# Carroll County Maryland's Regional Stormwater Management Strategy

COG Workshop

November 29th, 2016

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# NPDES & TMDL Compliance

Modified, Enhanced, and Enlarged Sand Filters as Retrofits of Existing Stormwater Management Ponds

# As of 2016
# 25 Carroll County Modified Sand Filters

| FACILITY | DRAINAGE AREA | IMPERVIOUS AREA | INCHES OF TREATMENT | TN REDUCTION (LBS/YEAR) | TP REDUCTION (LBS/YEAR) | TSS REDUCTION (TONS/YEAR) |
|---|---|---|---|---|---|---|
| Marriott Wood I Facility #1 | 3.00 | 0.56 | | 11.52 | 1.04 | 0.28 |
| Hickory Ridge | 23.75 | 4.80 | 3.80 | 116.80 | 10.73 | 2.92 |
| Bateman SWM Pond | 47.25 | 7.40 | 6.80 | 228.31 | 19.56 | 5.14 |
| Marriott Wood I Facility #2 | 7.12 | 2.04 | 4.63 | 36.15 | 3.72 | 1.07 |
| Marriott Wood II | 11.62 | 1.92 | 6.19 | 56.34 | 4.89 | 1.30 |
| Elderwood Village | 15.28 | 4.94 | 2.22 | 76.77 | 8.32 | 2.38 |
| Collins Estate | 32.68 | 6.36 | 2.99 | 160.26 | 14.56 | 3.94 |
| Oklahoma II Foothills | 23.72 | 6.06 | 2.36 | 102.04 | 9.99 | 2.81 |
| Oklahoma Phase I | 24.44 | 7.27 | 3.99 | 124.60 | 12.98 | 3.74 |
| Edgewood | 38.00 | 12.12 | 2.70 | 195.27 | 20.86 | 6.07 |
| Upper Patapsco Phase I -Naganna Pond | 24.50 | 10.00 | 2.70 | 130.03 | 15.27 | 4.60 |
| High Point | 9.40 | 1.82 | 2.58 | 46.08 | 4.18 | 1.13 |
| Westminster High School | 115.00 | 42.12 | 3.38 | 601.25 | 67.66 | 20.09 |
| Brimfield | 34.69 | 17.23 | 4.12 | 189.93 | 24.18 | 7.48 |
| Upper Patapsco Phase II -Hoff Pond | 77.30 | 2.98 | 52.57 | 356.27 | 24.42 | 5.54 |
| Heritage Heights | 21.40 | 4.10 | 6.96 | 104.82 | 9.48 | 2.56 |
| Clipper Hills - Gardenia | 33.19 | 11.08 | 3.13 | 171.49 | 18.49 | 5.46 |
| Clipper Hills - Hilltop | 43.82 | 13.40 | 3.47 | 224.09 | 23.40 | 6.82 |
| Wilda Drive | 6.75 | 1.60 | | 26.43 | 2.56 | 0.70 |
| Diamond Hills Section 5 | 51.80 | 16.26 | 2.16 | 259.37 | 27.37 | 7.91 |
| Carrolltowne 2A Gemini Drive | 87.73 | 34.43 | 2.56 | 463.02 | 53.12 | 16.05 |
| Benjamin's Claim | 47.10 | 15.78 | 2.31 | 237.67 | 26.09 | 7.58 |
| Eldersburg Estates 3-5 | 34.90 | 8.16 | | 136.50 | 13.15 | 3.61 |
| Benjamin's Claim Basin B | 1.33 | 0.55 | | 5.56 | 0.66 | 0.20 |
| Braddock Manor West | 49.30 | 7.65 | | 187.07 | 16.04 | 4.15 |
| Totals | 865.00 | 240.00 | | 4248.00 | 433.00 | 124.00 |

# History
# Began in 2000

**Modified Sand Filters**
**(or the Herring/Frock Method)**

- Myron Frock (who had worked with S.C.S. for many years) pointed out that grassed waterways used in agriculture to prevent soil erosion in fields also proved remarkably effective at filtering the water, particularly when underlain with drain "tile."
- The typical agricultural waterway consists of a perforated HDPE pipe surrounded by 4-inches to 6-inches of stone and overlain by sod.

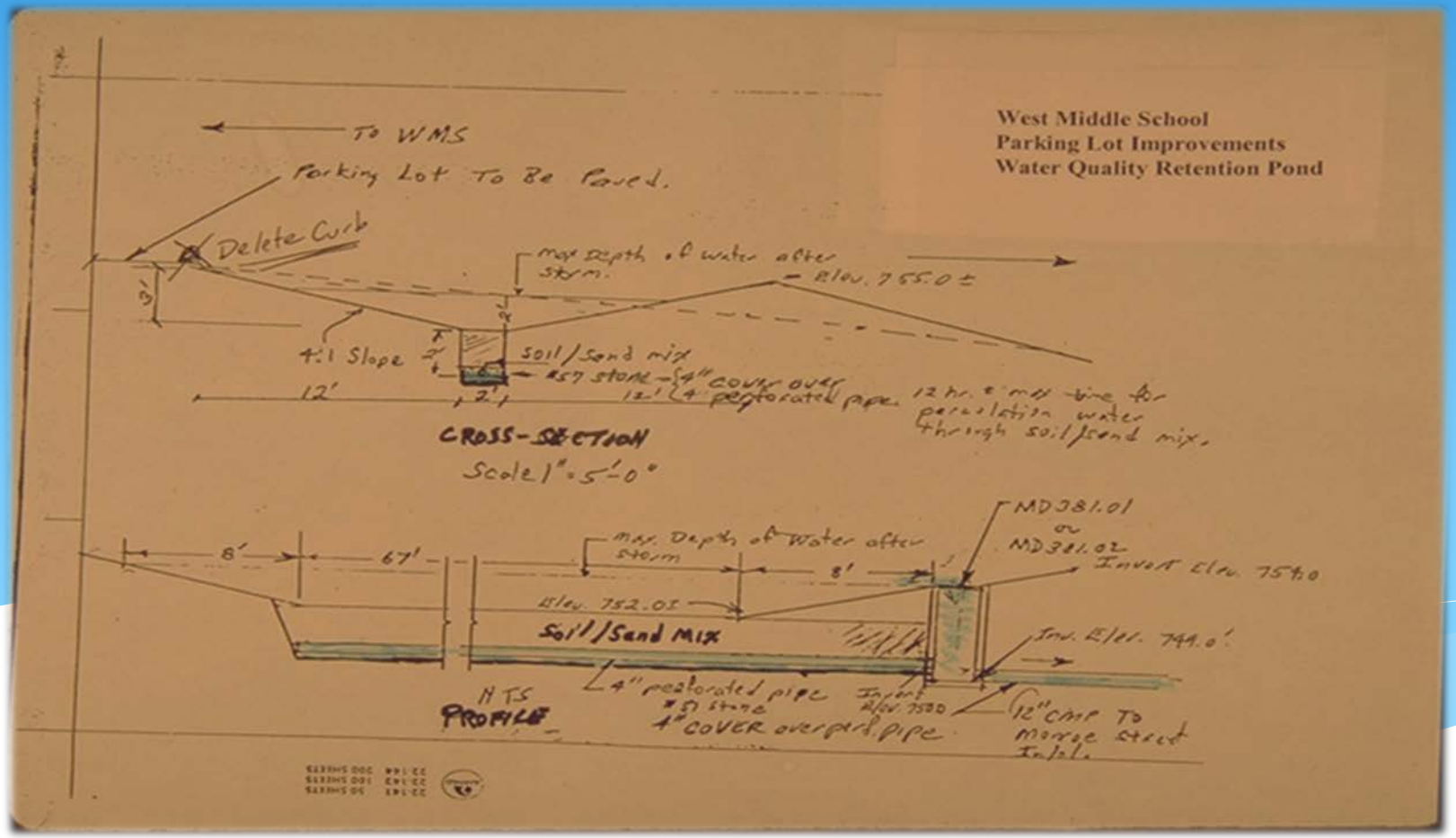
## Modified Sand Filters
**(or the Herring/Frock Method)**

**To modify the agricultural waterway for stormwater treatment we:**

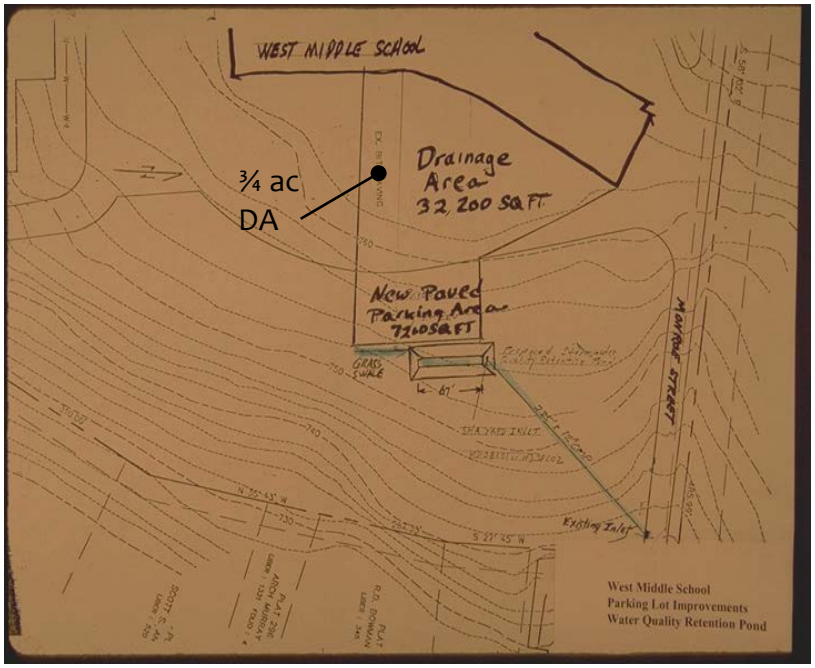
- added 2 feet of stone below the underdrain
  - This creates an underground reservoir of water that will infiltrate if the soil conditions permit.
- Mixed 2 parts construction sand to one part native soil above the underdrain.
  - This creates a man-made sandy loam conducive to infiltration.

# First Facilities

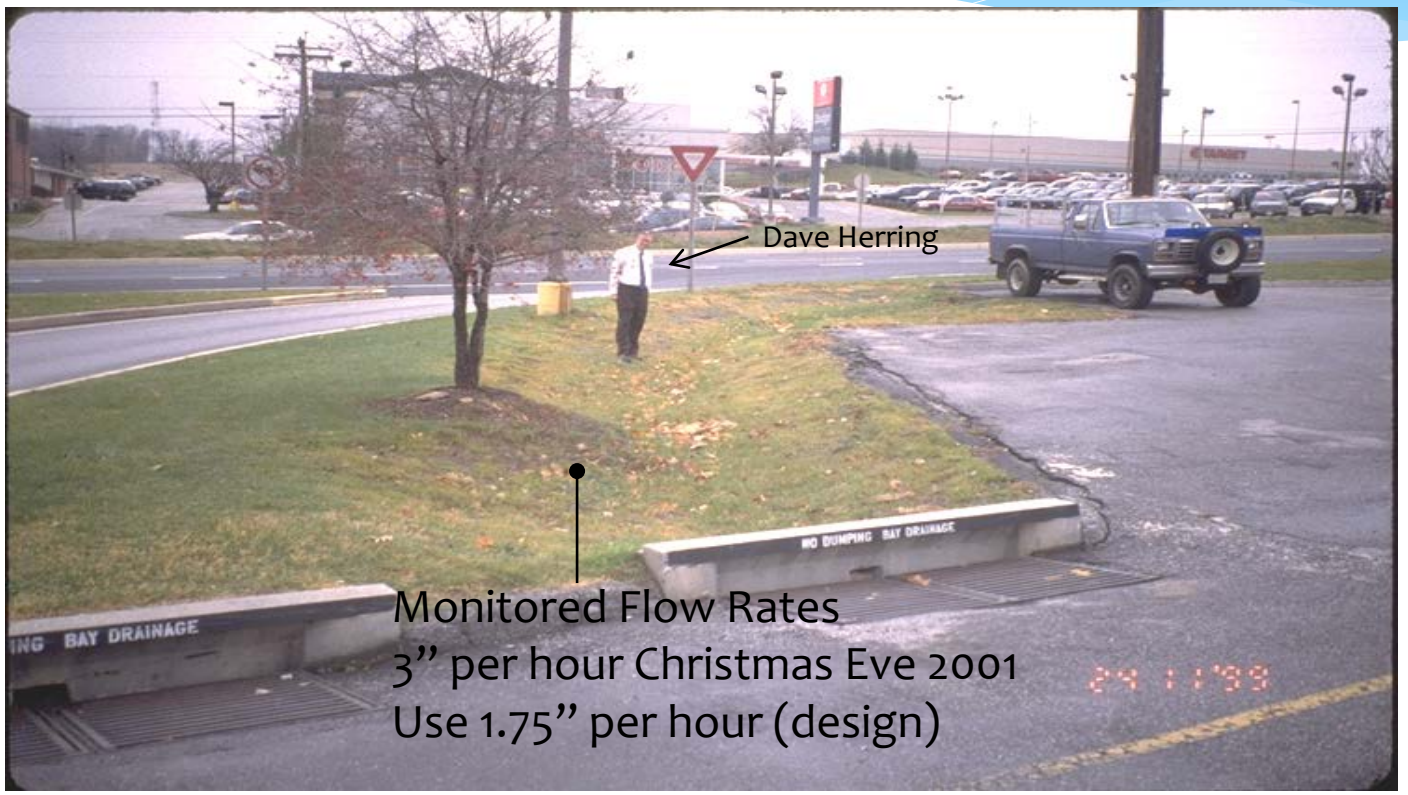
West Middle School
(Dave Herring)



# West Middle School



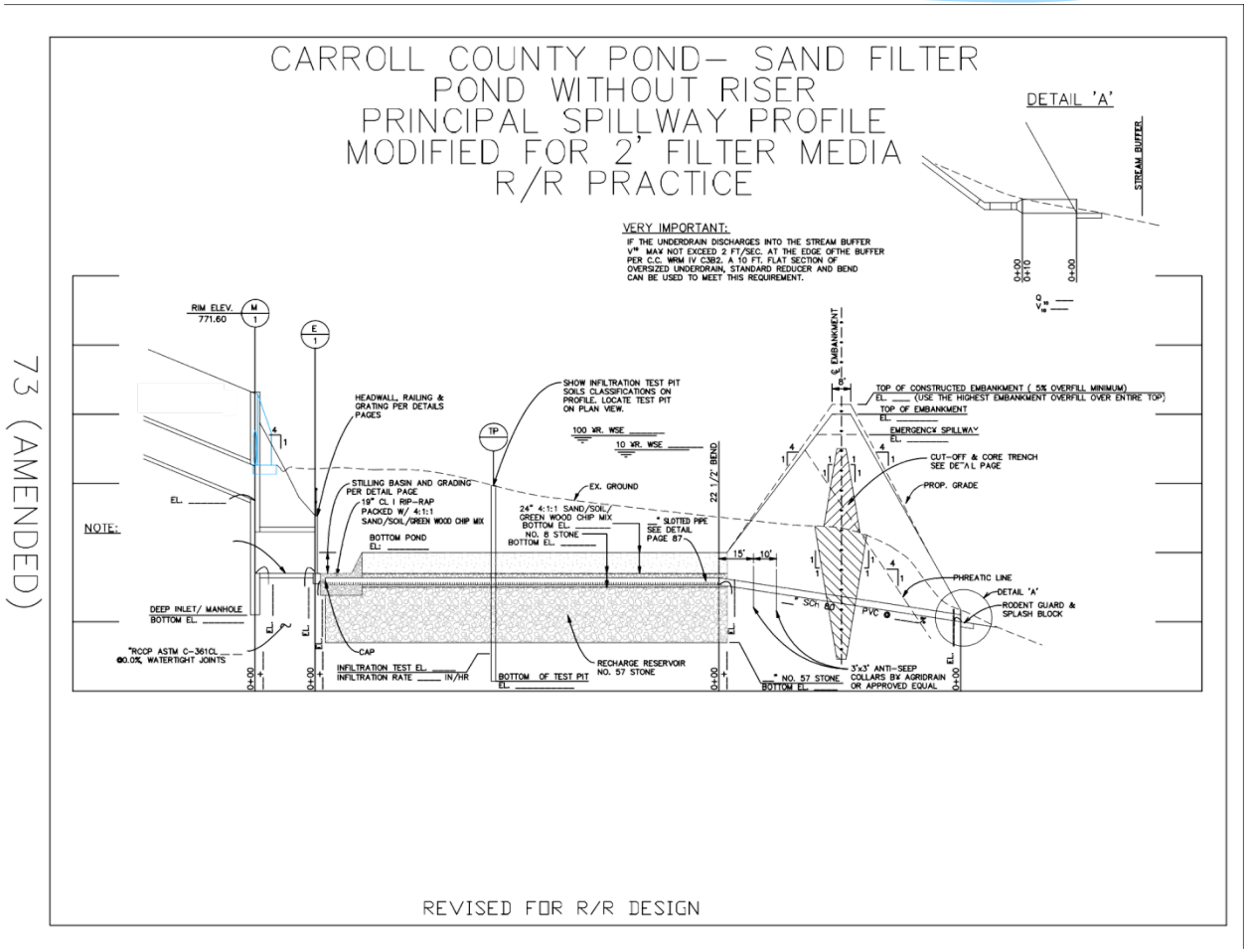

# Friendly's Retrofit



# Current Design 2016

Unique Characteristics:

1. No Riser- all design flows through sand control
2. Drop Structures and Level Pipes – No rip-rap inflows and Forebays in facility
3. Total Capture of 2 year storm, difference in 10 year runoff volume
4. Sand layer across entire bottom of facility
5. No limit on drainage area size
6. $Q_{10}$ captured and conveyed to pond



# Westminster High School Pond Retrofit



Information

DA - 115 acres IA - 42 acres

Volume to Spillway 3.4”/IA

| | ST Practice | RR Practice |
|---|---|---|
| TN | 601 lbs/year | 781 tons/year |
| TP | 67 lbs/year | 80 tons/year |
| TSS | 20 tons/year | 21.5 tons/year |

Constructed in 2013

Cost $1,100,00

$26,000/IA



# Hydrologic Results

## Bankful "Channel Shaping" Flow

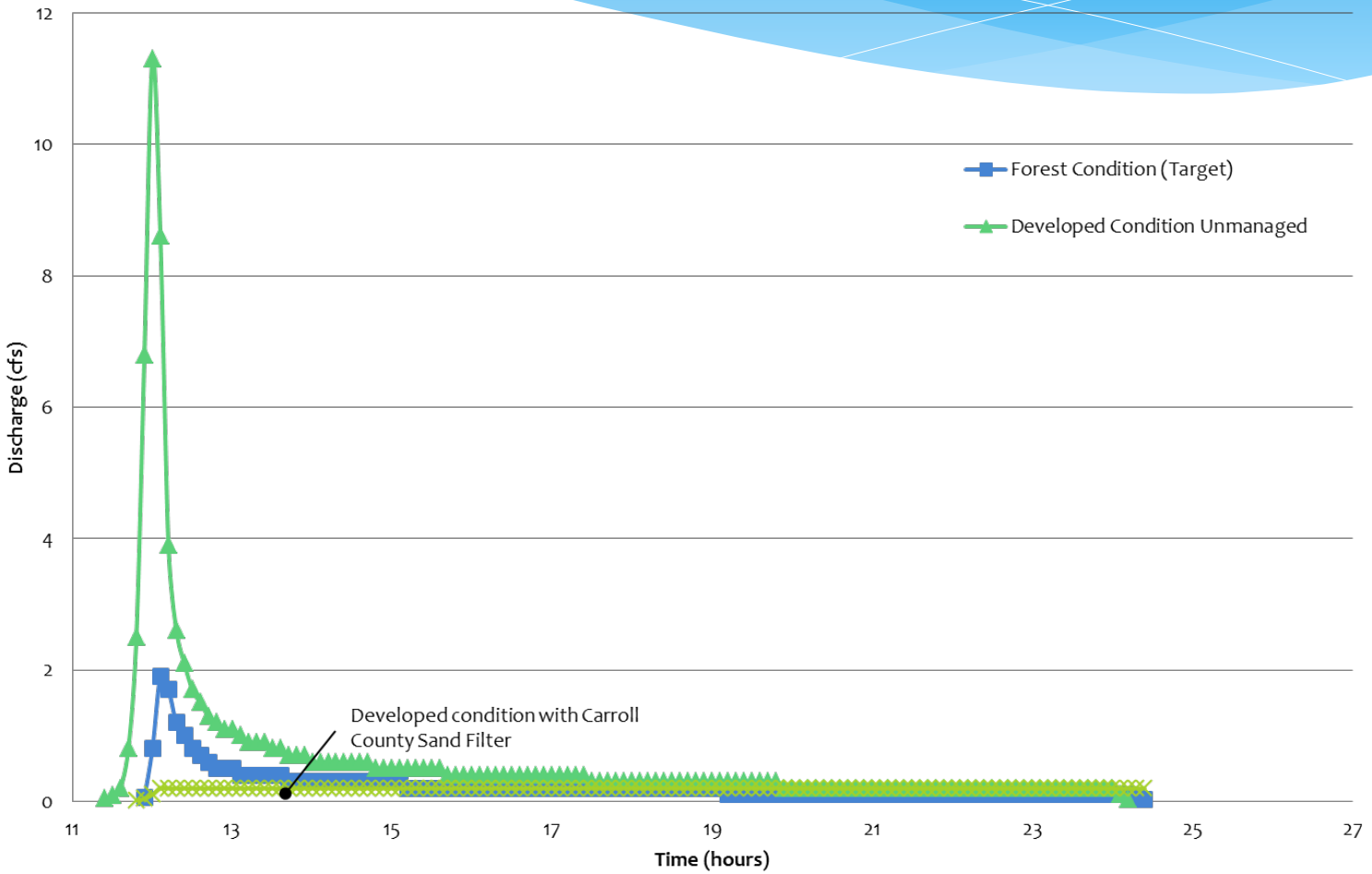
(Wolman & Leopold, 1957)

- 1.07 to 2.7 years (agricultural watersheds)
- (USGS, 554) reduced to 0.7 years with 20% impervious

# Hydrologic Results

## Figure 5

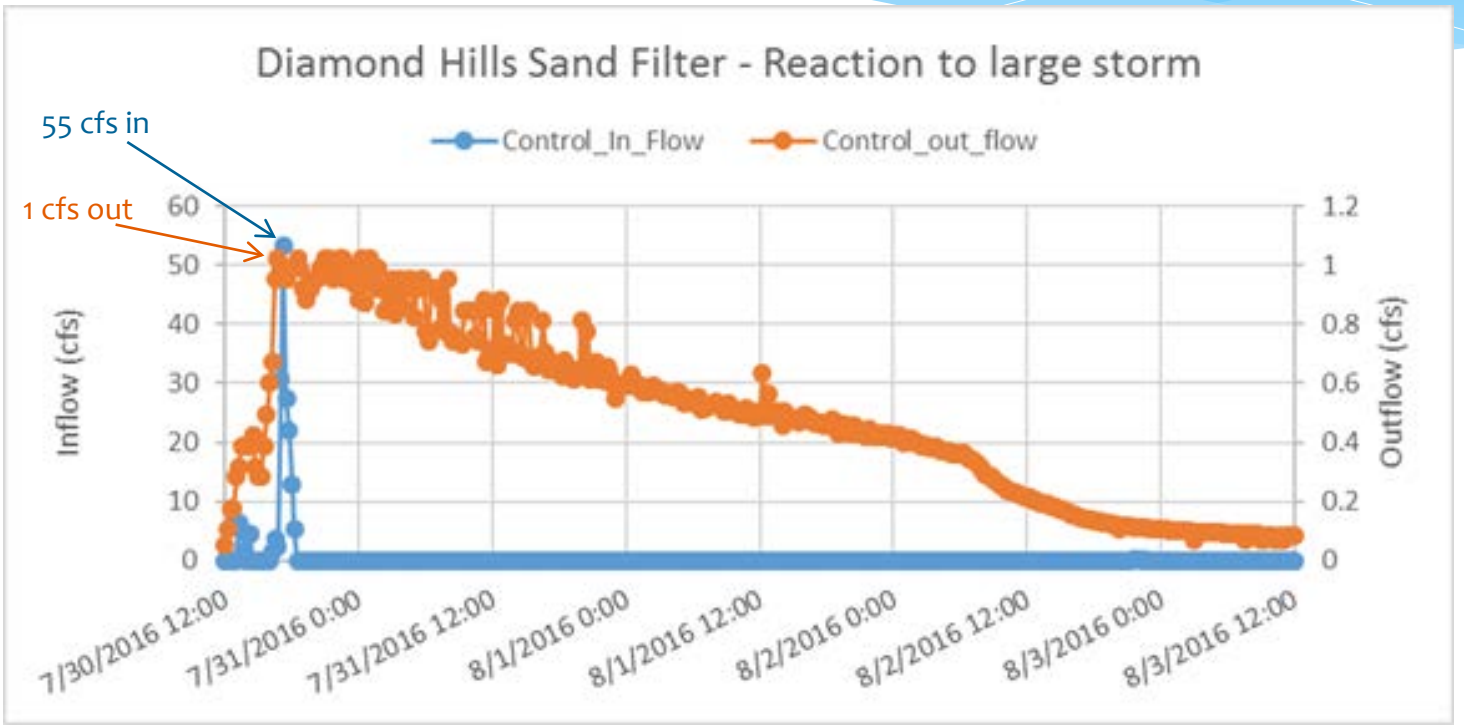
**2 Year Storm Runoff - 10 Acre - B Soil**
**Forest vs 30% Impervious (Developed) Unmanaged & Managed**




Extreme Extended Detention

- Thermal Impacts?
- See 5.6.5 "Additional Techniques for Mitigating Thermal Impacts"
- "Use the enhanced filter option"

# Diamond Hills



# Downstream Impacts

## Seeing is Believing

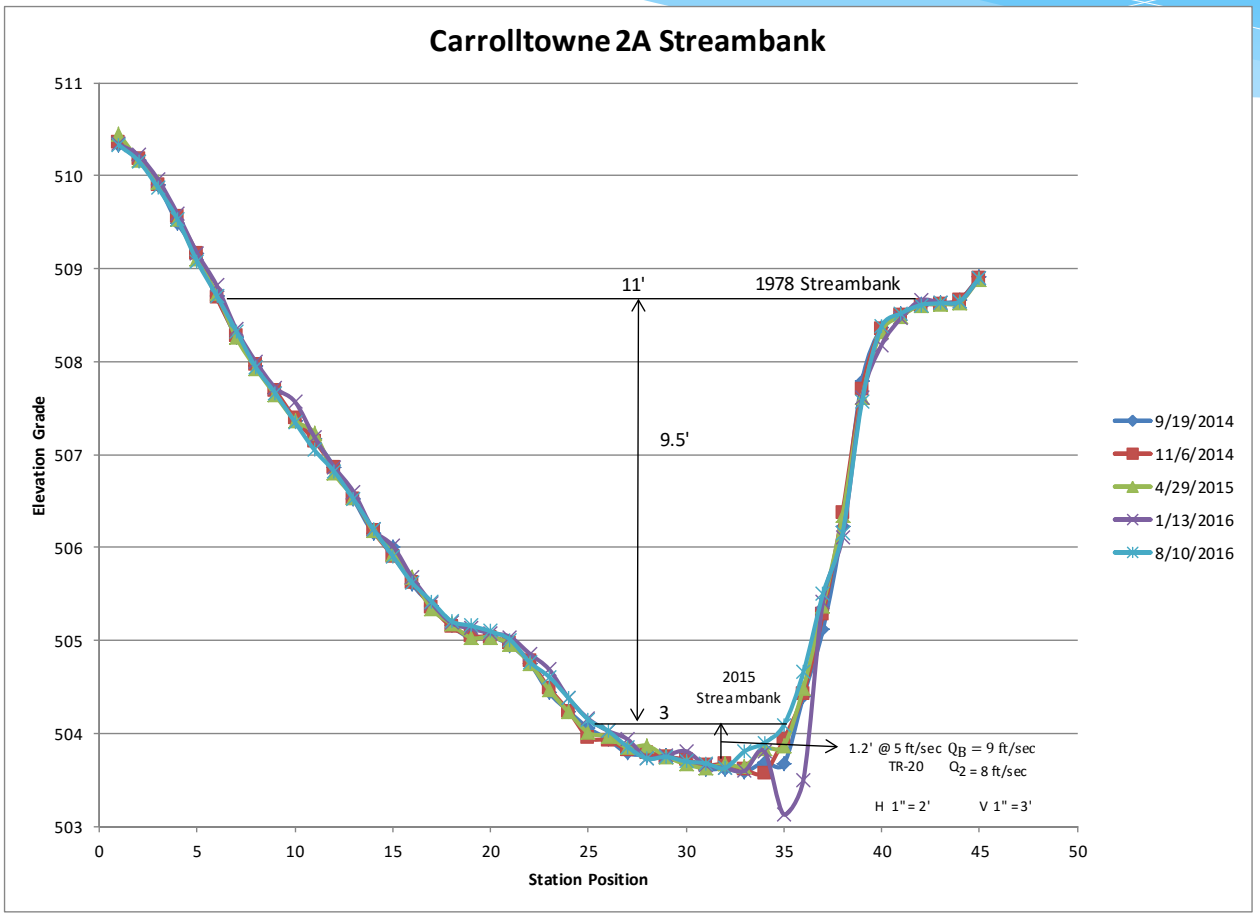
### Carrolltowne 2A Before


2014

### Carrolltowne 2A After

2016

# Carrolltowne 2A



# Accounting for Stormwater Wasteload Allocations & Impervious Area Treated (2014)

## 2.5” Volume Sand Filter Carrolltowne 2A

38 Years

| | |
|---|---|
| • Impervious Area to Pond | 34.4 acres |
| • 2014 Runoff Reduction “Bonus” | 6 acres |
| • Length of Hydrologically Restored Downstream Channel | 1,100 feet |
| • Stream Restoration Credit MDE 2011 | 11 acres |
| • Prevented Streambank Erosion Credit | 52 acres |

# Retrofit Problem/Emergency Spillway

1. Must be in undisturbed “virgin” ground, not dam fill
2. But the undisturbed land and ends of dam are not on the parcel

# Solution

In dam, stand alone weir walls, at 10 year WSEL able to pass the 100 year storm safely

# Retrofit Problem 2 – Base Flow

1. Saturated Filter
2. Constant water in plunge pools/forebays
   (concerns about West Nile/Zika)

# Solution 1

Check for leaks:

1. E. Coli (sewage)
2. Chlorine (drinking water)

Fix the leaks!

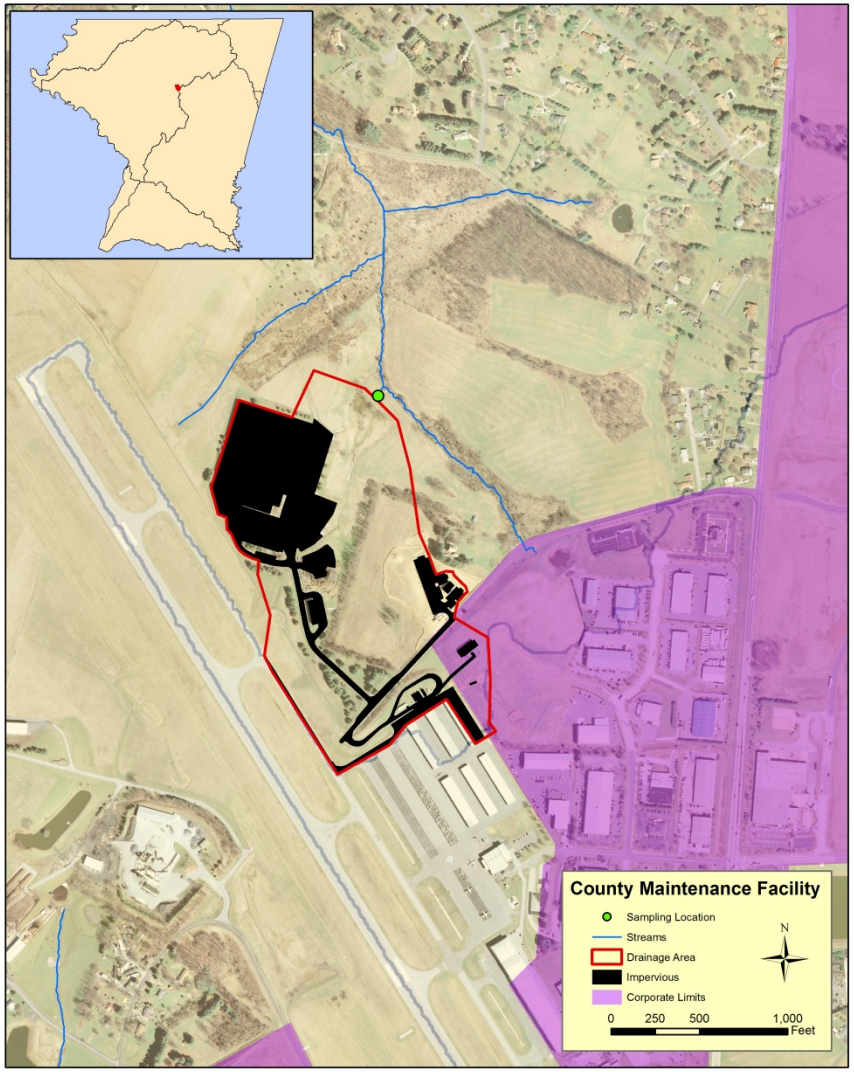
# Solution 2


Bypass base flow from drop structure

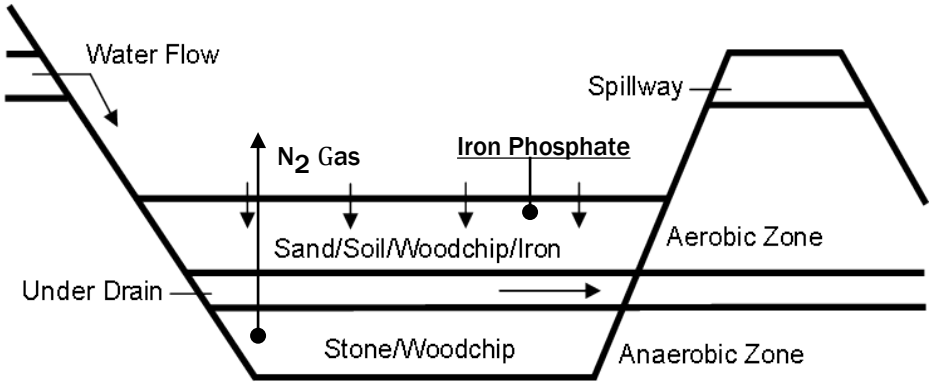
# Solution 3

Add more underdrain pipes

# Future Design Improvements
# Carroll County Maintenance Facility




- Double Pipe Creek Watershed
- Partnership
  - Center for Watershed Protection
  - Carroll County Government
- Standard vs. Enhanced sand filter
  - MDE Alternative/Innovative Technology Review
- Construction scheduled April, 2016



# Questions?

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Details at:

http://ccgovernment.carr.org/ccg/resmgmt/doc/Forms/swm.supplement.pdf?x=1464697527476