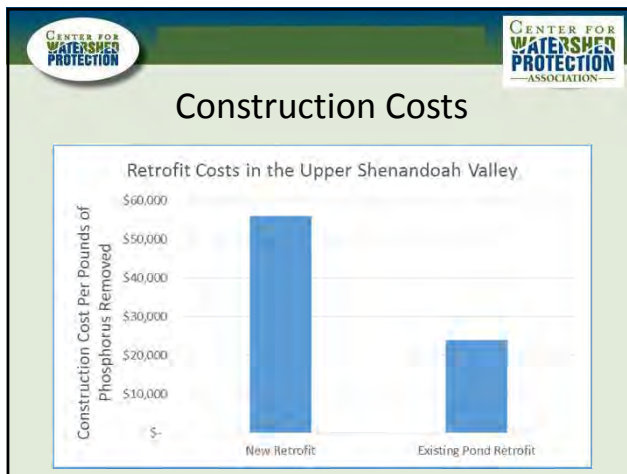
CENTER FOR WATERSHED PROTECTION

CENTER FOR WATERSHED PROTECTION ASSOCIATION



**3. RESTORATION**

**DREDGING AN UNDERPERFORMING POND TO RESTORE FULL PERFORMANCE**



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**Different Approaches for Pond Retrofits**

Reid Christianson, PE, PhD  
Water Resources Engineer  
Center for Watershed Protection

**TMDL Driver**

- Jurisdiction Watershed Implementation Plans (WIPs)

State	Total Nitrogen Cont. Goal (Lbs)	Total Phosphorus Cont. Goal (Lbs)	Sediment Cont. Goal (Ton)
New York	8,850,000	642,878	152,247
Pennsylvania	78,995,996	3,570,897	972,616
Maryland	41,170,000	2,810,000	674,827
Virginia	52,587,957	6,402,043	1,625,691
West Virginia	5,023,284	634,523	186,293
Delaware	3,391,049	276,832	49,897
DC	2,373,144	120,017	8,695

**CENTER FOR WATERSHED PROTECTION** Basic Pond Categories **CENTER FOR WATERSHED PROTECTION ASSOCIATION**

- Conversions
  - Dry to Dry Extended
  - Dry to Wet
  - Dry Extended to Wet Extended
- Enhancements
  - Pocket pools, wetland shelves, etc.
- Restoration of original function
- Storage optimization using flow control devices

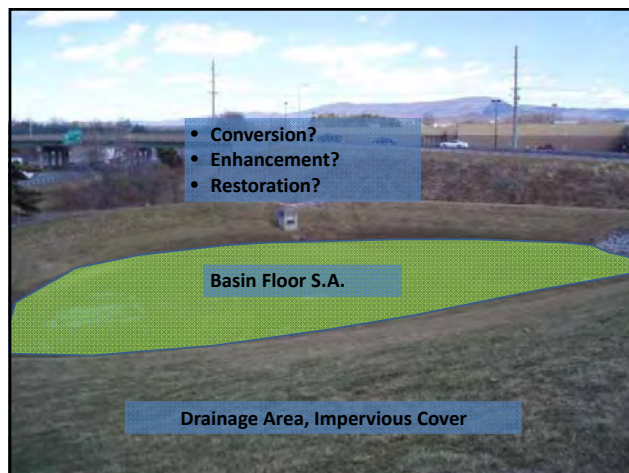
**CENTER FOR WATERSHED PROTECTION** Basic Pond Categories **CENTER FOR WATERSHED PROTECTION ASSOCIATION**

The diagrams illustrate various pond types and their cross-sections. Micropond ED Pond shows a small pond with a high water table. Dry ED Pond shows a pond with a lower water table. Wet Pond with ED (for Channel Protection) shows a pond with a high water table and a channel. Wet ED Pond shows a pond with a high water table and a channel. ED Wetland shows a pond with a high water table and a wetland area.

CWP, 2007

**CENTER FOR WATERSHED PROTECTION** Stormwater Costs **CENTER FOR WATERSHED PROTECTION ASSOCIATION**

- New Management Practice
  - Opportunity Lost
  - Design
  - Conveyance Infrastructure
  - Excavation
- Retrofit Existing Practice
  - Design
  - Excavation







**TMDL Reductions**

- Ponds with only quantity control rarely provide water quality TMDL enhancements
  - Peak flow reduction for stream stability
  - Storage for flood control

**What to Look For**

- General pond condition
- Previous modifications
- Stability/integrity of dam
- Short circuiting
- Evidence of standing water
- Drop to stream/outfall
- Designed hydraulic function

**Design Considerations**

- Confined to existing footprint?
  - Surrounded by private land
  - Steep slopes
- Ability to dig the facility deeper?
  - Water table depth
  - Appropriate soil type
- Risks associated with failure
  - Valuable property damage
- Will retrofit compromise primary function of facility?



**Existing Facility Inventory**

- Most jurisdictions have geospatial information on existing facilities
  - Comb through existing facilities based on type of facility
  - Desktop assessment of applicable retrofit
    - Rough estimate of cost
    - Base reduction estimate
- Potential priority on facilities that can be expanded

**Existing Facility Inventory**

Site ID	Site Description	Facility Practice	Proposed Practice if Conversion	Drainage Area (acres)	TIC	Percent Depth Captured per Impervious Area (%)	Planning Cost of Selected Practice (\$)	Cost Adjustments of Selected Practice (\$)	Selected Practice if reduced (by percent)	Relative Ranking # relative (by percent)	Final Rank
SP 044	Southern Maryland Higher Education Center	City Detention Pond	Controlled ESD (10' over pond area)	0.0	95%	2.05	580,223	520,849	0.62	5.66	74.83
SP 044	Southern Maryland Higher Education Center	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	22.0	21%	2.52	2544,718	21,524	0.83	64.88	74.83
SP 07-17	Westbury Phase 2 Section 1	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	18.1	10%	0.83	542,340	21,289	4.87	17.81	69.83
SP 07-17	Westbury Phase 2 Section 1	City Detention Pond	Vertical Wetland	22.2	70%	0.17	310,949	32,522	3.44	38.81	69.83
SP 08-08	History Hill Payment Fund 2	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	25.8	70%	0.23	248,088	21,244	0.57	54.75	62.79
SP 08-08	History Hill Payment Fund 2	City Detention Pond	Controlled ESD (10' over pond area)	43.8	70%	0.67	220,862	20,458	0.61	43.00	62.79
SP 08-08	History Hill Payment Fund 2	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	40.9	20%	1.18	571,721	22,187	64.09	528.45	59.84
SP 08-17	Westbury Phase 2 Section 2 B&C 2	City Detention Pond	Controlled ESD (10' over pond area)	14.0	20%	1.01	548,801	28,828	9.42	108.84	18.26
SP 08-17	Westbury Phase 2 Section 2 B&C 2	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	14.0	20%	2.57	248,894	22,525	6.09	62.82	39.24
SP 08-25	Aspenwood Park Village	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	0.1	70%	0.29	221,983	21,248	2.13	17.76	59.84
SP 08-25	Aspenwood Park Village	City Detention Pond	Vertical Wetland	0.1	70%	0.17	124,407	20,891	4.52	43.89	59.84
SP 08-27	Willow Woods	City Detention Pond	Microponds: Multiple ponds, Packer pond, Wet pond	0.8	70%	0.68	154,637	21,034	2.43	22.87	54.51
SP 08-27	Willow Woods	City Detention Pond	Vertical Wetland	0.8	70%	0.68	154,637	21,034	2.43	22.87	54.51

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Q & A


Follow-Up Questions: [webcast@cwpa.org](mailto:webcast@cwpa.org)

WHEATON PARK DISTRICT  
THE CITY OF WHEATON, IL


MAIN STREET/NORTHSIDE PARK  
FLOOD CONTROL AND RESTORATION PROJECT


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November 2014




Jedd M. Anderson PWS, CPESC  
Christopher B. Burke Engineering, Ltd.  
9575 W. Higgins Road, Suite 600  
Rosemont, IL 60018

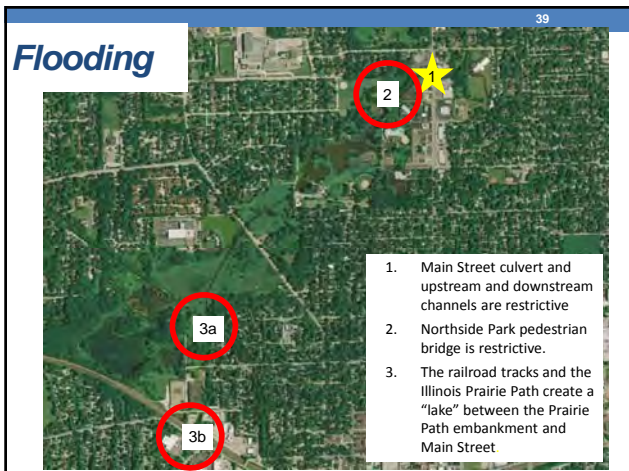
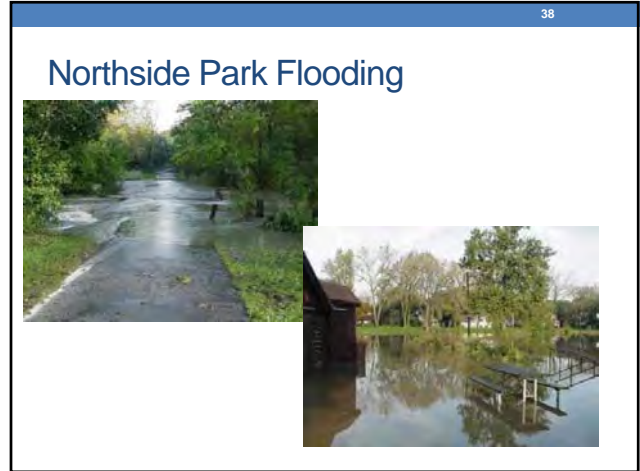
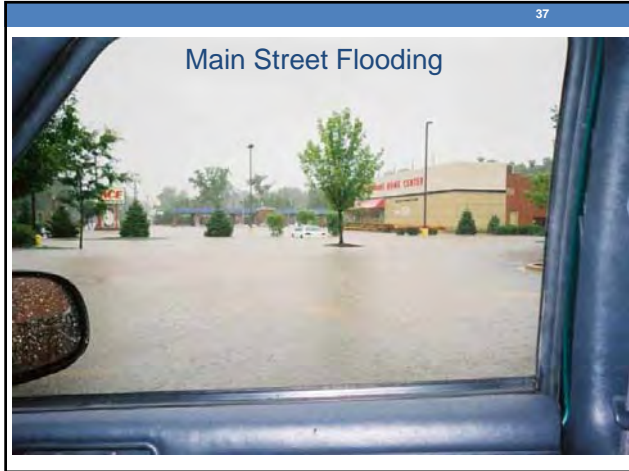




36

Northside Park  
DuPage County, Wheaton, IL  
Chicago Suburb





40

### Main Street Culverts

- The Main Street Culverts can't be modified on their own because those improvements will cause down stream damages.



41

## Northside Park

- On a separate but related issue Northside Park is severely degraded

42

## Shoreline Erosion



43

## Erosion and Siltation



44

## Northside Park Back Story

- Ten years in the making
- 1996 – 350 people thought it was a bad idea to restore Northside Park

45

## Fast Forward to 2007

46

## Two main issues

- Main Street Culverts routinely flood, cutting one side of town off from the other.
  - Major health safety and welfare issue
- Northside Park is severely degraded and needs to be restored

47

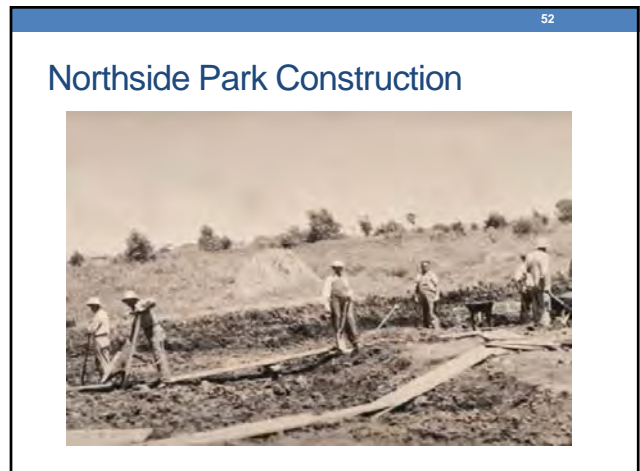
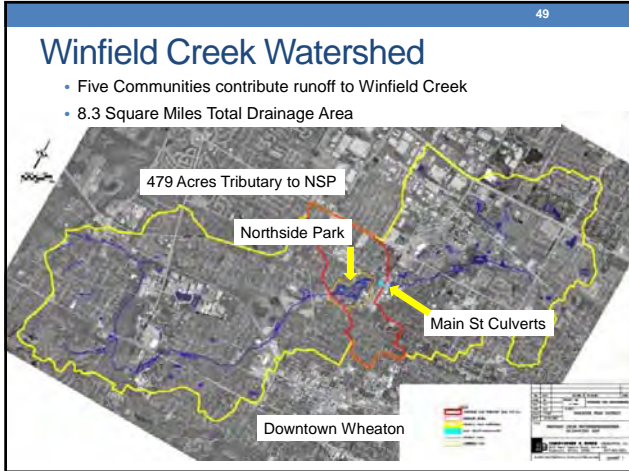
## Design & Permitting

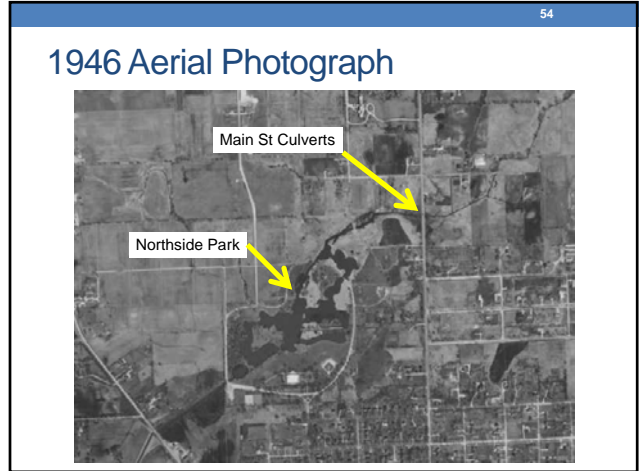
- Main Street culverts cannot be modified if they cause downstream damages
  - Strict County and State Permit Requirements
    - Flood Plain, Floodway, Wetland, Buffer and Riparian regs
- Park restoration will be some what controversial given the past history with the residents
- Team with the Wheaton Park District to agree to allow "damages" to occur within the park to allow the Main Street Culverts to be improved
- Community involvement
  - Invite the opposition to sit on a planning committee
  - Address their concerns
  - Resident's will hopefully see the overall benefit of the combined projects.

48

Now we have the context, let's talk specifics.







- 56
- ### Runoff Then and Now
- Conversion from farmland to suburban land use
    - Reduced Permeability – increased runoff
  - Reduced Times of Concentration – storm sewer systems
  - Constrained flood plain – levee on the west side of park
  - Increased need for detention/flood storage
  - Numerous restrictions to efficient flow from outdated infrastructure

57

### 10 Years Ago

- Mowed Turf Shoreline
- Significant resident goose population
- Shallow Water Depths
- Asphalt Parking Lots
- Outdated Bridges
- Eroded Weir
- Main Street flooding

58

### Main Street Project Components

1. Replace 60 and 72 inch culverts with a 25 foot bridge span
2. Realign and enlarge the downstream channel to efficiently convey flow to the west
3. Enlarge upstream channel
4. Repair weir the in Northside Park to compensate for upstream flood conveyance improvements

59

### Northside Park Flood Plain Improvements

- Replace and lower the deteriorated weir to create additional flood storage necessary to compensate for the improvements being constructed at Main Street.
- Replace the bridge in the northeast corner of the park
  - Enlarge the stream channel area downstream of the park bridge
- Restore the lagoon shoreline with native vegetation to prevent minimize future shoreline erosion and subsequent sedimentation
  - Include a wide riparian buffer in the design

60

### Northside Park Restoration Project Components

Restore park

- Incorporate native buffers around entire shoreline of lagoon
  - Significant goose population impacting park and usage
- Add fishing docks and hard access points to allow access through buffer
- Dredge lagoon to allow fish over wintering and to create an upstream sediment trap
  - Add aerators to improve oxygen load
- Raise sled hill with a portion of the dredged material
- Add additional bridges and paths to allow for a complete walking/biking loop
- Reconstruct parking lots to state of the art permeable paver systems

61

## Intended Consequences

- Prior to restoration there was no viable fish, amphibian or reptile population.
  - Very shallow water, prone to algal blooms, very poor water quality due to anoxic conditions.
    - Significant deposition of sludge on lagoon bottom
- Post restoration, would **significantly** increase in fish, amphibians reptiles and insects.
- Water quality and clarity would be significantly improved.
- Park usage would increase dramatically.

62

## Northside Park Renovation Project

### Weir Lowering to increase compensatory storage

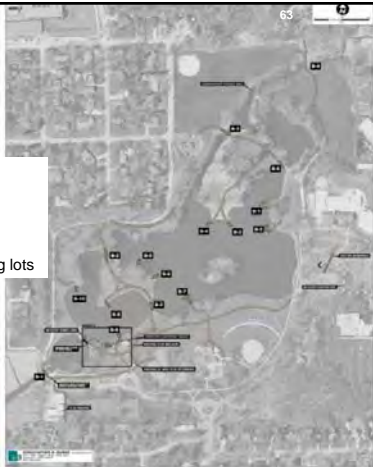


The image shows an aerial view of a park with various green spaces and paths. A yellow arrow points from the word 'Weir' to a specific location on the left side of the park, indicating the site of the weir lowering project.

63

## Paths, Bridges and Docks


- Ten new docks
- Five new bridges
- +/- 1 mile of new paths
- 4 new aerators
- 1 new weir
- 4 new permeable paver parking lots



The map shows the layout of the park with several small icons placed throughout the area, representing the locations of the planned improvements such as docks, bridges, paths, aerators, and parking lots.

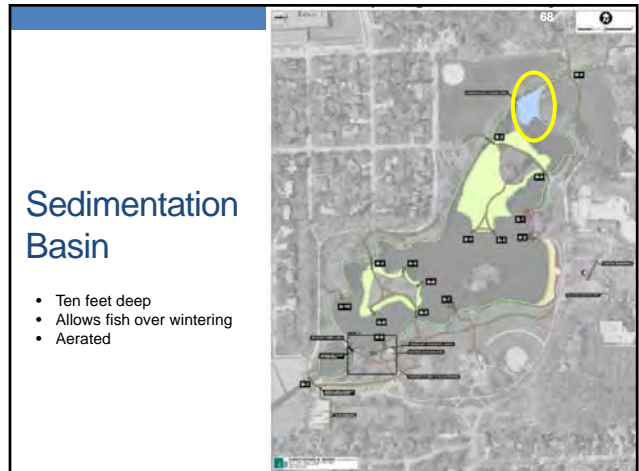
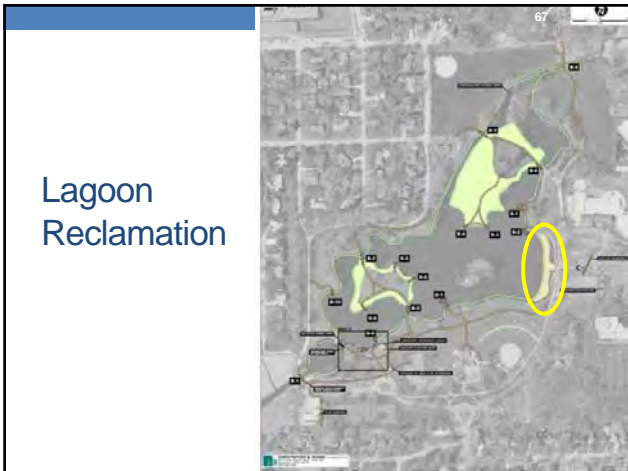
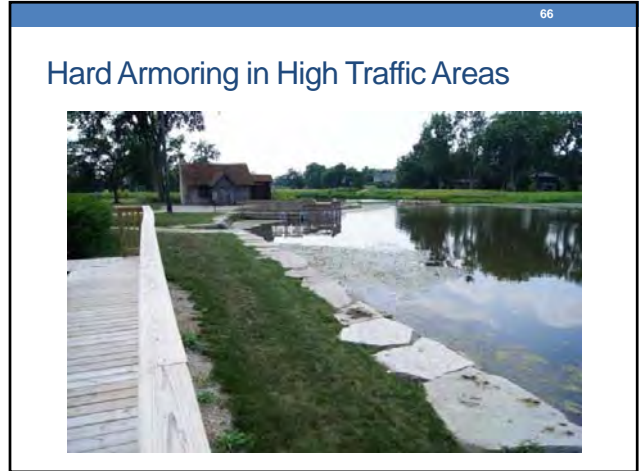
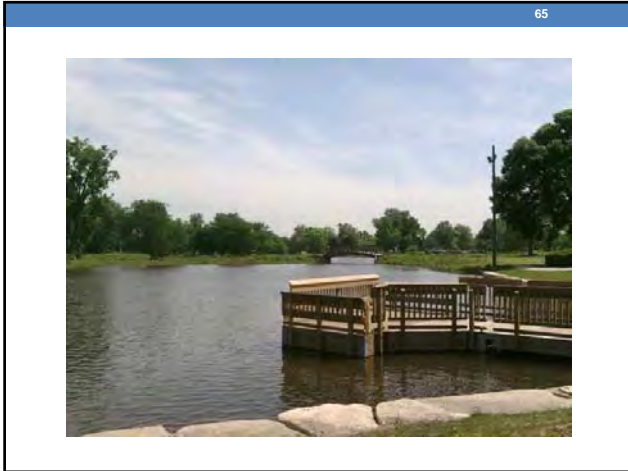
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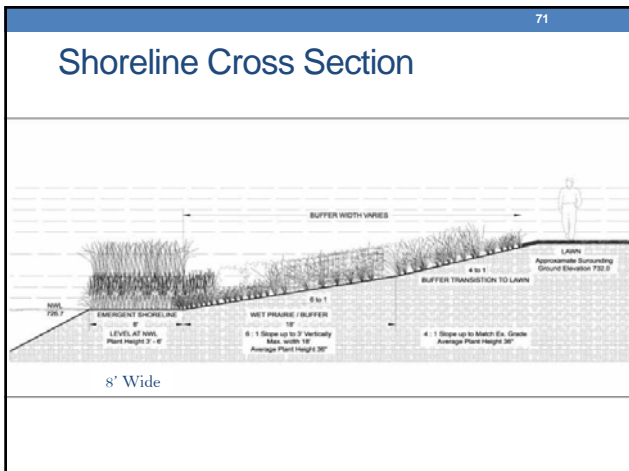
## Docks



The photograph shows a close-up view of a wooden dock with a railing, situated on a calm body of water. The dock is made of light-colored wood and has a simple, functional design.







- ### Main Street/Northside Park Flood Control Project Benefits
- Overtopping of Main Street will be reduced from 15 times to a projected 2 times over a 40 year period.
  - Structural flooding reduced or eliminated for 4 buildings along Main Street.
  - Project assisted in the complete restoration of Northside Park



73

## Phase One

- Removed invasive species
- Shoreline grading and native buffer installed
- Sediment basin excavation
- Bridge replacement and addition
- Increased size of sled hill
- Installed paths and docks
- Replaced the weir

74



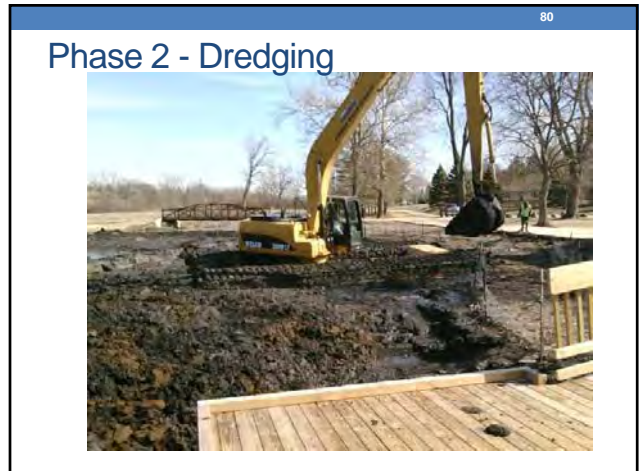
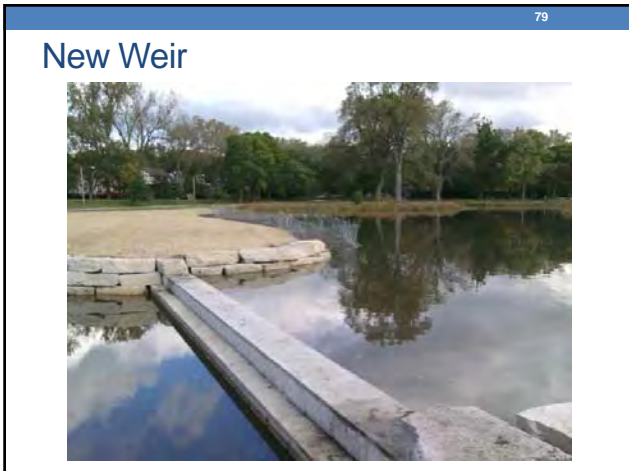
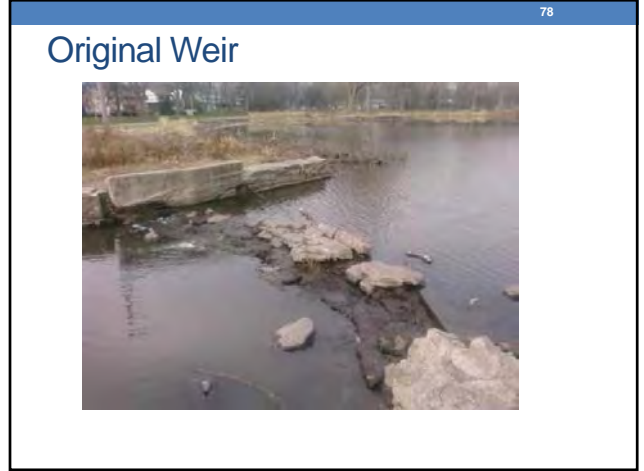
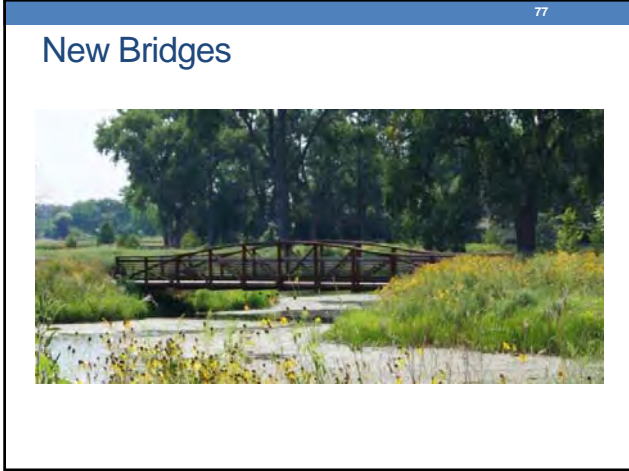
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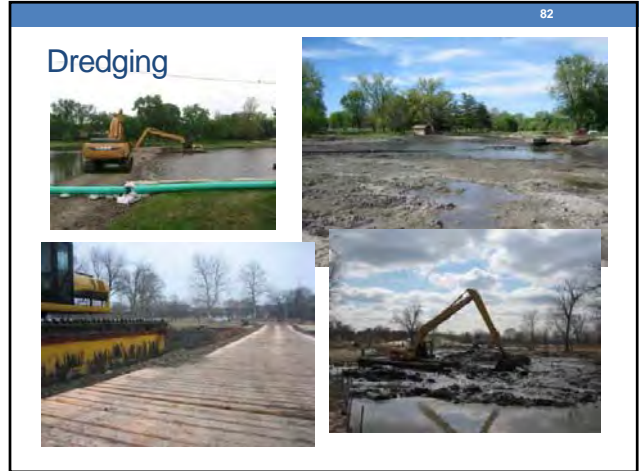


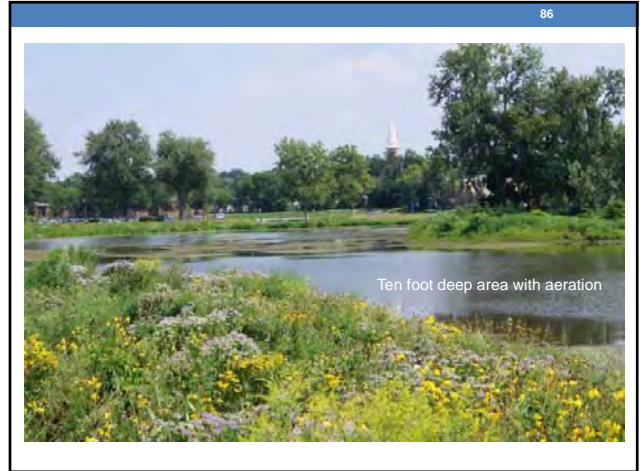
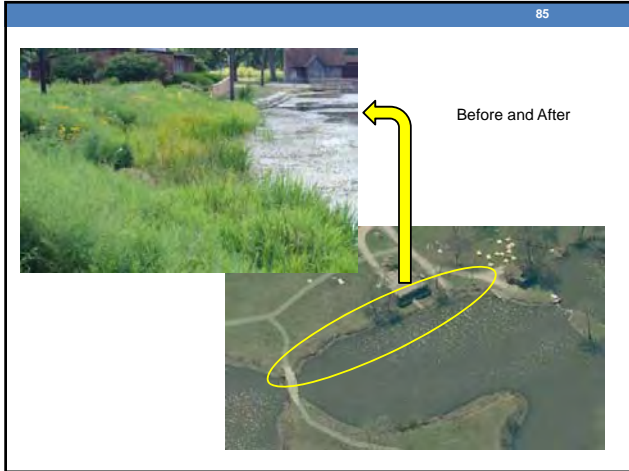
76

## Raised Sled Hill -15 feet











89

## Phase 4 – Main Street

Completed after park restoration because new flood storage had to be in place.

90

## Questions?

Jedd M. Anderson PWS, CPESC  
Christopher B. Burke Engineering, Ltd.  
9575 W. Higgins Road, Suite 600  
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Fairfax County  
**VIRGINIA**

## Watershed Restoration: Pond Retrofits

**Chesapeake Bay Watershed**

Size: 395 sq. miles  
Population: 1.1 million  
MS4 - Phase 1 Community

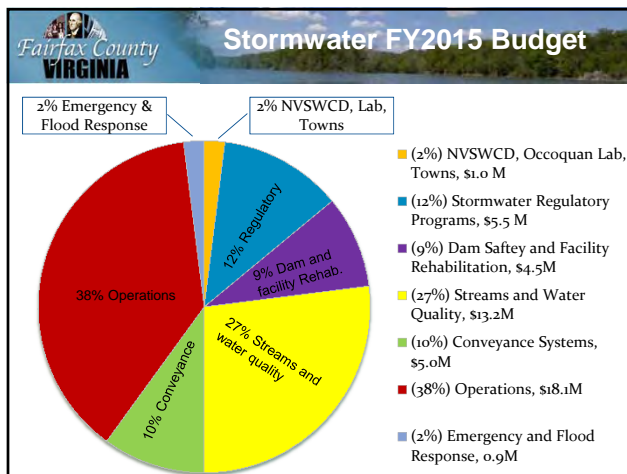
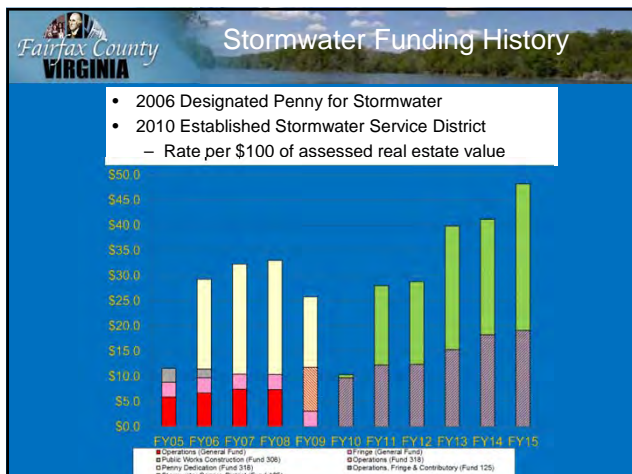
<http://www.fairfaxcounty.gov/dpwes/watersheds/>

Fairfax County  
**VIRGINIA**

## Watershed Restoration: Pond Retrofits

- Program Overview and Drivers
- Pond Retrofits
  - History of design and management practices
  - Project Prioritization
  - Project Benefits
  - Lessons Learned along the Way
- Program Cost and TMDLs

Stormwater Management



### Stream and Water Quality

**Structural Projects:**

- Stormwater Pond Retrofits
- LID Implementation
- Outfall Improvement
- Stream Restoration
- Area-Wide Stormwater Improvement Projects

### Stormwater Management Facilities Current Inventory

Facility Type	Privately Maintained	Publicly Maintained	Total
Dry Pond	530	1,339	1,869
Wet Pond	305	14	319
PL566 Dam - Lakes	0	6	6
Infiltration Trench	932	43	975
Underground Detention	528	80	608
Bioretention	422	70	492
Rooftop Detention	453	1	454
Treebox Filter / Filterra	165	111	276
Sand Filter	221	4	225
Manufactured BMP	164	8	172
Parking Lot	49	0	49
Permeable Pavement	5	21	26
Reforestation	1	18	19
Vegetated Swale	9	10	19
Vegetated Roof	1	5	6
Constructed Wetland	2	0	2
Forebay	1	0	1
<b>Grand Total</b>	<b>3,788</b>	<b>1,730</b>	<b>5,518</b>

Facility counts as of October 2014.



### Stormwater Management Ponds Current Inventory

Function	Privately Maintained		Publicly Maintained		Total
	Dry Pond	Wet Pond	Dry Pond	Wet Pond	
Detention Only	299	140	638	3	1,080
Water Quality BMP	231	165	701	11	1,108
Lakes (PL566)	0	0	0	6	6
<b>Grand Total</b>	<b>530</b>	<b>305</b>	<b>1,339</b>	<b>20</b>	<b>2,194</b>

Facility counts as of October 2014.



Typical Dry Pond



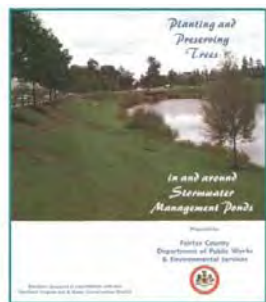
Lake Barton (PL566 Facility)

### History of Pond Retrofits

- No Mow Zones
- Community Plantings
- Dam Safety and Rehabilitation
- Water Quality Retrofits
  - Incorporated into dam safety projects
  - Non-routine maintenance
  - Watershed plans
  - Subwatershed improvements
- Lake Restoration and Dredging

<http://www.fairfaxcounty.gov/dpwes/stormwater/>

### History of Pond Retrofits



Interim Policy Regarding Tree Preservation and Planting In and Around Stormwater Management Ponds . Adopted March 1999

<http://www.fairfaxcounty.gov/nswcd/newsletter/understanding-stormwater-ponds.htm>



Before Planting



After Planting

### Southern Oaks Dam Safety/Pond Retrofit



### Southern Oaks Dam Safety/Pond Retrofit

Oaks Pl  
Completed 2009

### Fair Woods Pond Retrofits

**Before**

**After**

Area Treated (acres)	Phosphorous Removal (lbs/yr)	Nitrogen Removal (lbs/yr)	Sediment Removal (tons/yr)
26	9	44	0.9

### Fair Woods Pond Retrofits

**Before**

**After**


Area Treated (acres)	Phosphorous Removal (lbs/yr)	Nitrogen Removal (lbs/yr)	Sediment Removal (tons/yr)
26	9	44	0.9

### Fair Woods Pond Retrofits


**Now**

### Sycamore Ridge Pond Retrofit

**Before**




**After**



Area Treated (acres)	Phosphorous Removal (lbs/yr)	Nitrogen Removal (lbs/yr)	Sediment Removal (tons/yr)
78.4	38	202	9.4


### Sycamore Ridge Pond Retrofit

**Before**



### Sycamore Ridge Pond Retrofit


**After**







### Lake Restoration and Dam Rehabilitation

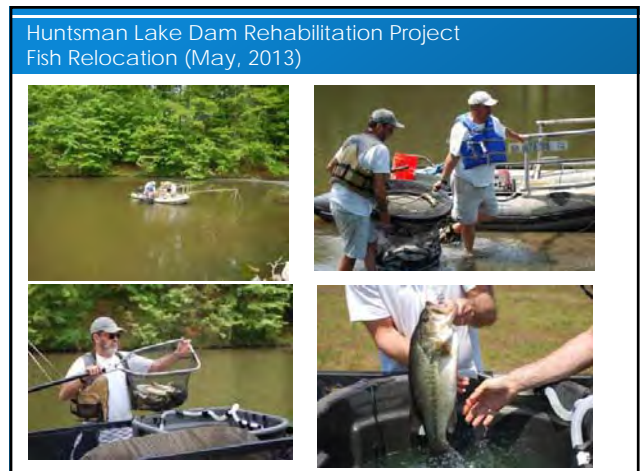
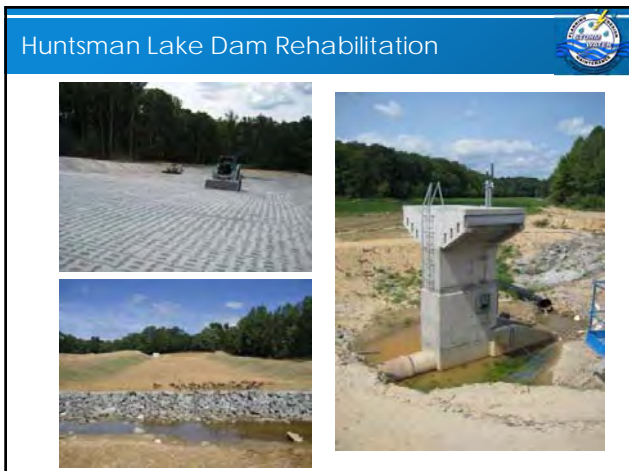
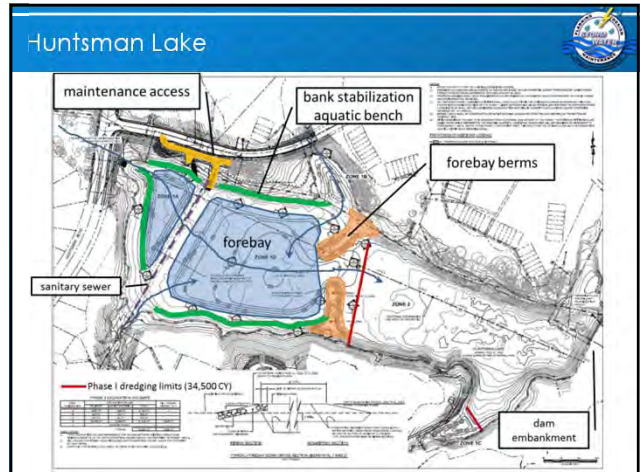
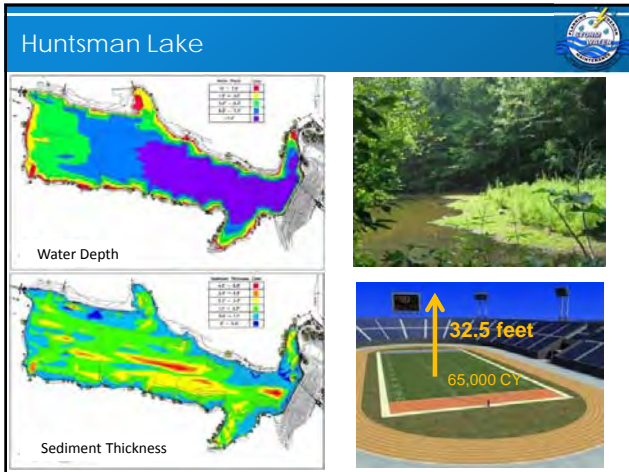
**Huntsman Lake**

- Public Law 83-566: Watershed Protection and Flood Prevention Act



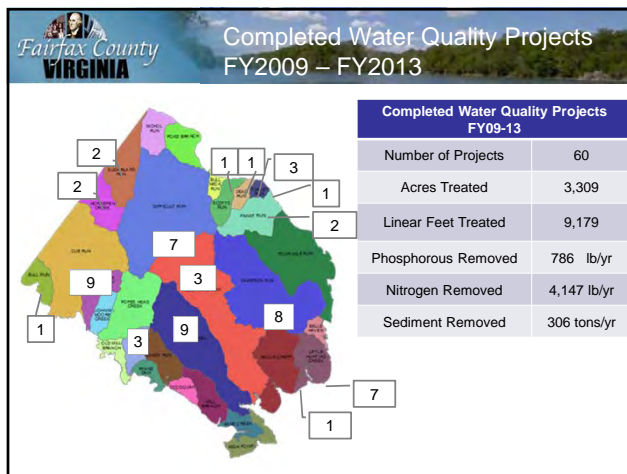




### Huntsman Lake Dredging and Restoration



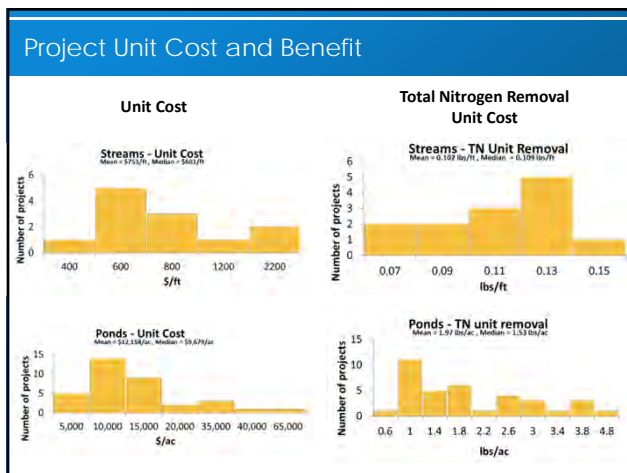
- Project complete Fall 2014
- Fish stocking by VDGIF



### Fairfax County VIRGINIA Completed Water Quality Projects FY2009 – FY2013

Practices	Number Installed	Capital Cost (\$/lb/yr)		
		TP	TN	TSS
Stream Restoration	10	\$ 25,583	\$ 2,812	\$ 13
Infiltration Swales & Trenches	3	\$ 33,583	\$ 5,765	\$ 204
Pond Retrofits	32	\$ 35,908	\$ 7,928	\$ 183
Soil Compost Amendment	9	\$ 120,164	\$ 16,797	\$ 781
Dry Swales	7	\$ 132,423	\$ 22,732	\$ 803
Bioretention (Rain Gardens)	18	\$ 168,973	\$ 28,935	\$ 1,026
Pervious Pavement	4	\$ 198,624	\$ 33,631	\$ 1,211

- Cost per pound of pollutant removed
- Based on capital cost for first year of treatment



### Chesapeake Bay TMDL: Program Scenarios and Cost

Project Type	Range	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Stream Restoration	30-100%	100%	65%	60%	50%	30%
Pond Retrofits	0-70%	0%	35%	20%	30%	50%
GI/LIDs	0-20%	0%	0%	10%	20%	20%
Program Cost		\$453 M	\$ 475 M	\$496 M	\$524 M	\$539 M

### Project Selection for Capital Improvement Plan

- Pond Retrofit Evaluation Example

**Leigh Meadows Dry Pond:**  
 Drainage Area: 2.2 ac impervious, 3.4 ac turf, 3.2 ac forested (8.8 ac total)  
 Pond surface area is approximately 7,000 sf, and the pond bottom is approximately 4,000 sf

### Pond Retrofitting Considerations

1. Create micropools in pond bottom:
  - Does not impact current functionality
  - Estimated removal efficiencies assuming total additional storage volume is 4,000 cf (assuming an average 1' micropool depth over the pond bottom) are 41% for TP and 26% for TN.
2. Level I constructed wetland design (50% TP and 25% TN removal efficiency)
  - Estimated storage required is 0.25 ac-ft (10,890 cf).
  - Assuming normal pool surface area is 5,000 sf, this would result in an average wetland depth of approximately 2 ft.
  - May require raising the facility dam embankment to provide storage for detention currently provided by facility
3. Level II constructed wetland design (75% TP and 55% TN removal efficiency)
  - Storage required is 1.5 x Level I storage (16,335 cf)
  - Mean wetland depth has to be less than 1 ft
  - This would significantly increase the facility footprint (by at least a factor of 2.5)
  - May not be feasible with existing easements

### Fairfax County VIRGINIA Pond Retrofits

Matthew Meyers, Chief  
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- Webcast 6: Checking in on Post-Construction Stormwater Management

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**Thanks for Attending  
Retrofitting Existing Stormwater  
Ponds & Basins**





# Thank you for Attending!

Center for Watershed Protection

Retrofitting Existing Stormwater Ponds & Basins Webinar Rebroadcast  
(December 10, 2014)

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	Name (Please Print)	Affiliation	Sign-in or Initial
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2	Wendy Gilhe	City of Bend	<i>Wendy Gilhe</i>
3	Corey Charon	The Green Consultant	<i>Corey Charon</i>
4	Pennis Collins	Stormwater Service	<i>Pennis Collins</i>
5	Derek Meyer	Stormwater S.U.C.	<i>Derek Meyer</i>
6	Aaron Calkett	Bend Park District	<i>Aaron Calkett</i>
7	JERRY ANGLE	ANGLE CONSULTING	<i>Jerry Angle</i>
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11	Chris Amy	CUB	<i>Chris Amy</i>
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13	Phil Buchanan	CUB	<i>Phil Buchanan</i>
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