

Tree Planting
TMDL Crediting and MS4 Compliance in Maryland

Susanna Brellis, Project Scientist, KCI Technologies, Inc.

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WE'VE ENGINEERED IS OUR TEAM

	Impervious Surface Reduction	Pollutant Load Reduction
Current Permit	MDE Guidance, August 2014 (Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated)	MAST/ Chesapeake Bay Phase 5.3.2 Model
New Permit	New MDE Guidance, 2019 (not yet released)	CAST/ Chesapeake Bay Phase 6.0 Model

Impervious Credit- 2014 MDE Guidance

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
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Catch Basin Cleaning	High density urban areas; storm drains are routinely maintained	3.5	1.4	420	0.40
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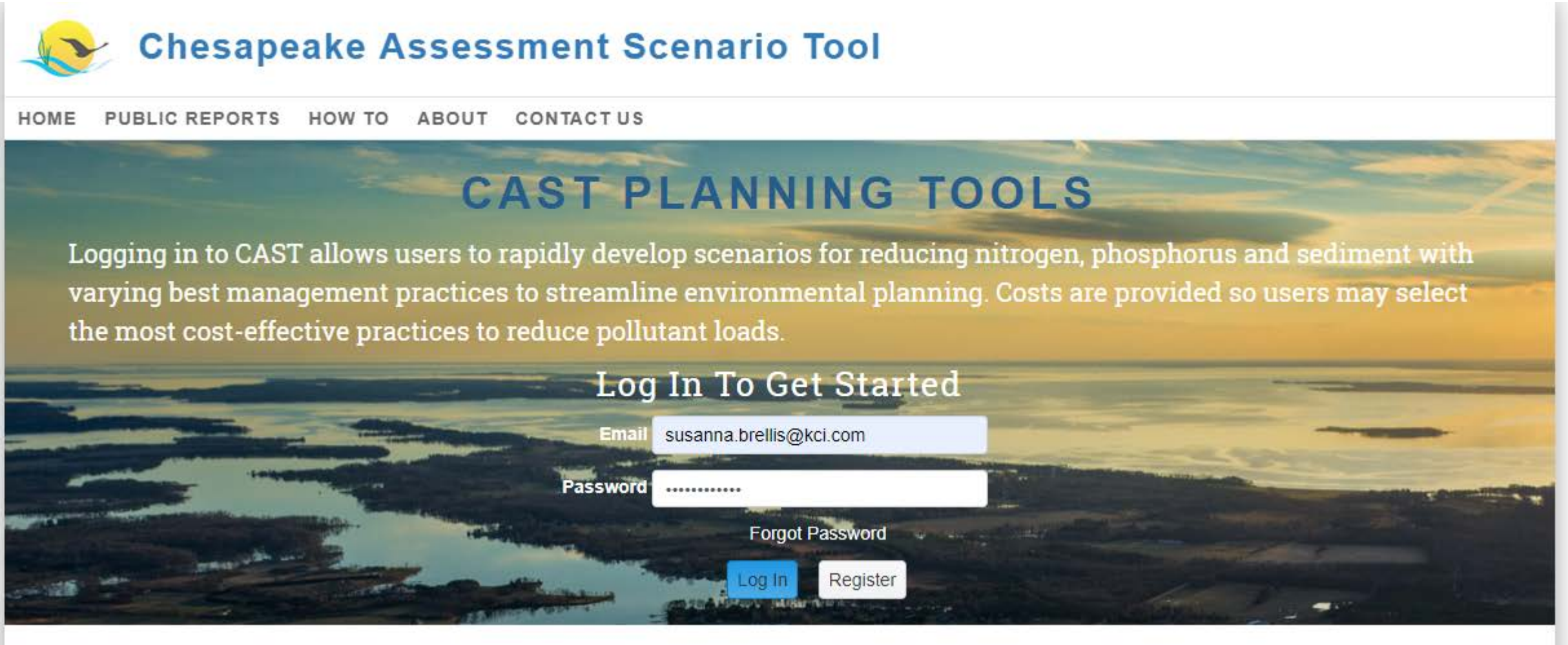
Stream Restoration: load reductions for interim rate[2]	Schueler and Stack (2014) specify qualifying conditions and protocols to calculate individual load reductions per project	0.075	0.068	15/45	0.01
Outfall Stabilization	Stabilization or repair of localized areas of erosion below a storm drain outfall; max credit is 2 acres per project	n/a	n/a	n/a	0.01
Shoreline Management [3]	Revised protocols are pending CBP approval	0.075	0.068	137	0.04
		Lbs Reduced / Unit			Impervious Acre Equivalent
		TN	TP	TSS	
Septic Pumping	Pumping system is maintained and verified for annual credit	0[4]	0	0	0.03
Septic Denitrification	Permanent credit for installing enhanced septic denitrification	0[4]	0	0	0.26
Septic Connections to WWTP	Permanent credit for septic system connected to a WWTP	0[4]	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. Load reductions are based on current proposal under consideration by CBP. TSS is based on coastal plain and non-coastal plain applications. (Refer to Appendix E, Stream Restoration).
3. Load reductions are based on current proposal under consideration by CBP based on Drescher and Stack (2014). (Refer to Appendix E, Shoreline Management).
4. Actual load reductions shall be reported through local health department. Septic system credits only apply to impervious acre requirements.

Source: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated MDE, August 2014


Chesapeake Assessment Scenario Tool
HOME
PUBLIC REPORTS
HOW TO
ABOUT
CONTACT US
CAST PLANNING TOOLS
Logging in to CAST allows users to rapidly develop scenarios for reducing nitrogen, phosphorus and sediment with varying best management practices to streamline environmental planning. Costs are provided so users may select the most cost-effective practices to reduce pollutant loads.
Log In To Get Started
Email
susanna.brellis@kci.com
Password
Forgot Password
Log In
Register

BMPs for crediting toward the Bay TMDL

- **Forest Buffer**: Forest buffers are linear wooded areas that help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. The recommended buffer width is 100 feet, with a 35 feet minimum width required. Enter units of acres of buffer or percent.
- **Forest Planting**: Urban forest planting includes trees planted in a contiguous area to establish forest-like conditions, with minimal mowing as needed to aid tree and understory establishment. Do not include plantings used to establish riparian forest buffers. Trees are planted on pervious areas. Enter units of acres or percent.
- **Tree Planting - Canopy**: Tree plantings on developed land (turf grass or impervious) that result in an increase in tree canopy but are not intended to result in forest-like conditions. If source data are in a count of trees, consider 300 trees equivalent to one acre. Enter units of acres or percent.

Land Use Conversions

BMP	From Land Use	To Land Use
Forest Buffer	Turf Grass	True Forest
Forest Planting	Turf Grass	True Forest
Tree Planting - Canopy	Buildings and Other	Tree Canopy over Impervious
	Roads	Tree Canopy over Impervious
	Turf Grass	Tree Canopy over Turf Grass

- Forest buffers have the additional reduction of 25% nitrogen, 50% phosphorus and 50% sediment.

Typical Reductions

BMP	TN (lbs/acre reduced)	TP (lbs/acre reduced)	TSS (lbs/acre reduced)
Forest Buffers	5.9 to 8.8	1.1 to 1.6	729 to 915
Forest Planting	4.1 to 7.3	0.8 to 1.2	381 to 451
Tree Planting - Canopy	0 to 1.8	0.03 to 0.15	18 to 223

Actual amount varies depending on location and other BMPs implemented.

The data for all BMPs is available at: http://cast.chesapeakebay.net/Documentation/DevelopPlans.

Comparison of Co-Benefits

Co-Benefits are listed that the BMP has a high impact on

Tree and Forest Planting

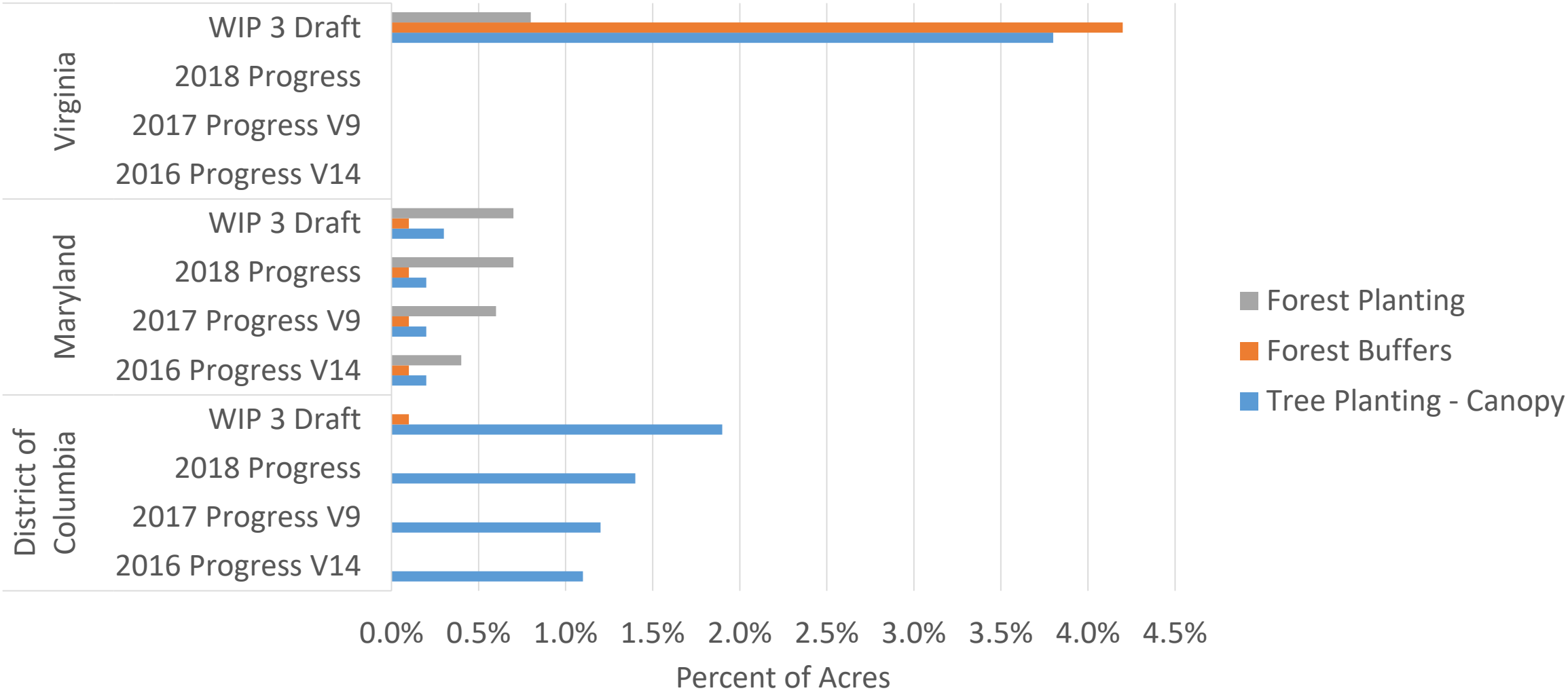
- Citizen Stewardship
- **Air Quality**
- **Energy Efficiency**
- **Groundwater Recharge/ Infiltration**

Forest Buffers

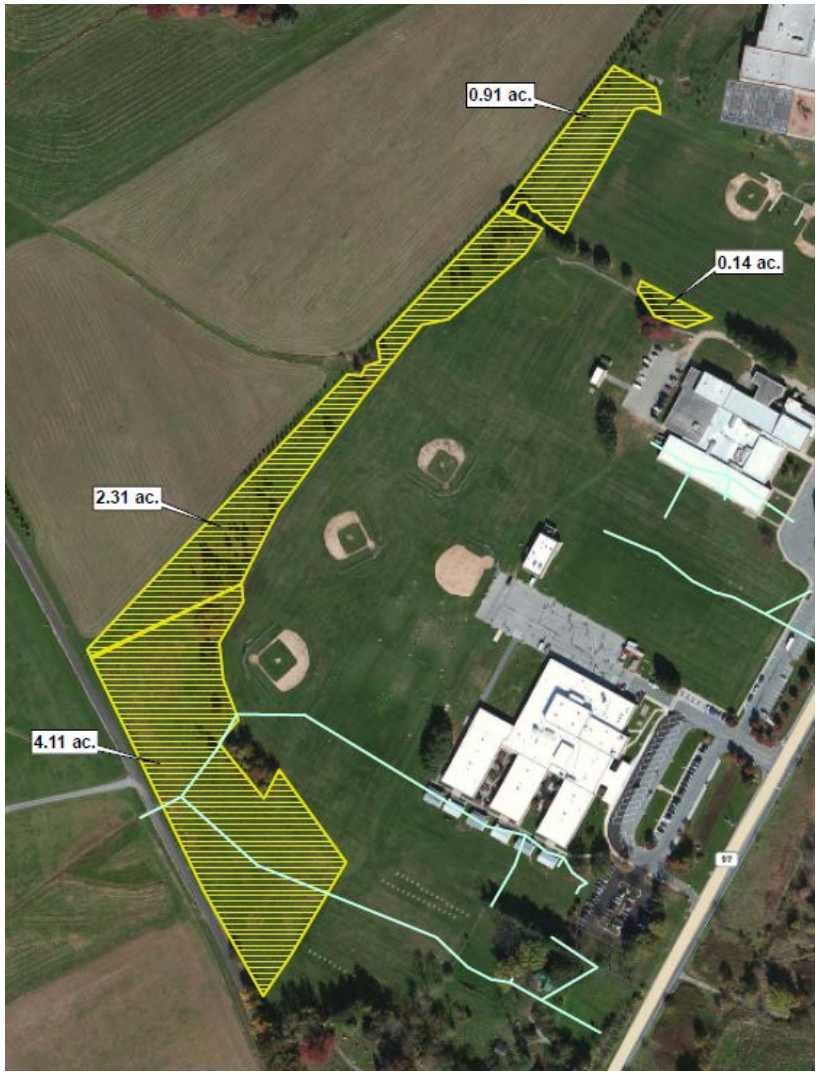
- Protected Lands
- Biodiversity and Habitat
- Brook Trout
- Stream Health
- Wetlands
- Healthy Watersheds
- Land Use Methods and Metric Development
- Fish Habitat
- **Air Quality**
- Bacteria Loads
- Climate Adaptation
- **Energy Efficiency**
- Flood Control/ Mitigation
- **Groundwater Recharge/ Infiltration**
- **Tree Canopy**

BMP Co-Benefit Impact Scores are available at: http://cast.chesapeakebay.net/Documentation/DevelopPlans

Amount of BMP credited in the DMV



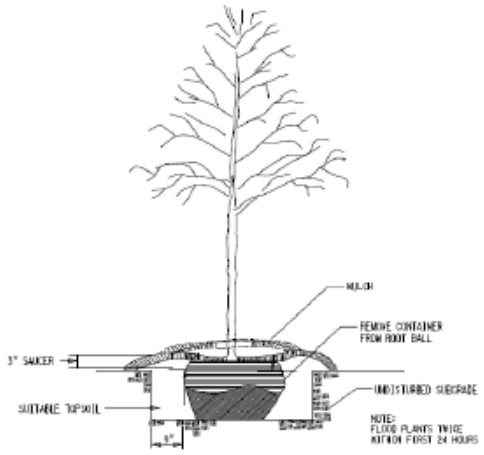
Howard County School Plantings- Students Branching Out



Howard County School Planting Plans

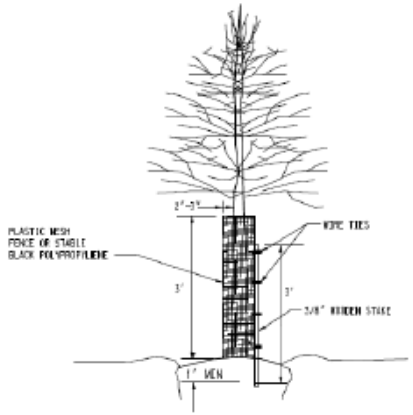
Reforestation Zone					
1.95	acres				
84,942	square feet				
384	trees				
Quantity	**Common Name**	**Botanical Name ***	**Size**	**Form**	**Spacing/ Rate**
77	northern red	*Quercus rubra*	1" caliper	container	14'-15' O.C./ 200 trees per acre
77	willow oak	*Quercus phellos*	1" caliper	container	14'-15' O.C./ 200 trees per acre
77	persimmon	*Diospyros virginiana*	1" caliper	container	14'-15' O.C./ 200 trees per acre
77	sugar maple	*Acer saccharum*	1" caliper	container	14'-15' O.C./ 200 trees per acre
76	black gum	*Nyssa sylvatica*	1" caliper	container	14'-15' O.C./ 200 trees per acre

** Selected tree species are native to Maryland.*



TREE PLANTING DETAIL

NOT TO SCALE



TREE SHELTER DETAIL

NOT TO SCALE

- Survival rate of 100 trees per acre or greater, with at least 50% of trees having a DBH of at least 2”.
- Aggregate of smaller sites may be used
- Minimum 0.25 acre sites may be aggregated

Source: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated
MDE, August 2014






Warranty Inspection

- Warranty inspection conducted within one year of planting
- Counted dead and alive trees
- Average survival was 86% across all 10 sites

Cost

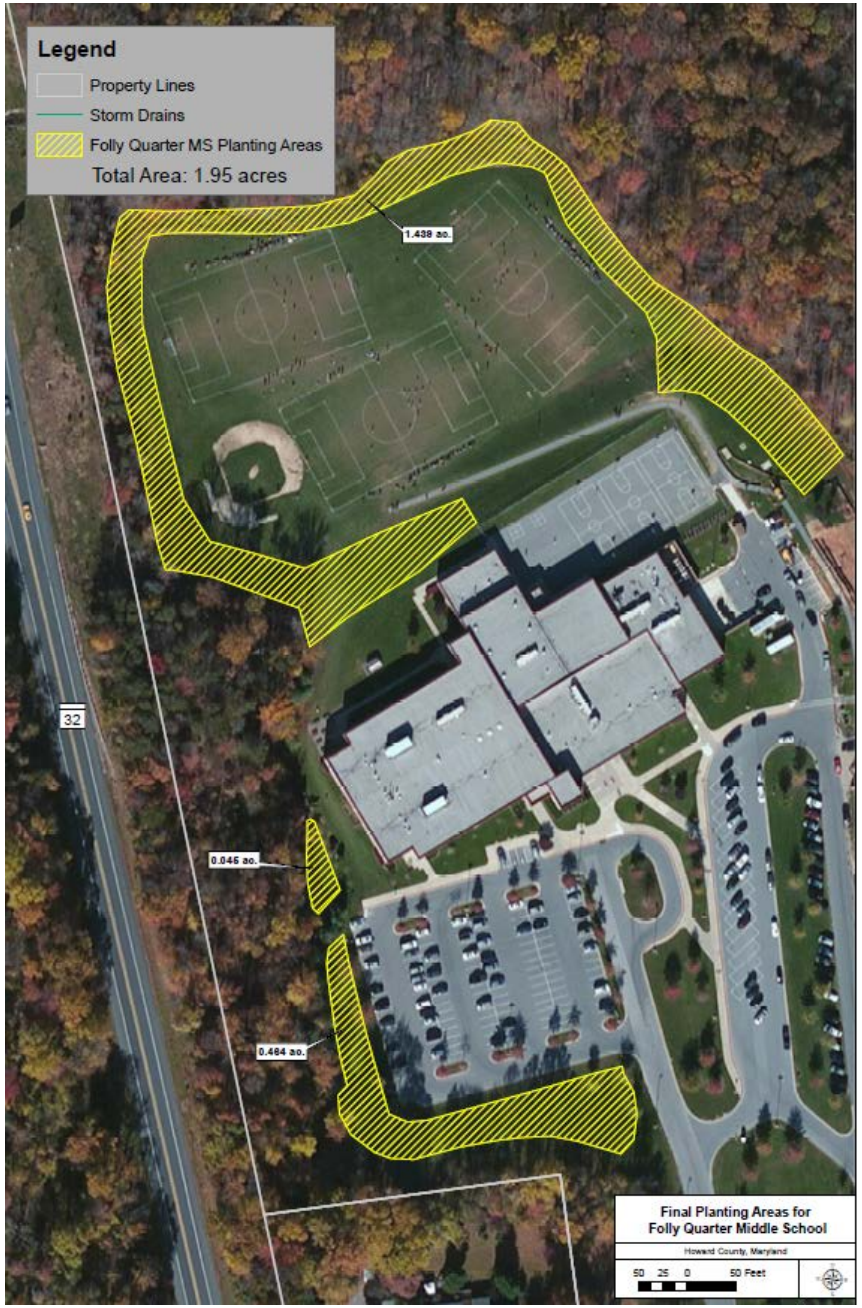
- Approximately $12,000/ acre

- 15% Primary Consultant (KCI)
  - Field Meetings Attendance
  - Planting Plan Development
  - Inspections/Planting Oversight
  - Warranty Inspection

- 85% Landscape Contractor (HTI)
  - Materials: Trees, Shelters, Mulch
  - Labor: Installation
  - Warranty Replacements, Materials + Labor

How to Model?

- **Forest Buffer**: Adjacent to stream, within ~100 feet of stream buffer.
- **Forest Planting**: Adjacent to large forest tract, or planting is large enough to establish forest-like conditions.
- **Tree Planting - Canopy**: Increasing tree canopy but is not intended to result in forest-like conditions.



Forest Planting

Tree Planting- Canopy

Forest Buffer

Impervious Credit

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4. Actual load reductions shall be reported through local health department. Septic system credits only apply to impervious acre requirements.

- 22.3 acres planted
- Reforestation on Pervious Urban = 0.38 impervious acre equivalent
- 8.5 acre credit

Source: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated MDE, August 2014

Baseline Impervious Accounting Results

	Brighton Dam	Little Patuxent	Middle Patuxent	Patapsco LNB	Patuxent Upper	Rocky Gorge Dam	S Branch Patapsco	Countywide
Impervious Baseline and Target (Impervious Credit Acres)								
Impervious Area								
Total Impervious Area	1,511.9	8,145.6	2,953.9	3,611.2	372.6	471.0	661.8	17,728.0
County MS4 Impervious Area	**743.9**	**7,057.1**	**2,187.3**	**2,929.7**	**309.8**	**311.9**	**236.0**	**13,775.7**
Impervious Baseline Treated								
1985 - 2002 Stormwater BMPs	76.3	1102.3	361.8	650.2	98.6	35.3	15.0	2,339.5
New Development	28.6	770.5	311.5	564.2	97.7	34.6	15.0	1,822.2
Redevelopment	47.7	331.8	50.3	86.0	0.9	0.7	0.0	517.4
Restoration through 6/20/2010	103.8	127.2	122.2	91.3	1.5	12.9	41.4	500.3
Stormwater BMPs	3.2	32.7	3.4	10.8	0.0	0.0	0.5	50.7
Tree Plantings	100.6	64.7	117.2	67.8	0.1	7.1	40.9	398.5
Stream Restoration	0.0	29.8	1.6	2.1	1.3	0.0	0.0	34.8
Headwater Streams and Outfalls	0.0	0.0	0.0	10.6	0.0	5.8	0.0	16.4
Outfall Stabilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHA Streams and Trees	0.0	93.0	0.1	7.4	0.0	0.0	0.0	100.6
SHA SWFAC BMPs	0.0	43.3	5.9	11.6	0.0	1.6	0.0	62.4
Rain Barrels	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2
Rooftop Disconnect	17.4	151.8	45.1	36.1	5.3	6.5	3.4	265.6
Non-Rooftop Disconnect	77.4	128.6	115.8	83.8	7.8	25.4	26.2	465.0
Impervious Baseline Treated	**274.9**	**1,646.3**	**651.0**	**880.4**	**113.2**	**81.8**	**86.0**	**3,733.6**
Impervious Baseline Untreated	**469.0**	**5,410.8**	**1,536.2**	**2,049.3**	**196.6**	**230.2**	**150.0**	**10,042.0**
20% Restoration Target								**2,008.4**

- 398.5 impervious acre credits
- Baseline: 10.7% of impervious baseline treated from tree planting projects

Source: Howard County Impervious Baseline Accounting: Revised Methodology and Results
Table 10
KCI, December 2018

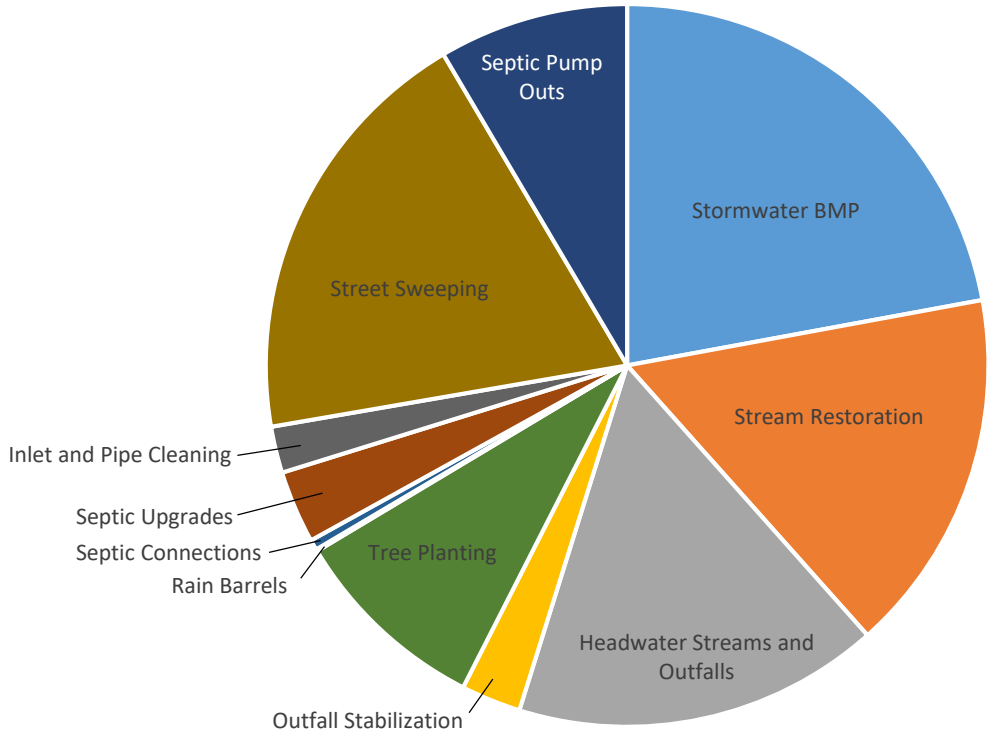
Restoration Impervious Accounting Results

	Brighton Dam	Little Patuxent	Middle Patuxent	Patapsco LNB	Patuxent Upper	Rocky Gorge Dam	S Branch Patapsco	Countywide
Impervious Baseline and Target (Impervious Credit Acres)								
Impervious Baseline Untreated								**10,042.0**
20% Restoration Target								**2,008.4**
Impervious Restoration Through FY18 Progress (Impervious Credit Acres, 6/21/2010 to 6/30/2018)								
Stormwater BMP	2.8	264.8	96.8	47.8	0.0	0.5	0.9	413.6
Stream Restoration	0.0	185.9	6.2	113.3	0.0	0.0	0.0	305.4
Headwater Streams and Outfalls	0.0	244.5	34.9	27.5	0.0	0.0	0.0	307.0
Outfall Stabilization	0.0	11.5	34.2	4.0	0.0	0.4	0.0	50.1
Tree Planting	76.0	14.8	43.0	18.6	0.0	3.4	10.8	166.8
Rain Barrels	0.1	0.8	0.2	0.3	0.0	0.0	0.0	1.6
Septic Connections	0.0	3.9	1.2	3.5	0.0	0.0	0.0	8.6
Septic Upgrades	20.0	1.6	29.4	0.8	0.0	5.2	3.9	60.8
Subtotal (permanent credits)								**1,313.9**
Impervious Restoration Annual Credit Practices as of FY18 (Impervious Credit Acres)								
Inlet and Pipe Cleaning (average back to FY17)								38.9
Street Sweeping (average back to FY11)								359.8
Septic Pump-outs (5 yr period)								158.9
Subtotal (annual credits)								**557.6**
Total Impervious Restoration FY18 Progress - All Credits (Impervious Credit Acres)								
Total Impervious Restoration								**1,871.5**
% Impervious Treated								**18.6%**
Remaining Impervious Restoration to be Complete by December 17, 2019								**136.9**

- 166.8 impervious acre credits
- FY18 Progress: 8.9% of total impervious credits from tree plantings

Source: Howard County Impervious Restoration Accounting: Revised Methodology and Results
Table 3
KCI, December 2018

Restoration Impervious Accounting Results



Maintenance and Verification

- Inspections are performed by the Department of Recreation and Parks
- Performed according to the Policies and Procedures: Restoration Tree Planting on Public and Private Lands, Inspecting Forest Conservation Easements, and Inspecting Forest Conservation Easements with GIS Tools.
- Inspections for voluntary BMPs on private property and those installed by Howard EcoWorks, formerly READY, are performed by the Office of Community Sustainability.
- Ensures that MDE standards of 100 trees/acre at least 50% at least 2 inches or greater DBH.

Questions?

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Olivia Devereux: Olivia.Devereux@kci.com

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