



Maryland Association of Floodplain and Stormwater Managers

State of the State - Stormwater Management



October 12, 2017





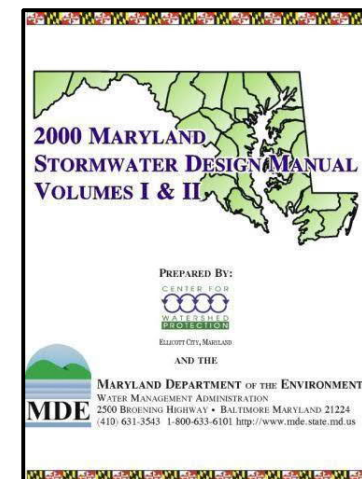
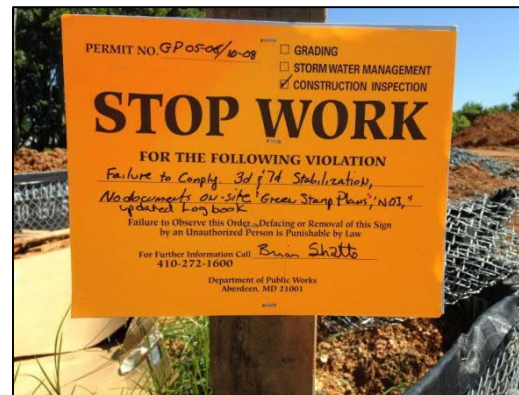
Sediment, Stormwater, & Dam Safety Program

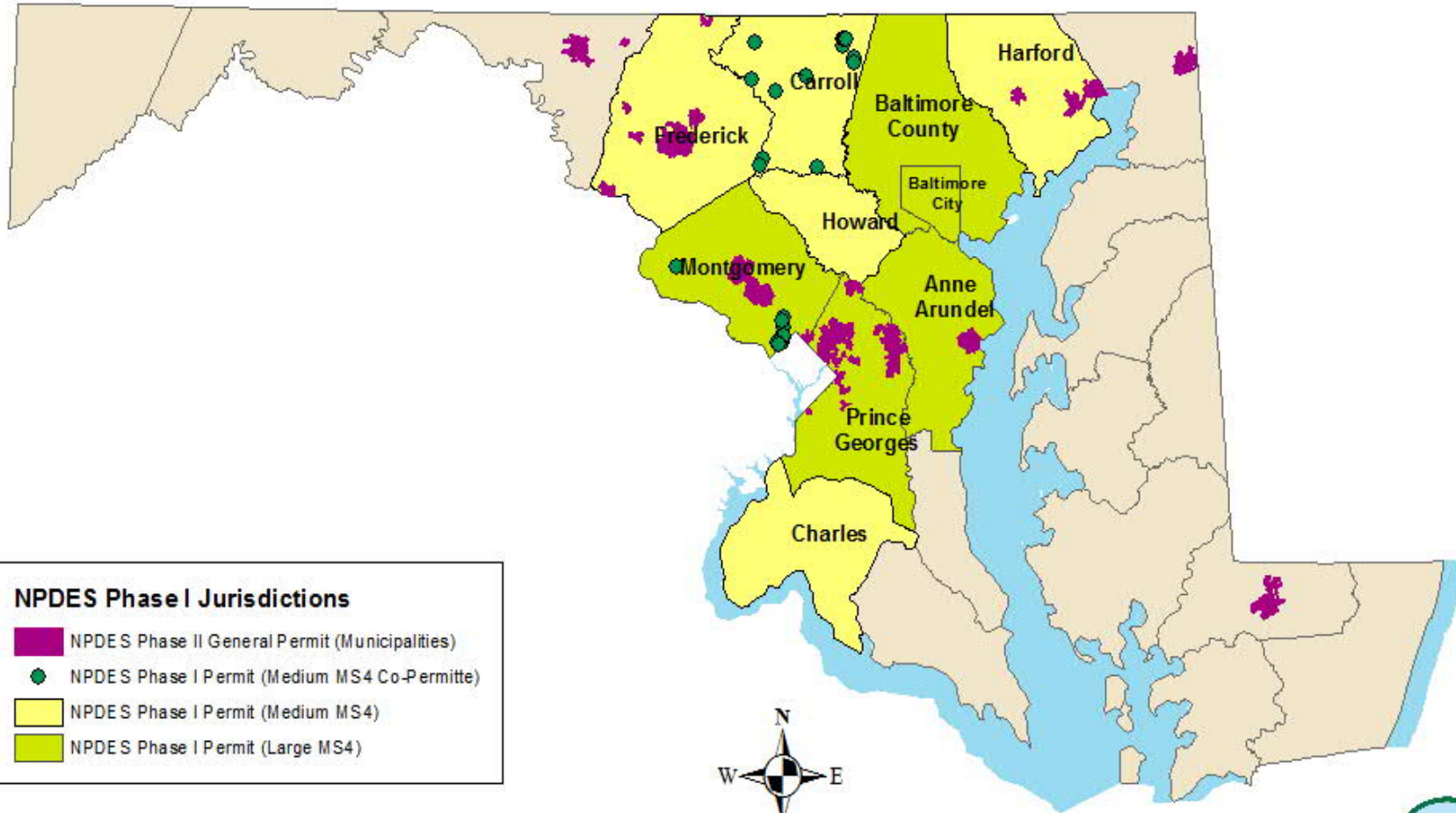
- Sediment and Stormwater Program Review
- Sediment and Stormwater Plan Review
- Dam Safety





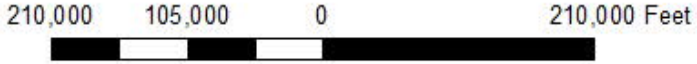
NPDES MS4 Permits Impervious Surface Restoration





NPDES Phase I Jurisdictions

-  NPDES Phase II General Permit (Municipalities)
-  NPDES Phase I Permit (Medium MS4 Co-Permittee)
-  NPDES Phase I Permit (Medium MS4)
-  NPDES Phase I Permit (Large MS4)



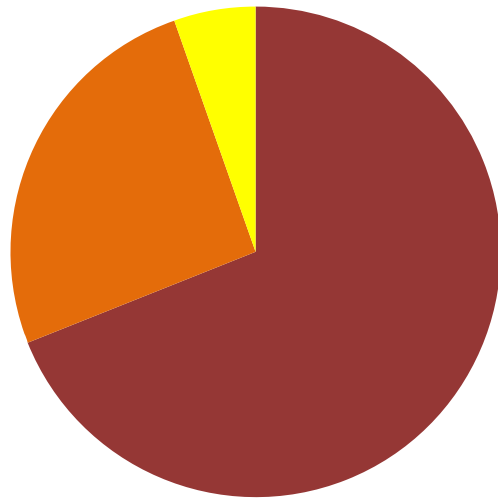
Map Date - 25 April 2016



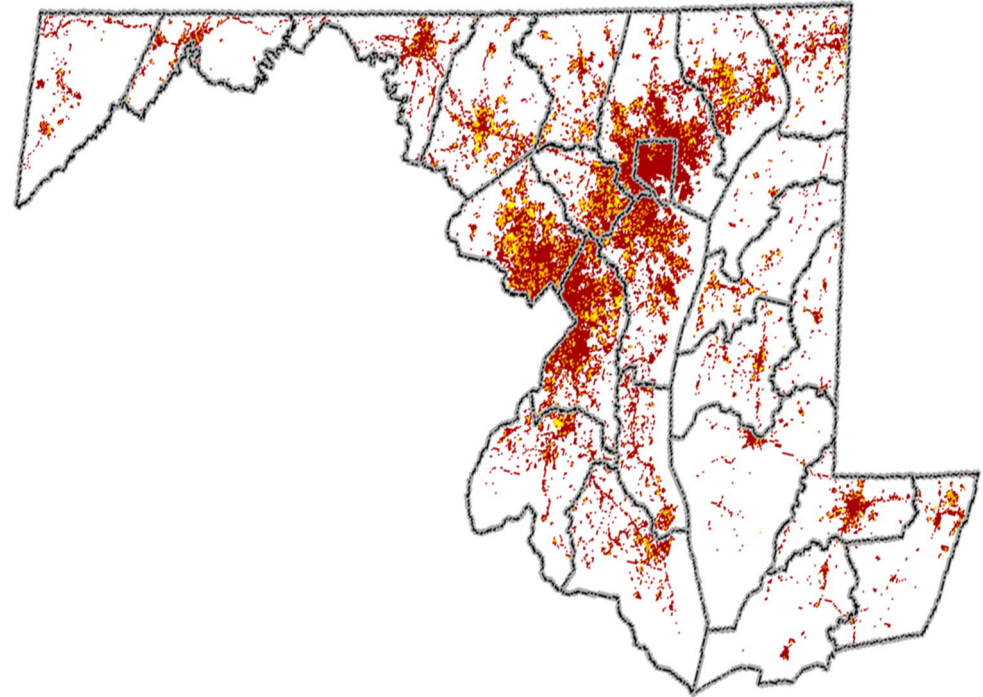
Larry Hogan, Governor
 Boyd Rutherford, Lieutenant Governor
 Ben Grumbles, Secretary



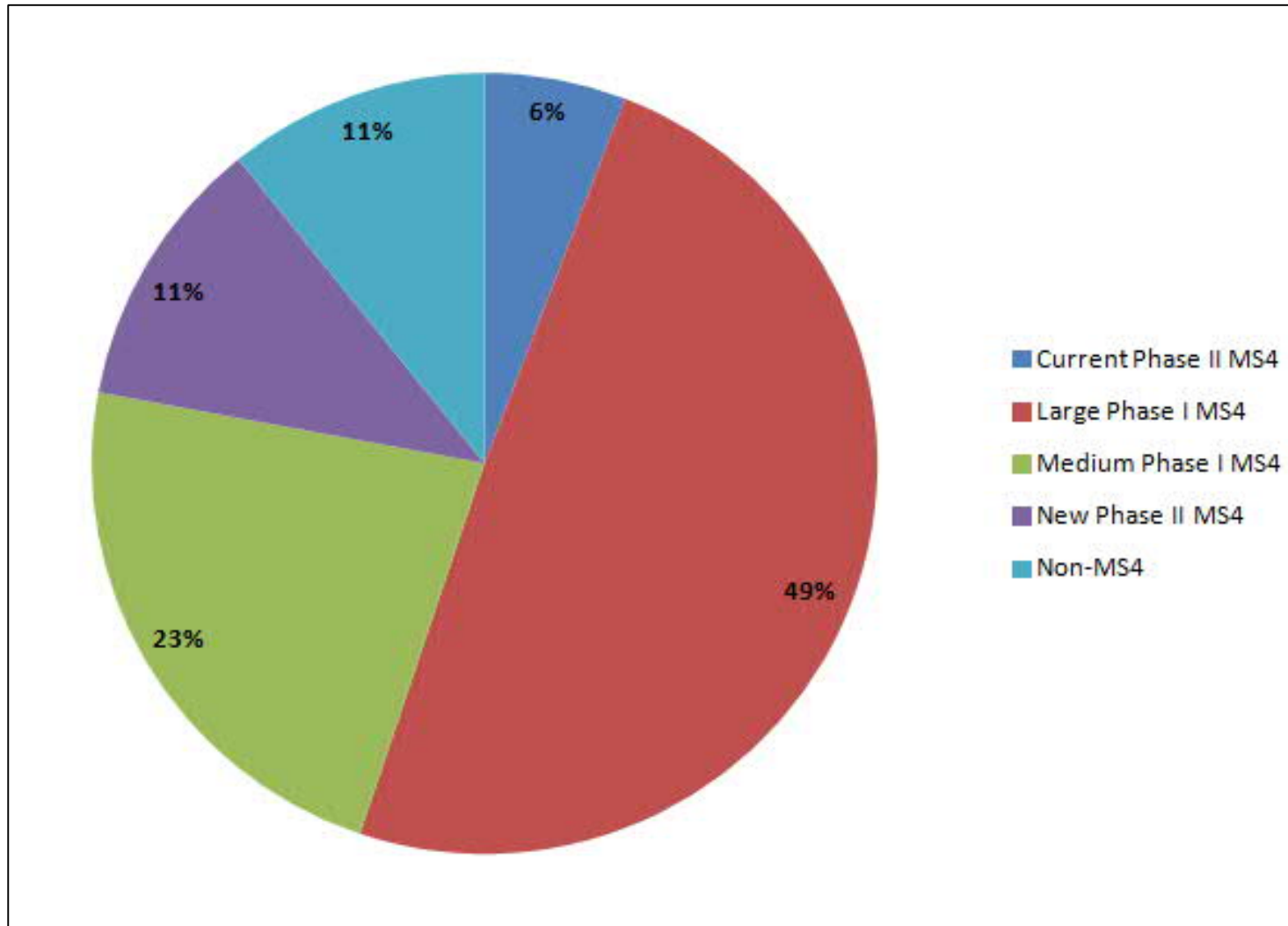
Urban Stormwater Runoff From Older Areas Is One Of Our Most Significant Challenges



- pre-1985
- 1985-2002
- 2002-2013



Impervious Area Distribution Across Maryland





Calculating Impervious Acre Restoration Requirements

- Baseline Impervious Acres in 2002
- Restoration requirement = 20% of baseline
- Restoration BMPs are required to provide a minimum management of the full WQv or 1 inch of rainfall (PE=1.0 inch)

Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated

Guidance for
National Pollutant Discharge Elimination
System Stormwater Permits

August 2014



Department of the Environment

1800 Washington Boulevard | Baltimore, MD 21230-1718 | www.mde.maryland.gov
410-537-3000 | 800-633-6101 | TTY Users 800-735-2258
Martin O'Malley, Governor | Anthony G. Brown, Lt. Governor | Robert M. Summers, Ph.D., Secretary

Table 3.E. Alternative Urban BMPs

	Notes	Efficiency Per Acre			Impervious Acre Equivalent
		TN	TP	TSS	
Mechanical Street Sweeping	High density urban areas where sweeping occurs 2x/month	4%	4%	10%	0.07
Regen/Vacuum Street Sweeping	High density urban areas where sweeping occurs 2x/month	5%	6%	25%	0.13
Reforestation on Pervious Urban	Survival rate of 100 trees/acre or greater; at least 50% of trees have two inch diameter or greater (4.5 ft. above ground)	66%	77%	57%	0.38
Impervious Urban to Pervious	Remove pavement and provide vegetative cover for 95% of area	13%	72%	84%	0.75
Impervious Urban to Forest	Survival rate of 100 trees/acre or greater; at least 50% of trees have two inch diameter or greater (4.5 ft. above ground)	71%	94%	93%	1.00
Regenerative Step Pool Storm Conveyance (SPSC) ¹	Located in dry or ephemeral channels; nutrient removal and impervious area credit is based on runoff depth treated	57%	66%	70%	1.00
		Lbs Reduced / Ton			Impervious Acre Equivalent
		TN	TP	TSS	
Catch Basin Cleaning	High density urban areas; storm drains are routinely maintained	3.5	1.4	420	0.40
Storm Drain Vacuuming	High density urban areas; storm drains are routinely maintained	3.5	1.4	420	0.40
Mechanical Street Sweeping	High density urban areas where sweeping occurs 2x/month	3.5	1.4	420	0.40
Regen/Vacuum Street Sweeping	High density urban areas where sweeping occurs 2x/month	3.5	1.4	420	0.40
		Lbs Reduced / Linear Ft			Impervious Acre Equivalent
		TN	TP	TSS	
Stream Restoration: load reductions shown for interim rate	Schueler and Stack (2014) specify qualifying conditions and protocols to calculate individual load reductions per project	0.075	0.068	248	0.01
Outfall Stabilization	Stabilization or repair of localized areas of erosion below a storm drain outfall; max credit is 2 acres per project	n/a	n/a	n/a	0.01
Shoreline Management	Revised protocols are pending CBP approval	0.16	0.11	451	0.04
		Lbs Reduced / Unit			Impervious Acre Equivalent
		TN	TP	TSS	
Septic Pumping	Pumping system is maintained and verified for annual credit	0 ²	0	0	0.03
Septic Denitrification	Permanent credit for installing enhanced septic denitrification	0 ²	0	0	0.26
Septic Connections to WWTP	Permanent credit for septic system connected to a WWTP	0 ²	0	0	0.39

1. Efficiencies and impervious acre equivalents shown are based on treating 1 inch of rainfall. When less than 1 inch of rainfall is treated, then refer to Table 2 for impervious acre equivalent and Table 6 for nutrient and sediment removal efficiencies.
2. Actual load reductions shall be reported through local health department. Septic system credits only apply to impervious acre requirements.



Calculating Impervious Acre Restoration Requirements

- Alternative practices are given an impervious acre equivalent
- BMP efficiencies are approved by the Chesapeake Bay Urban Stormwater Workgroup
- Urban impervious nutrient loads are based on a statewide average:
 - 10.85 lbs/acre/yr TN
 - 2.04 lbs/acre/yr TP
 - 0.46 tons/acre/yr TSS

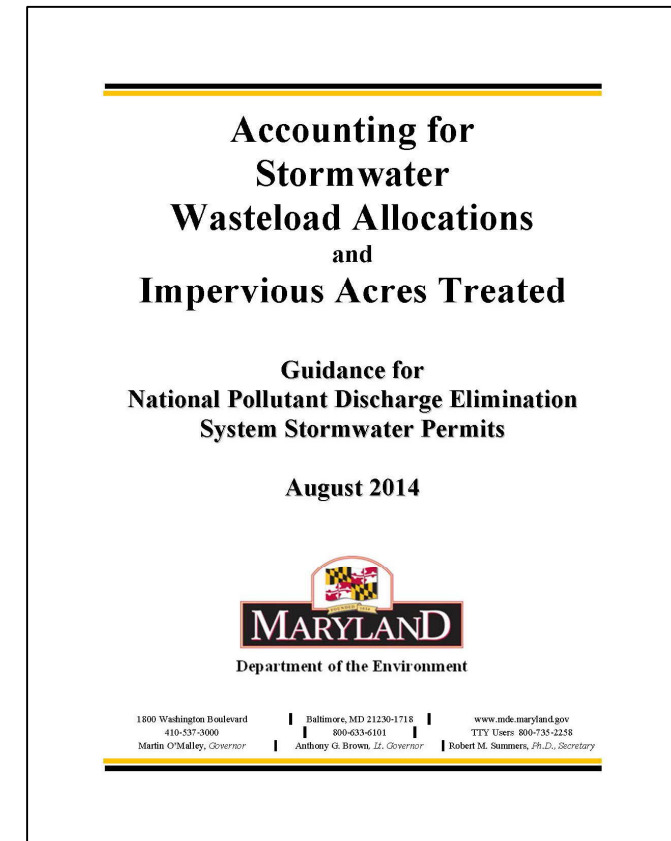


Table D.1 Pollutant Loads for Impervious and Forest Cover

Parameter	Impervious (lbs/acre/yr)	Forest (lbs/acre/yr)	Delta (lbs/acre/yr)
TN	10.85	3.16	7.69
TP	2.04	0.13	1.91
TSS (tons)	0.46	0.03	0.43

Source: CBWM version 5.3.0, Maryland statewide average urban loading rates ~~without BMPs provided~~ by the Science Services Administration, MDE, 2011.

Table D.2 Estimated Pollutant Load Reductions from Mechanical Street Sweeping

Parameter	Implementation Units	Urban Impervious (lbs/acre/yr)	Reduction Efficiency	Pollutant Load Reduction (lbs/acre/yr)
TN	1 acre	10.85	4%	0.43
TP	1 acre	2.04	4%	0.08
TSS (tons)	1 acre	0.46	10%	0.05

Table D.3 Equivalent Impervious Acre Analyses for Street Sweeping

Parameter	Implementation Units	Treatment Delta (lbs)	BMP Load Reduction (lbs)	Impervious Acre Conversion Factor
TN	1 acre	7.69	0.43	0.06
TP	1 acre	1.91	0.08	0.04
TSS (tons)	1 acre	0.43	0.05	0.12
Average for Nutrients and Sediment:				0.07



NPDES MS4 Permits Impervious Surface Restoration

- Phase I Permit requires restoration of 20% of impervious area not currently managed to the MEP. This equates to a total of 35,274 impervious acres.
- The Phase II permit will require a similar restoration effort. This equates to an estimated 9,000 impervious acres.



NPDES MS4 Permits Impervious Surface Restoration

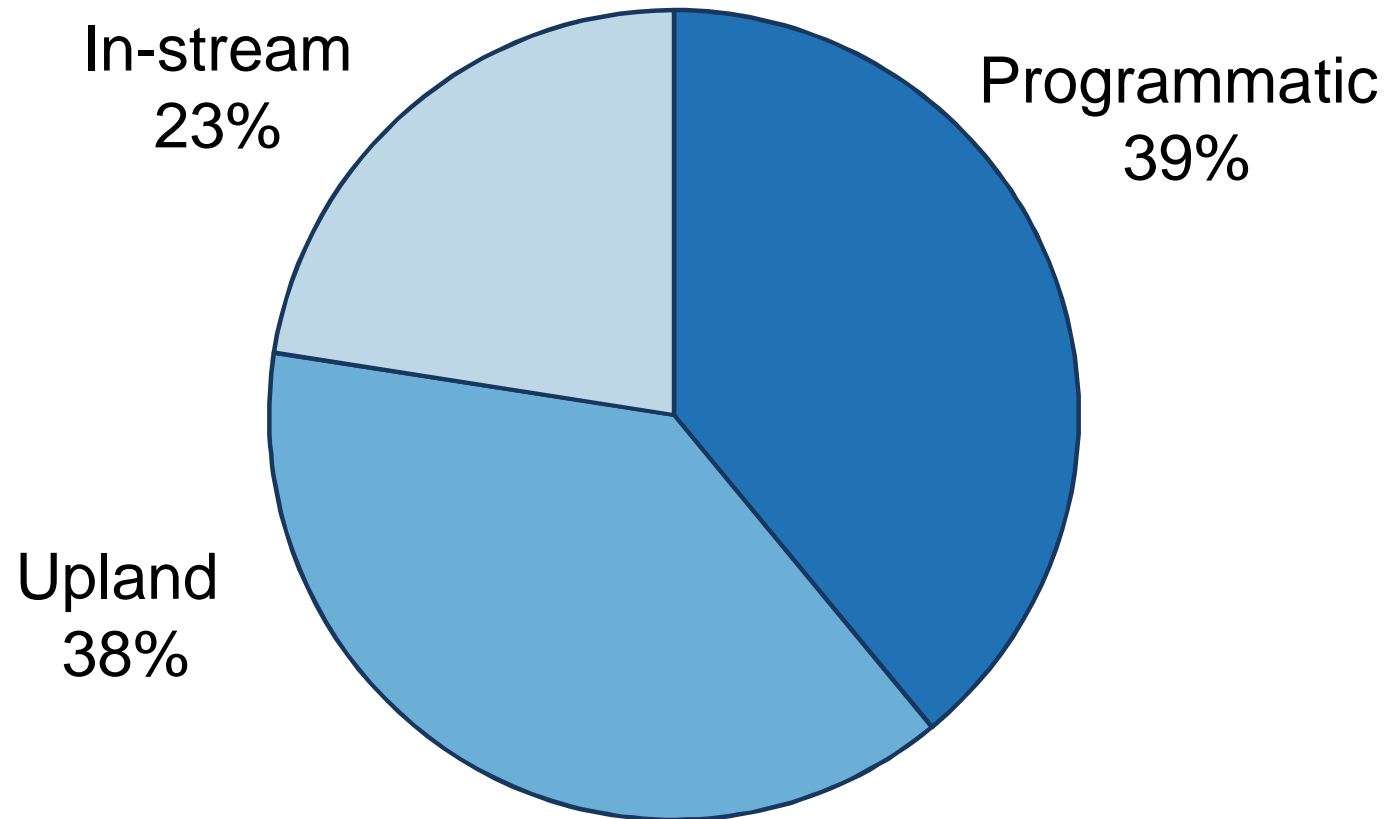
- Phase I jurisdictions have restored 10,549 impervious acres or (30%)
- \$1.1 billion projected to be spent by the Phase I MS4 jurisdictions
- Average cost range of \$24,000-\$42,000 per acre
- \$216 million - \$378 million projected to be spent by Phase II MS4 permittees



NPDES MS4 Phase I Permits – Impervious Surface Restoration*			
Jurisdiction	Impervious Acres Requiring Restoration	Impervious Acres Restored (as of 2016)	Restoration Requirement Met (as of end of 2016)
Montgomery County	3,761	1,918	51%
Baltimore County	6,144	983	16%
Baltimore City	4,314	3,624	84%
Prince George's County	5,625	225	4%
Anne Arundel County	5,700	912	16%
Howard County	2,448	1,028	42%
Charles County	1,488	253	17%
Carroll County	2,043	1,328	65%
Frederick County	1,006	161	16%
Harford County	2,265	453	20%
TOTAL	34,794	10,885	31%

*Based on 2017 Financial Assurance Plan Report and Annual Permit Reporting

Completed and Projected Stormwater BMP Retrofits



Source: 2017 Financial Assurance Plans



Carroll County, Double Pipe Creek Tree Planting

Description: 10.5 acres of trees on 12 private properties

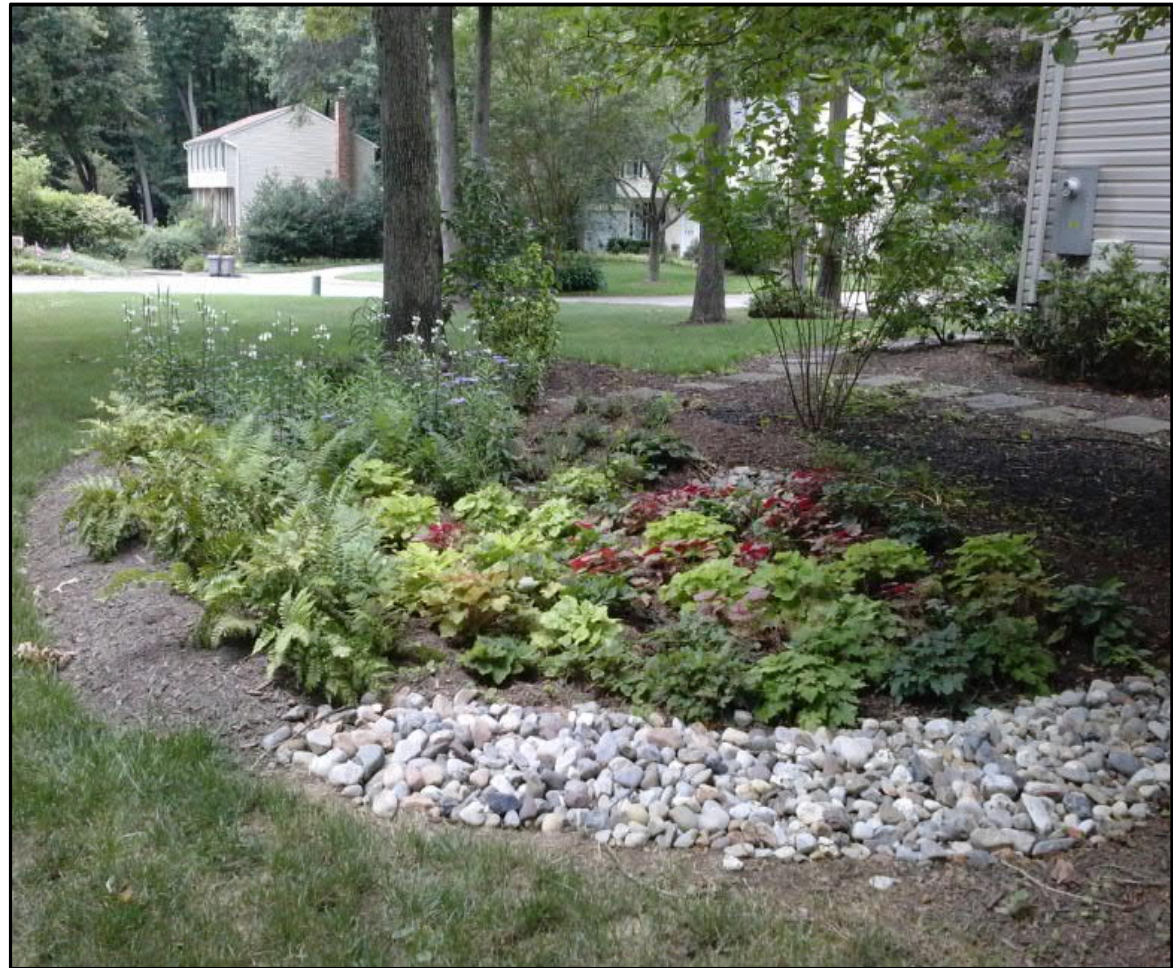
Cost: \$63,898

Impervious Acre Credit: 3.5 impervious acres

Cost per acre credit: \$18,257 per acre.



www.cleanwaterhoward.com



Howard County, Homeowner Rain Gardens

Description: The CleanScapes program is a homeowner partnership project. County estimates that 40% of its impervious surface is on residential properties.

Cost: \$5,800 on average

Impervious Acre Credit: 2.8 acres treated on 150 properties



Montgomery County , Green Roof

Description: Built in 2012, the BMPs at the White Oak Community Recreational Center, an eco-friendly LEED certified facility, include a green roof, include permeable pavement and a sand-filter. These BMPs are used as an educational tool for visitors.

Impervious Acre Credit: 0.44 impervious acres



Anne Arundel County, Step Pool Conveyance

Description: Under a pay-for-performance contract, Anne Arundel County is installing step pool conveyance systems to provide treatment of runoff while converting surface stormwater flow to shallow groundwater flow.

Cost: Recent trends show cost of construction has been reduced by 40%



MdTA I-95, Bioswales

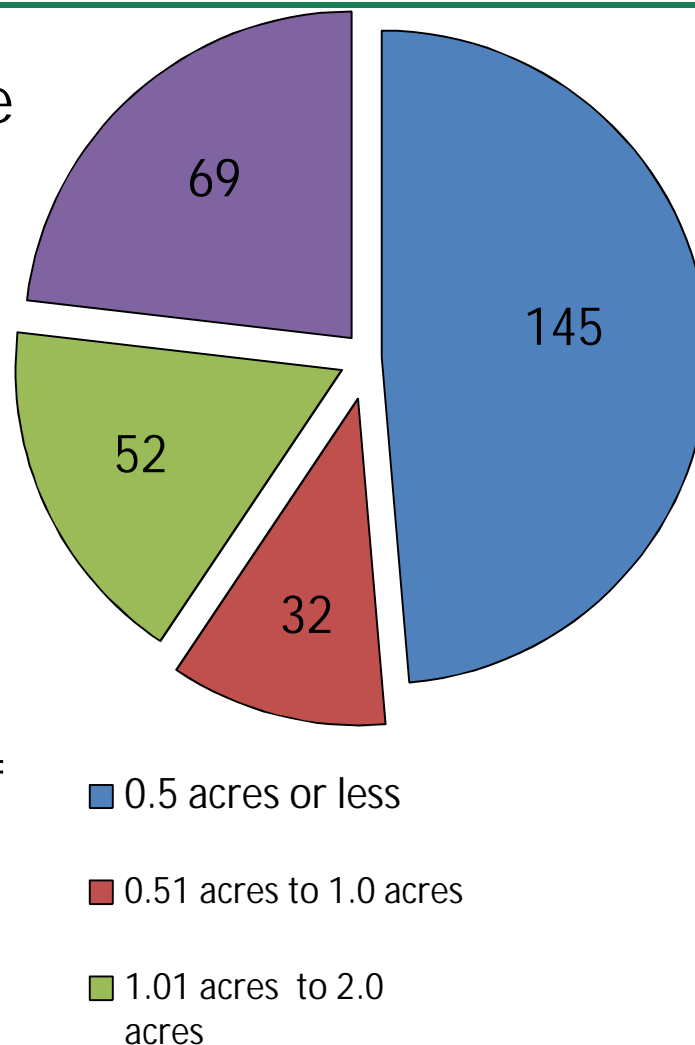
Description: MdTA is a Phase II NPDES MS4. To meet its upcoming 20% impervious area restoration requirement, MdTA has installed 8 modified bioswales in the medians along I-95 north of Baltimore. Each BMP will provide water quality treatment of 1 inch of runoff from untreated paved areas. MdTA uses a lowland seed mix in their bioswales to improve salt intolerance and to address for heat and drought conditions.

Impervious Acre Credit: 5.65 acres



Industrial Stormwater 12-SW Permits

- 298 Industrial 12-SW permits with the 20% impervious area restoration requirement
- Industrial sites over 5 acres located within a NPDES MS4 Phase I or Phase II jurisdiction
- Estimated total of 431.27 impervious acres required to be managed
- Average facility restoration required = 1.45 impervious acres
- Impervious acre treatment cost estimates range from \$23K to \$335K





Industrial NPDES, Micro-bioretention

Description: A Phase II permittee has used precast micro-bioretention planter boxes to retrofit existing paved areas

Impervious Acre Credit: 0.45 acres

Cost: \$19,250 per box; \$79,250 total

Cost per Acre

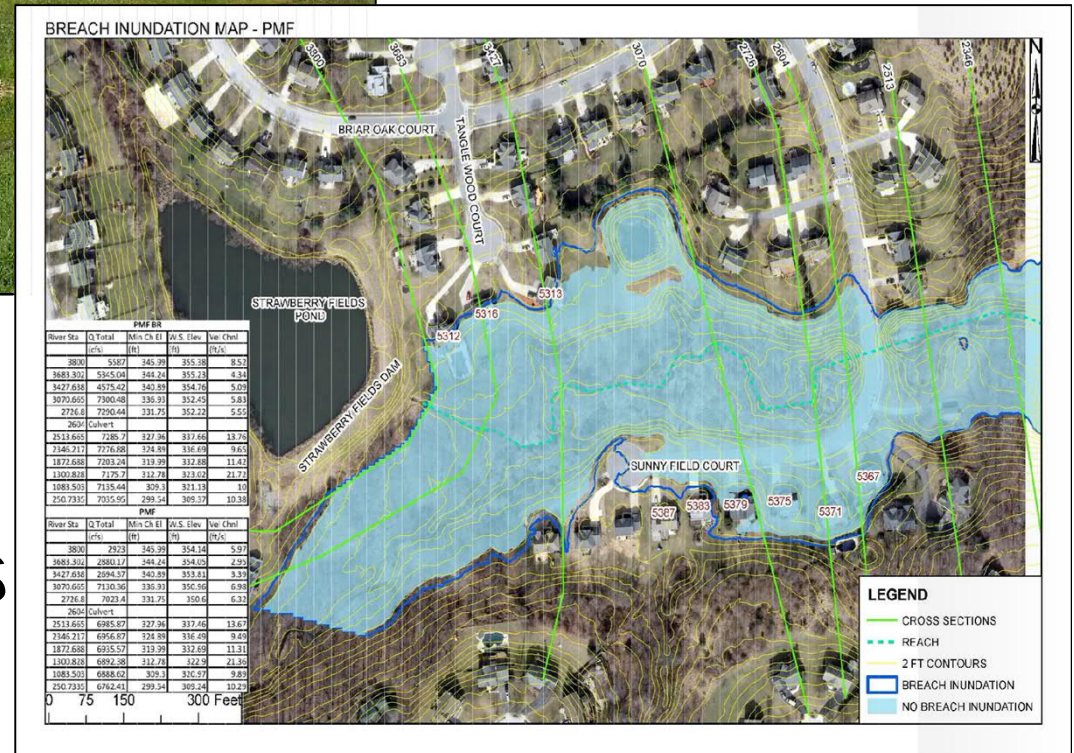
Credit:

\$42,780/\$176,000



Road Blocks and Issues

- High cost and limited opportunities for constructing SW BMP retrofits
- Permitting Delays
- Access to Private Property
- Limited Available Sites
- Limited Availability of Designers and Construction Contractors
- Public Acceptance

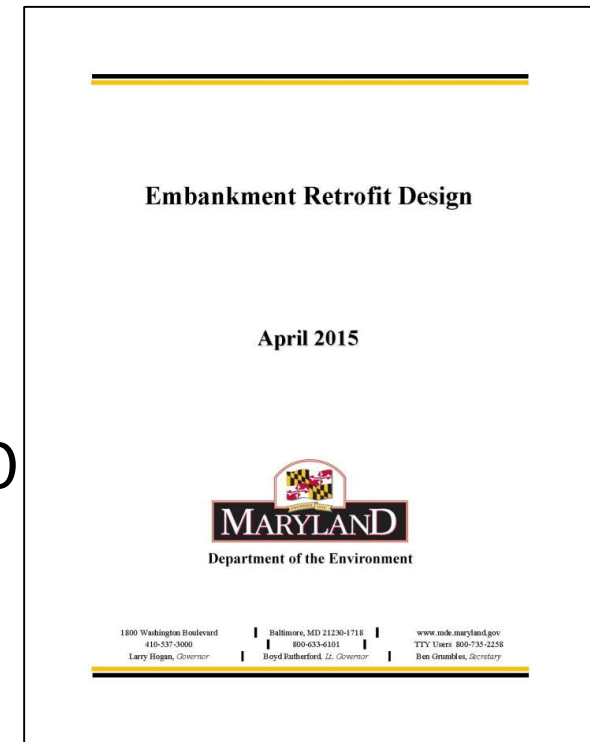


- Hazard Creep
- Incorrect Hazard Class
- Inadequate Design
- Inadequate Construction



Pond Retrofit Guidance

- Pond Retrofit Guidance
- Guidance and Checklist for Dam Breach Analysis for Small Ponds
- Small Pond Code 378 Workshop

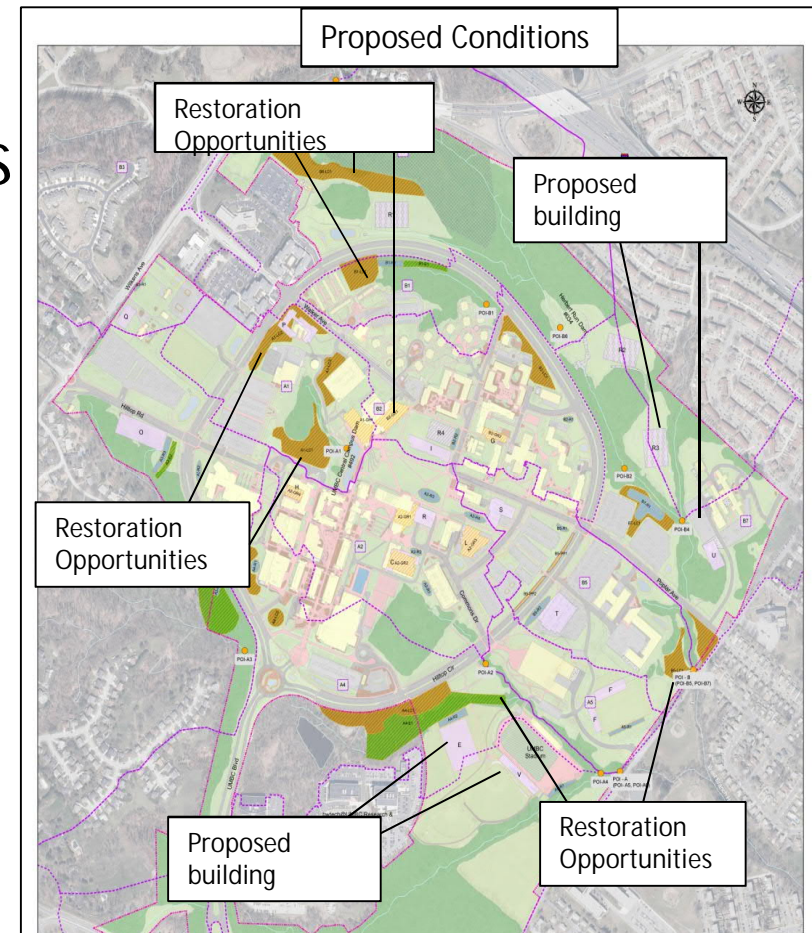


<http://mde.maryland.gov/programs/Water/StormwaterManagementProgram/Pages/index.aspx>



Innovative Solutions

- New BMPs and Incentivizing Green Infrastructure
- New Crediting Protocols
- Institutional Management Plans



STORMWATER MANAGEMENT OPPORTUNITIES	IMPERVIOUS ACRES TREATED
EXISTING RETROFITS	
18 BMP Retrofits	21
NEW DEVELOPMENT BMPS	
7 Green Roof	2.21
4 Reaches of Ecological Restoration	27.75
11 Landscape Conversions	4.62
7 Permeable Pavement areas	0.53
TOTAL	56.11

From: UMBC , Campus Stormwater Institutional Management Plan , 2016 .
 Prepared by: Biohabitats, Inc. and RK&K



Next Steps

- Nutrient Trading Regulations
- Chesapeake Bay TMDL WIP III
- Next generation permits

A scenic view of a river flowing through a forest with autumn foliage. The river is the central focus, with water flowing over rocks and creating small rapids. The surrounding trees are in various stages of autumn, with some showing vibrant reds and oranges, while others are still green. The lighting is soft, suggesting an overcast day or late afternoon. The overall mood is peaceful and natural.

QUESTIONS?

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Sediment, Stormwater, & Dam Safety
Program
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