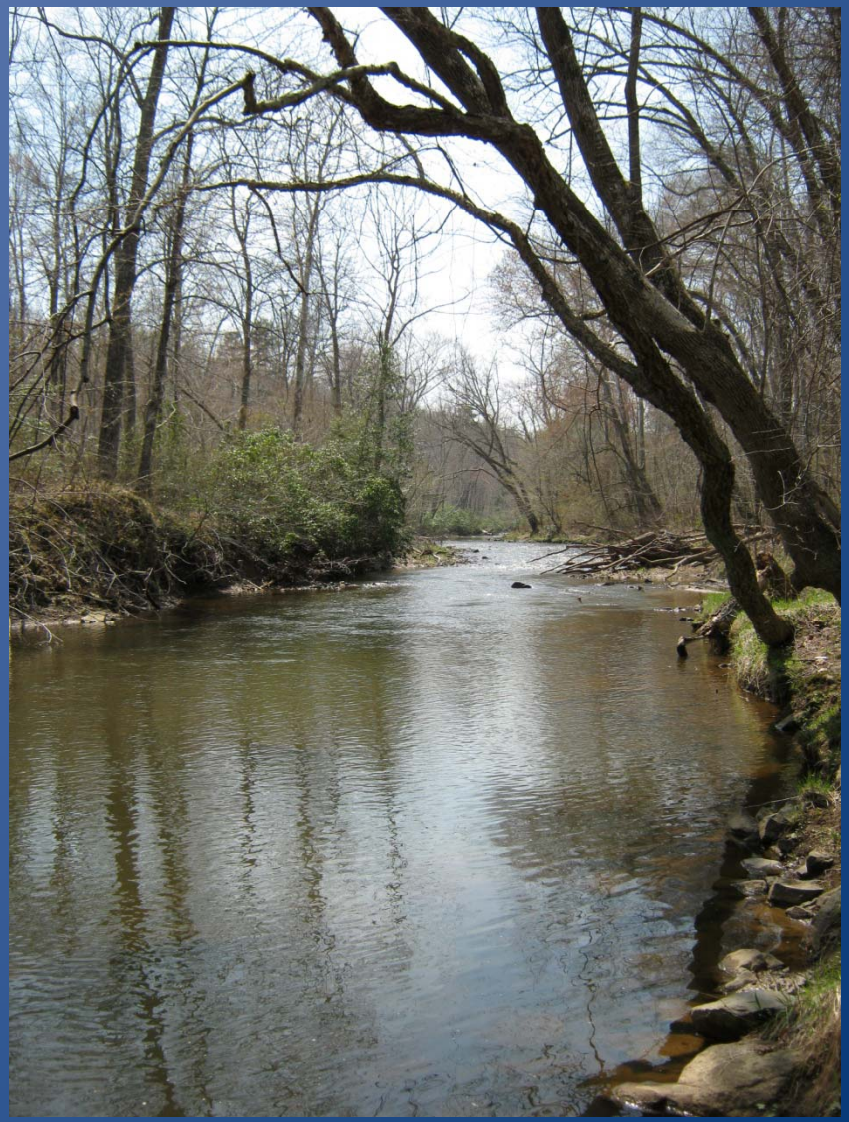
Bacteria Total Maximum Daily Load Studies for Tributaries to the Potomac River: Prince William and Stafford Counties



Final Public Meeting
February 1, 2012

Why are we here?

Portions of several tributaries to the Potomac River do not meet water quality standards.

- Who is involved in this process?
- Which tributaries are included in this study?
- How do we know the standards aren't being met?
- Why aren't the standards being met?
- What is being done to correct the problem?

Who is involved in this process?

DEQ :	Lead Agency for TMDL Development
DCR :	Partners with DEQ in TMDL Development, Lead Agency for TMDL Implementation Plan Development
Contractor:	Performs Modeling for TMDL Development (for this project, contractor is the Louis Berger Group).
TAC:	Representatives from state and local governments, watershed groups, planning district commission, soil and water conservation districts, etc. Provides technical input and information for TMDL development.
Citizens:	Any citizen who wishes to participate in the project; provide local knowledge and information.

What streams are involved in this study?

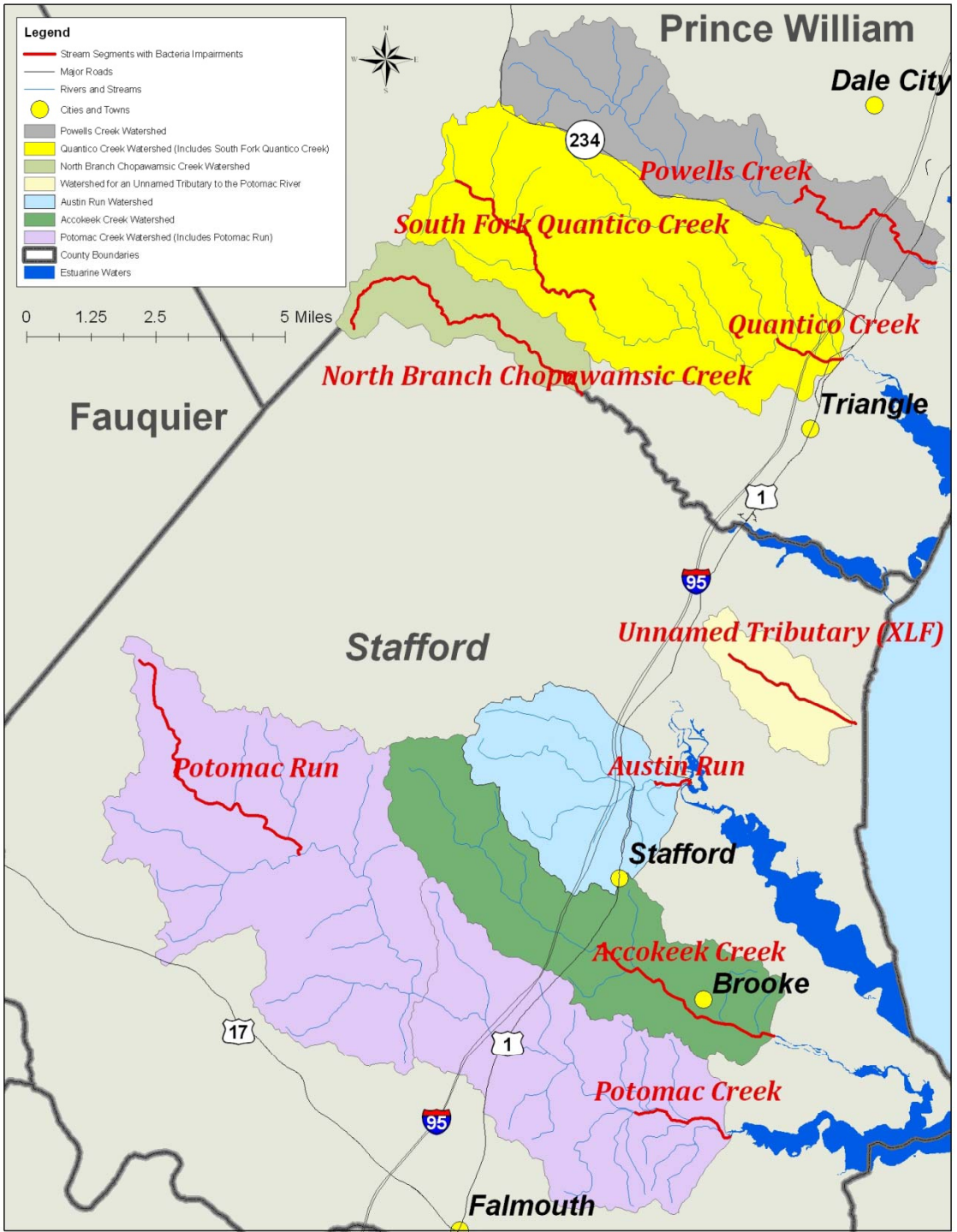
Waterbody Name *Location*	**Segment Size**	**Cause**	**Upstream Limit**	**Downstream Limit**	**DEQ Monitoring Station(s)** *Station Location*	**Year First Listed as Impaired**	**2010 Exceedance Rate**
Powells Creek *Prince William County*	4.62 miles	*E. coli*	0.2 rivermiles below Lake Montclair	End of the free-flowing waters	**1aPOW006.11** *Northgate Drive Bridge Crossing*	2006	2 of 13 samples (15.4%)
Quantico Creek *Prince William County Town of Dumfries*	1.45 miles	*E. coli*	Confluence with South Fork Quantico Creek	Start of the tidal waters of Quantico Bay.	**1aQUA004.46** *Route 1 Bridge Crossing*	2006	7 of 27 samples (25.9%)
South Fork Quantico Creek *Prince William County Town of Dumfries*	4.63 miles	*E. coli*	Headwaters of the South Fork Quantico Creek	Start of the impounded waters	**USGS Station** *1658500*	2004	7 of 47 samples (14.9%)
North Branch Chopawamsic Creek *Stafford County Prince William County*	6.9 miles	*E. coli*	Headwaters of North Branch Chopawamsic Creek	Confluence with Middle Branch	**USGS Station** *165900*	2004	2 of 17 samples (11.7%)
Unnamed Tributary to the Potomac River *Stafford County*	2.9 miles	*E. coli*	Headwaters of the unnamed tributary	Confluence with the Potomac River	**1aXLF000.13** *Route 633 Bridge Crossing*	2010	2 of 11 samples (18.2%)

What streams are involved in this study?

Waterbody Name *Location*	**Segment Size**	**Cause**	**Upstream Limit**	**Downstream Limit**	**DEQ Monitoring Station(s)** *Station Location*	**Year First Listed as Impaired**	**2010 Exceedance Rate**
Austin Run *Stafford County*	0.79 miles	*E. coli*	Confluence with an unnamed tributary (streamcode XGQ)	Confluence with Aquia Creek	**1aAUS000.49** *End of Aquia Drive*	2010	2 of 10 samples (20.0%)
Accokeek Creek *Stafford County*	4.21 miles	*E. coli*	Confluence with an unnamed tributary	End of the free-flowing waters	**1aACC006.13** *Route 608 Bridge Crossing*	2006	4 of 23 samples (17.4%)
Potomac Creek *Stafford County*	2.18 miles	*E. coli*	Railroad crossing at the west end of swamp, upstream from Route 608	Downstream until the east end of swamp	**1aPOM006.72** Route 608 Bridge Crossing	2006	4 of 13 samples (30.8%)
Potomac Run *Stafford County*	6.13 miles	*E. coli*	Headwaters of Potomac Run	Confluence with Long Branch	**1aPOR000.40** (Route 648 Bridge Crossing)	2006	10 of 13 samples (76.9%)

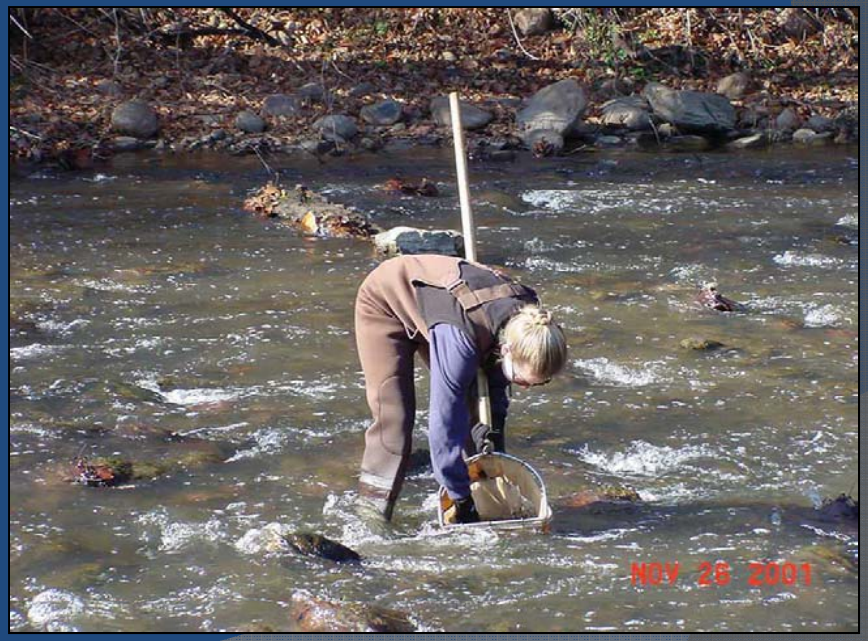
TMDL Watersheds:

- Powells Creek
- Quantico Creek
- South Fork Quantico Creek
- North Branch Chopawamsic Creek
- Unnamed Tributary to the Potomac River
- Austin Run
- Accokeek Creek
- Potomac Creek
- Potomac Run



How do we know if water bodies in Virginia are healthy?

- Perform physical and chemical monitoring on water bodies throughout the state.
- Monitor parameters such as:
  - pH
  - Temperature
  - Dissolved Oxygen
  - Biological Community
  - Bacteria
  - Nutrients
  - Fish Tissues
  - Metals/Toxic Pollutants



What does DEQ do with the monitoring data that is collected?

Compare the data collected to the water quality standards.

Water Quality Standards:

- Regulations based on federal and state law.
- Set numeric and narrative limits on pollutants.
- Consist of designated use(s) and water quality criteria to protect the designated uses.

Designated Uses

- Recreational
- Public Water Supply
- Wildlife
- Fish Consumption
- Shellfish
- Aquatic Life

The attainment of the recreational use is evaluated by testing for the presence of E. coli bacteria in freshwater systems.

Recreational Use Impairment:
Fecal Coliform and *E. coli*

Fecal Coliform:

- Found in the digestive tract of humans and warm blooded animals
- Indicator of the potential presence of pathogens in water bodies

Escherichia coli:

- Subset of fecal coliform bacteria
- Correlate better with swimming associated illness in freshwater

Indicator	Geometric Mean Criterion (cfu/100mL)	Maximum Assessment Criterion (cfu/100mL)
E. coli	126	235

- *Geometric Means are calculated using all data collected during any calendar month with a minimum of four weekly samples.*
- *If there are insufficient data to calculate a monthly geometric mean, no more than 10% of the total samples in the assessment period should exceed 235 cfu/100 ml of E. coli in freshwater.*

Potential Sources of *E. coli* Bacteria

What happens when a water body doesn't meet water quality standards?

- Waterbody is listed as "impaired" and placed on the 303(d) list.
- Once a water body is listed as impaired, a Total Maximum Daily Load value must be developed for that impaired stream segment to address the designated use impairment.
- TMDL Studies are required by law:
  - 1972 Clean Water Act (CWA)
  - 1997 Water Quality Monitoring Information and Restoration Act (WQMIRA)

What is a TMDL ?
Total Maximum Daily Load

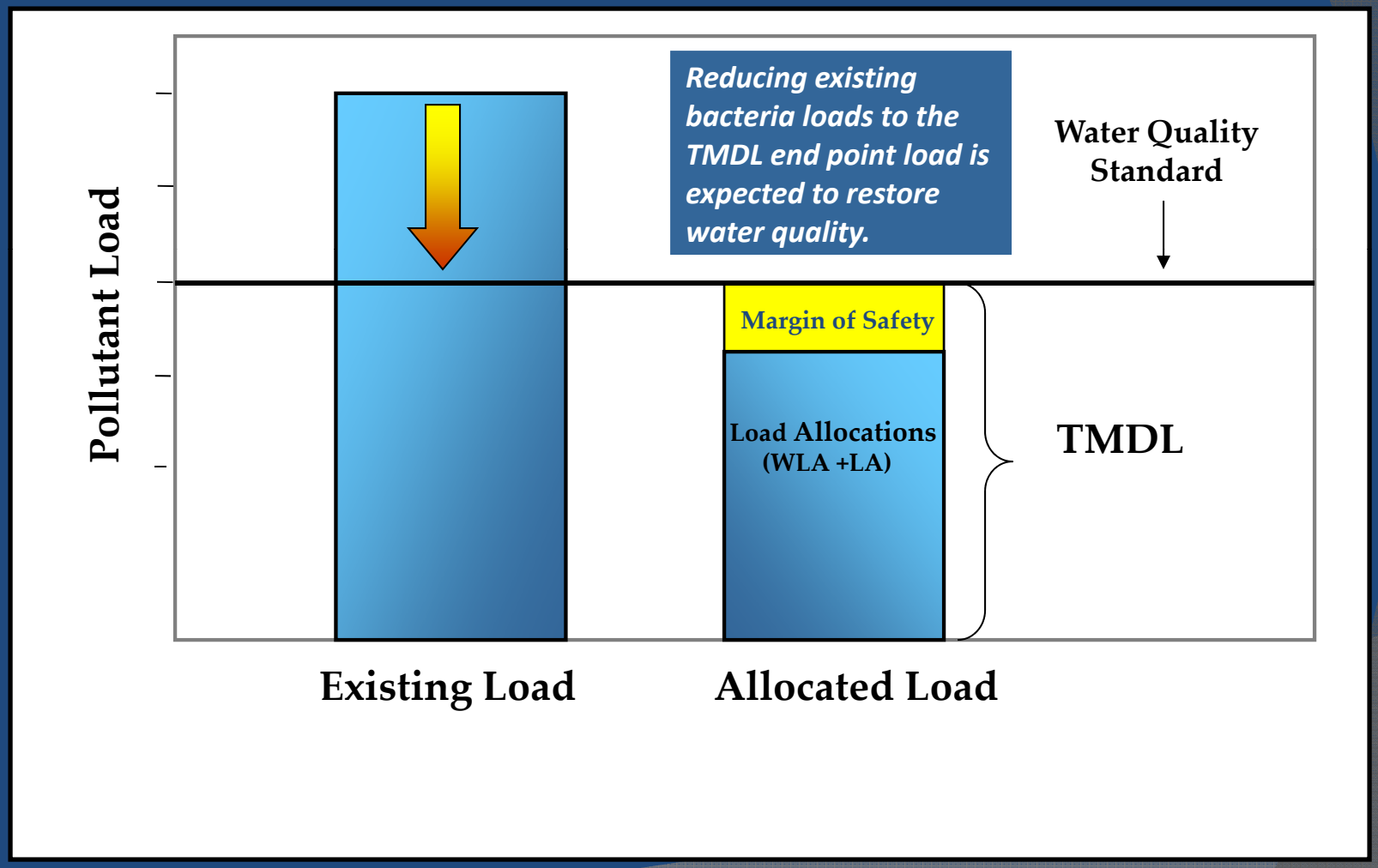
TMDL = Sum of WLA + Sum of LA + MOS

Where:

TMDL	**=**	**Total Maximum Daily Load**
WLA	**=**	**Waste Load Allocation (point sources)**
LA	**=**	**Load Allocation (nonpoint sources)**
MOS	**=**	**Margin of Safety**

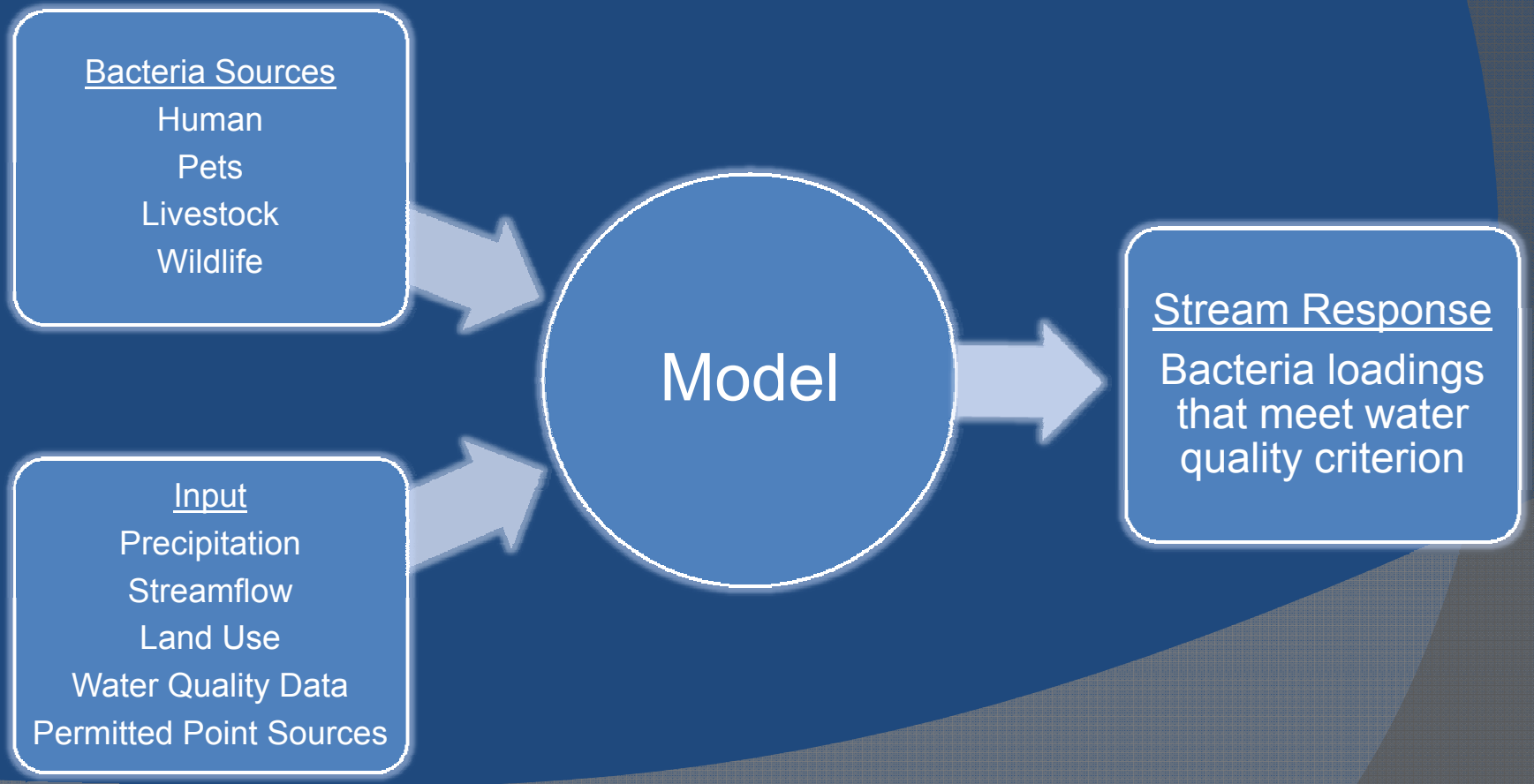
A TMDL is the maximum amount of a pollutant a water body can receive and still meet water quality standards.

An Example TMDL



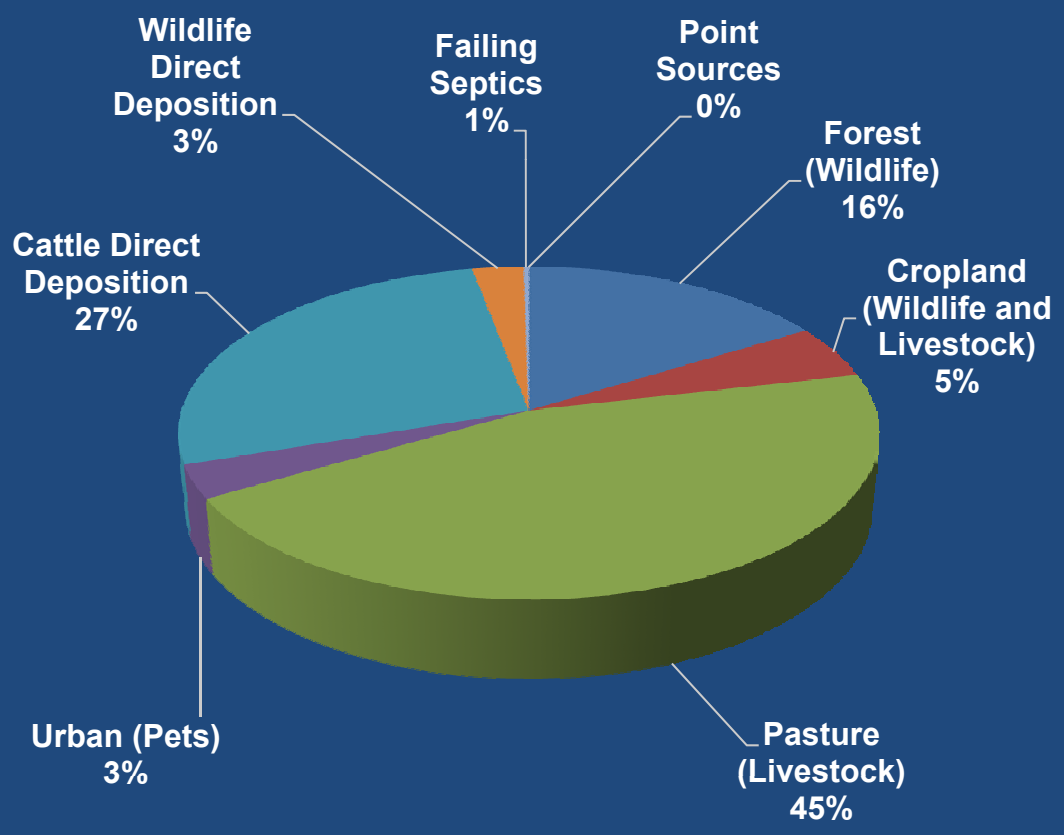
TMDL Development Methodology

Enter available data into a computer model. Model simulates pollutant loadings into the watershed.



Example of TMDL Results: Potomac Run Watershed

DRAFT Existing Bacteria Loads in the Potomac Run Watershed



Source	Annual Average *E. coli* Existing Loads in the Potomac Run Watershed	
	cfu/yr	%
Forest (Wildlife)	1.31E+13	16.3%
Cropland (Wildlife and Livestock)	4.14E+12	5.1%
Pasture (Livestock)	3.64E+13	45.2%
Urban (Pets)	2.63E+12	3.3%
Cattle Direct Deposition	2.19E+13	27.2%
Wildlife Direct Deposition	2.17E+12	2.7%
Failing Septics	2.16E+11	0.3%
Point Sources	0.00E+00	0.0%
Total	8.05E+13	100.0%

DRAFT Potomac Run TMDL Scenarios and DRAFT TMDL Equation

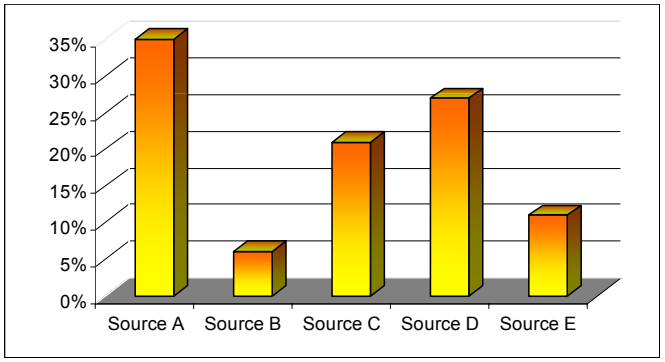
Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							100%	85%
1	100						100%	85%
2	100	50					97%	77%
3	100	100					15%	34%
4	100	100	100	100			7%	20%
5	100	100				50	2%	25%
6	100	100				75	0%	25%
7	100	100	95	95	95	0	5%	18%
8	100	100	85	85	85	0	7%	21%
9	100	100	90	90	90	0	8%	21%
10	100	50	50	50	50	0	36%	43%
11	100	75	75	75	75	0	22%	34%
12	100	100				100	0%	24%
13	**100**	**100**	**98.0**	**98.0**	**98.0**	**59.0**	**0%**	**10%**

TMDL Equation for Potomac Run (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
6.21E+10	**1.97E+12**	**Implicit**	**2.03E+12**

Questions?

We are here

TMDL Study

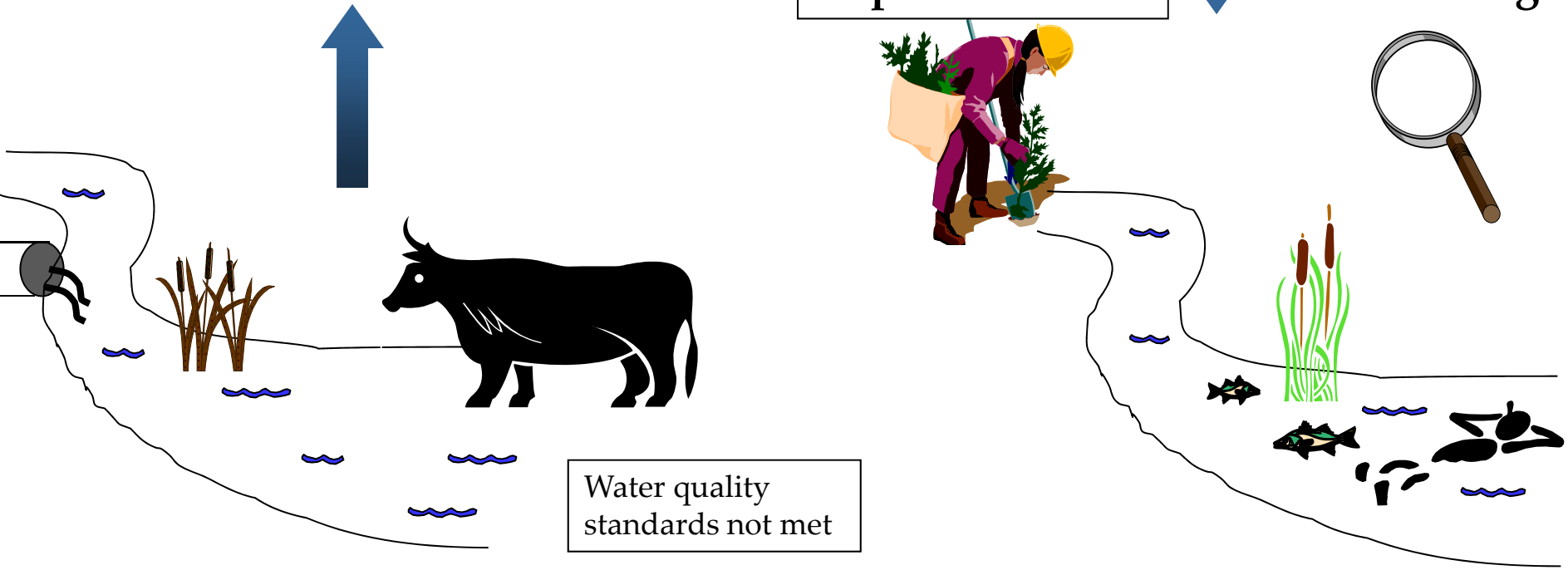


Implementation Plan

DCR

Implementation

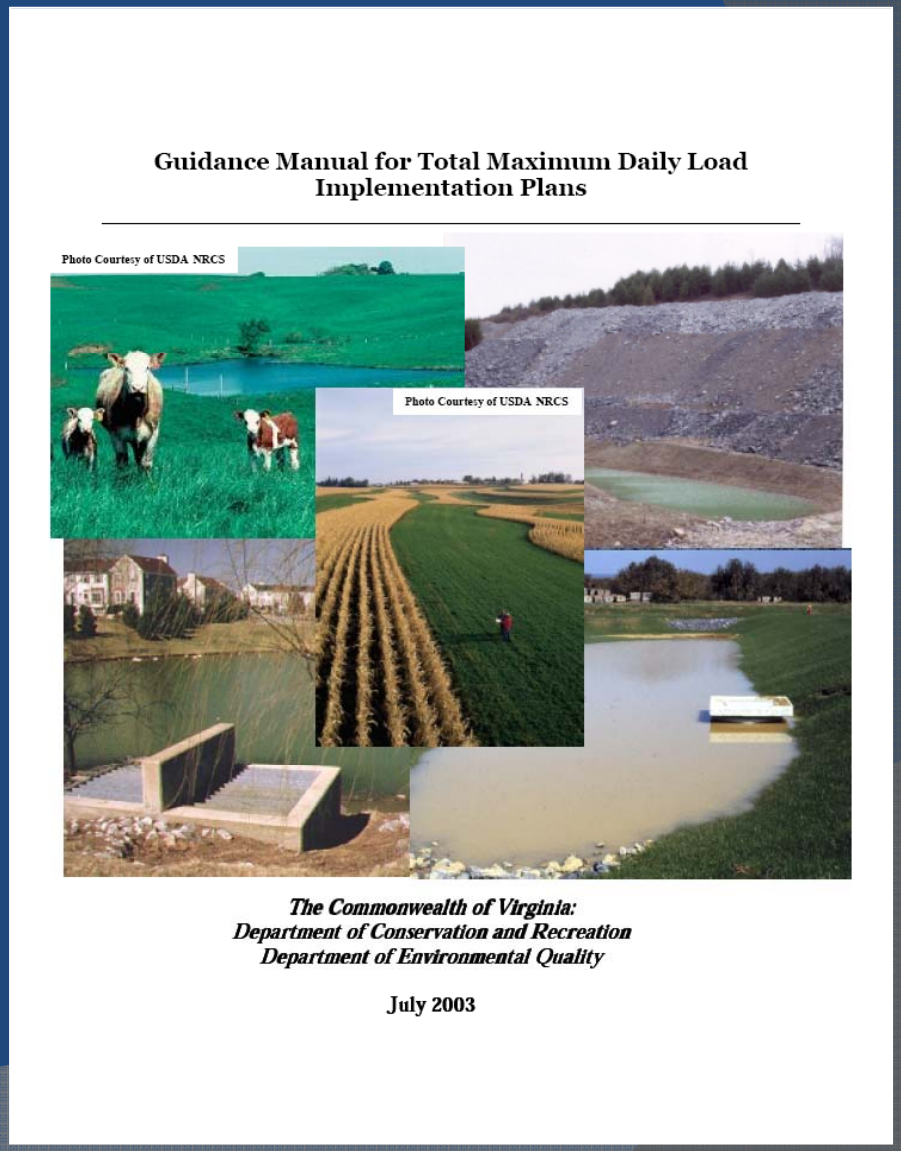
Monitoring



Water quality standards not met

Why Implementation Plans?

- Implementation Plan development is required by state legislation
- Supported by federal, state and local organizations
- Procedures outlined in DCR & DEQ Implementation Plan Guidance Document



Guidance Manual for Total Maximum Daily Load Implementation Plans

Photo Courtesy of USDA NRCS

Photo Courtesy of USDA NRCS

The Commonwealth of Virginia:
Department of Conservation and Recreation
Department of Environmental Quality

July 2003

Implementation Plan Development

- Implementation Plan is done **locally**
- Stakeholders have the opportunity to participate in the plan development
  - Public meetings
  - Working groups
  - Steering committee

What is included in the TMDL Implementation Plan?

Review of TMDL Study

- Implementation Actions
- Cost & Benefits
- Measurable Goals and Milestones
- Stakeholder's Roles
- Potential Funding Sources
- Public Participation

TMDL Implementation Strategy

- Implementation to focus on human controlled actions:
  - Excluding livestock from stream corridor
  - Improving pasture & cropland management
  - Removing straight pipes
  - Repairing / replacing failing septic systems
  - Managing pet waste

Straight Pipe

Livestock Stream Access

Failed Septic System

Potential Control Measures

Livestock Exclusion and Pasture

Exclusion Fencing

Riparian Buffer

Cross-fencing

Watering Trough

Hardened Crossing

Potential Control Measures

Composters & Stormwater BMPs

Pet Waste Composters

Vegetated Buffer (No Mow Zone)

Rain Garden

Infiltration Trenches

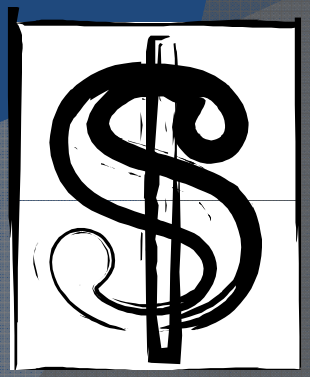
What goes into an implementation plan?

- Existing plans or improvement projects
- Actions to improve water quality
- Project timeline
  - Implementation goals
  - Implementation milestones
- Roles and responsibilities
- Funding sources

Potential Funding Sources

Potential funding sources for best management practices identified in Implementation Plans:

- USDA Programs - CREP/EQIP
- Water Quality Improvement Fund
- State Revolving Loan Funds
- State Cost-Share Program
- State Tax Credits
- National Fish & Wildlife Foundation

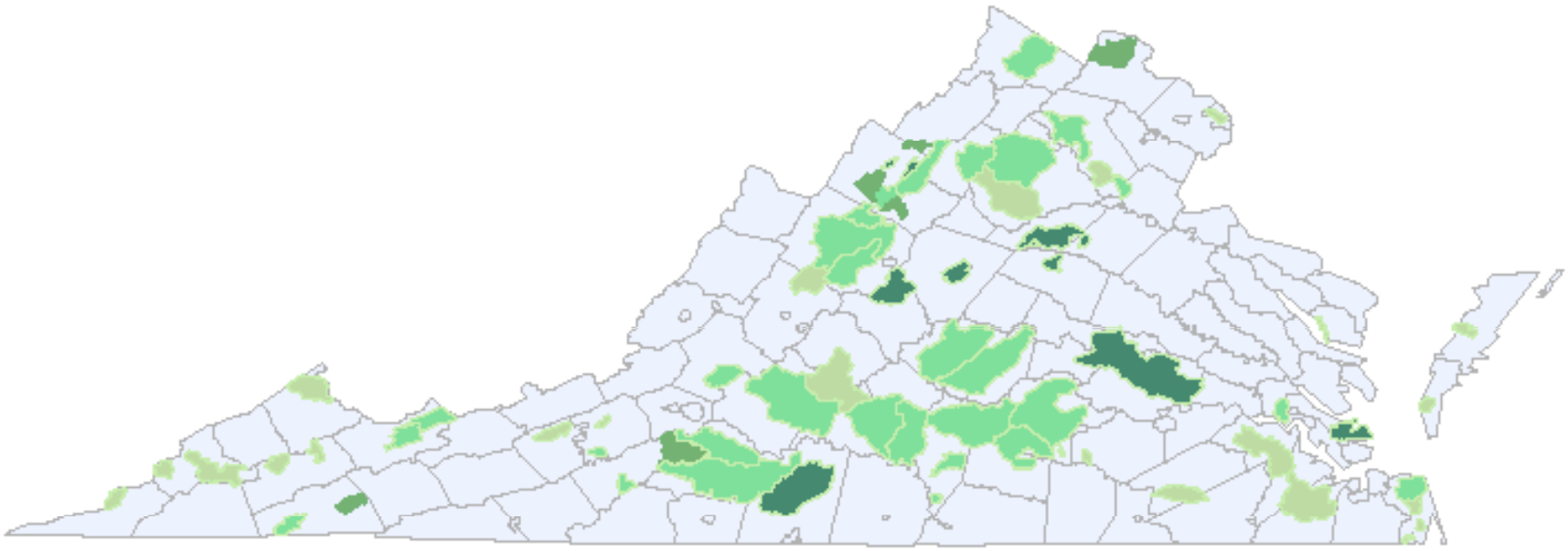


Are we making **progress** at the local level?

Now meeting bacteria water quality criteria and removed from the impaired waters list

- Guest River (3.02 miles)
- 13.98 miles of the Big Otter (13.98 miles)
- Maggodee Creek (4.4 miles)
- Stroubles Creek (2.1 miles)
- Muddy Creek (2.17 miles)
- Willis River (34.71 miles)
  - 32 miles of fencing
  - 3,944 head of cattle excluded

TMDL Implementation Plan Development
April 2011



Legend

- Implementation complete
- Implementation plan complete
- Implementation plan under development
- Implementation underway

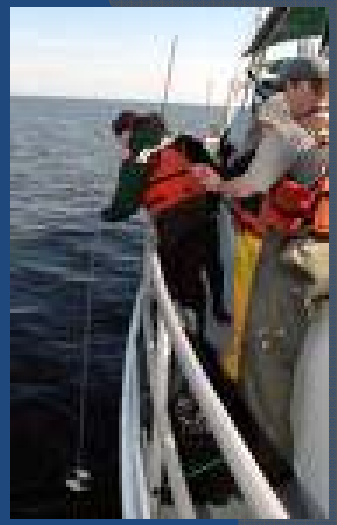
0 35 70 140 Miles

VA Department of Conservation and Recreation
Division of Soil and Water Conservation

DCR

What can you do in the meantime?

- Show interest to agencies (comments to both DCR/DEQ)
- Continue BMP implementation
- Initiate outreach activities
- Continue stream monitoring
- Form watershed steering committee in each county
- Identify funding opportunities and partnerships



One last point to remember

TMDL's and IP's are a mechanism for restoring water quality and are an opportunity for diverse groups of people to come together to improve watershed health

For more information, contact:

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VA DCR - DIVISION OF SOIL & WATER CONSERVATION

Regional Office Service Areas

DCR-DSWC Regional Office Service Areas

- Abingdon
- Christiansburg
- Clarksville
- Richmond
- Staunton
- Suffolk
- Tappahannock
- Warrenton

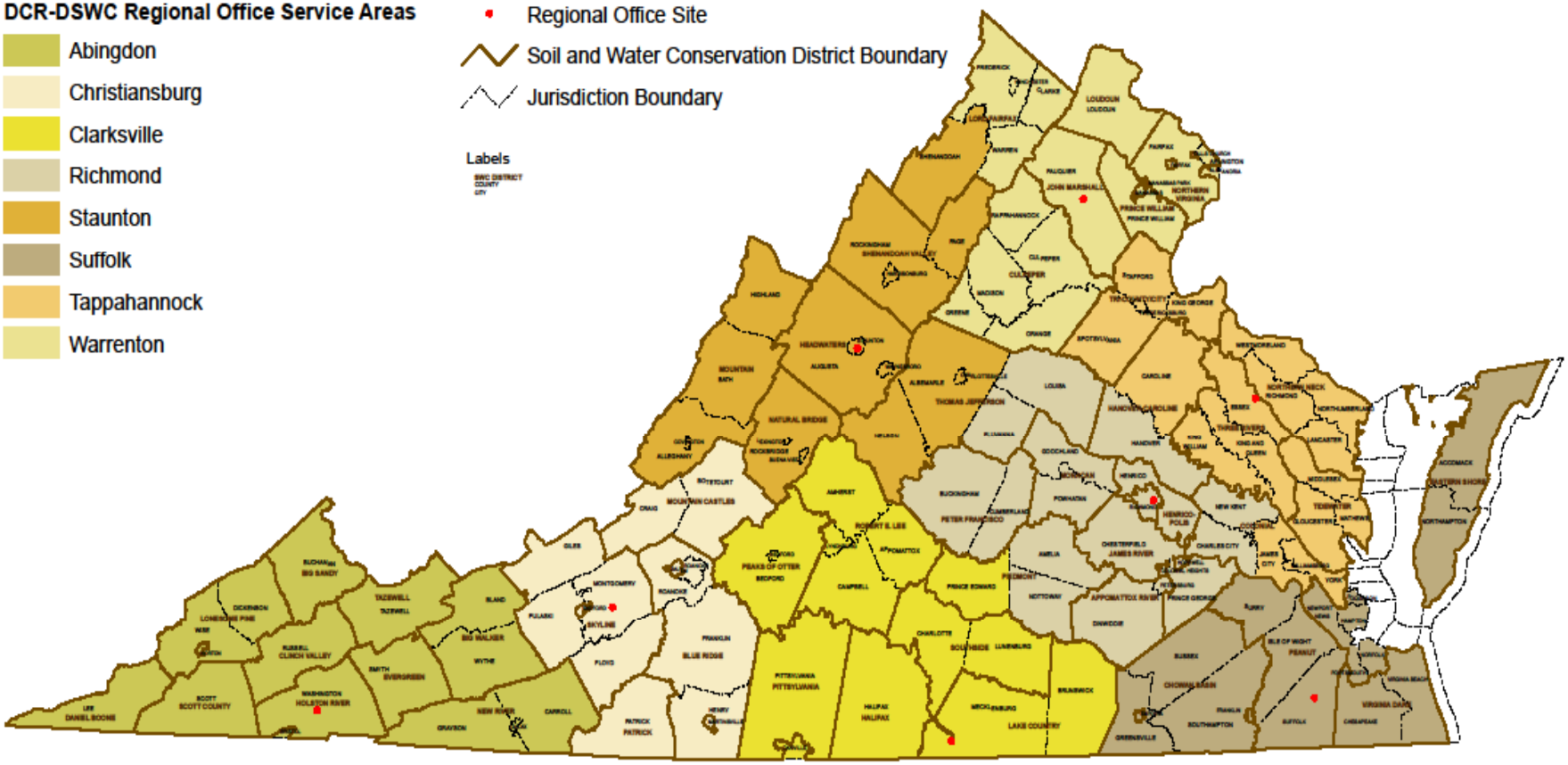
Regional Office Site

Soil and Water Conservation District Boundary

Jurisdiction Boundary

Labels

SWC DISTRICT
COUNTY
CITY



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20 10 0 20 40

Miles

DATA SOURCES:
SOIL & WATER DISTRICT BOUNDARY - VDCR
JURISDICTION BOUNDARY - VDCR
DCR REGIONAL OFFICE BOUNDARY - VDCR

02 JULY 2009

DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Questions?

What's next?

- Comment Period on the Draft Report:
  - February 1, 2012 – March 2, 2012
  - Link to Draft Report: http://www.deq.virginia.gov/tmdl/drftmdls/pototribs.pdf
  - Comments should be submitted in writing to:

    Katie Conaway
    Katie.Conaway@deq.virginia.gov
    13901 Crown Court, Woodbridge, VA 22193
- Response to Comments
- Submit Draft Report to EPA for Approval

Poster Session

CONTACTS

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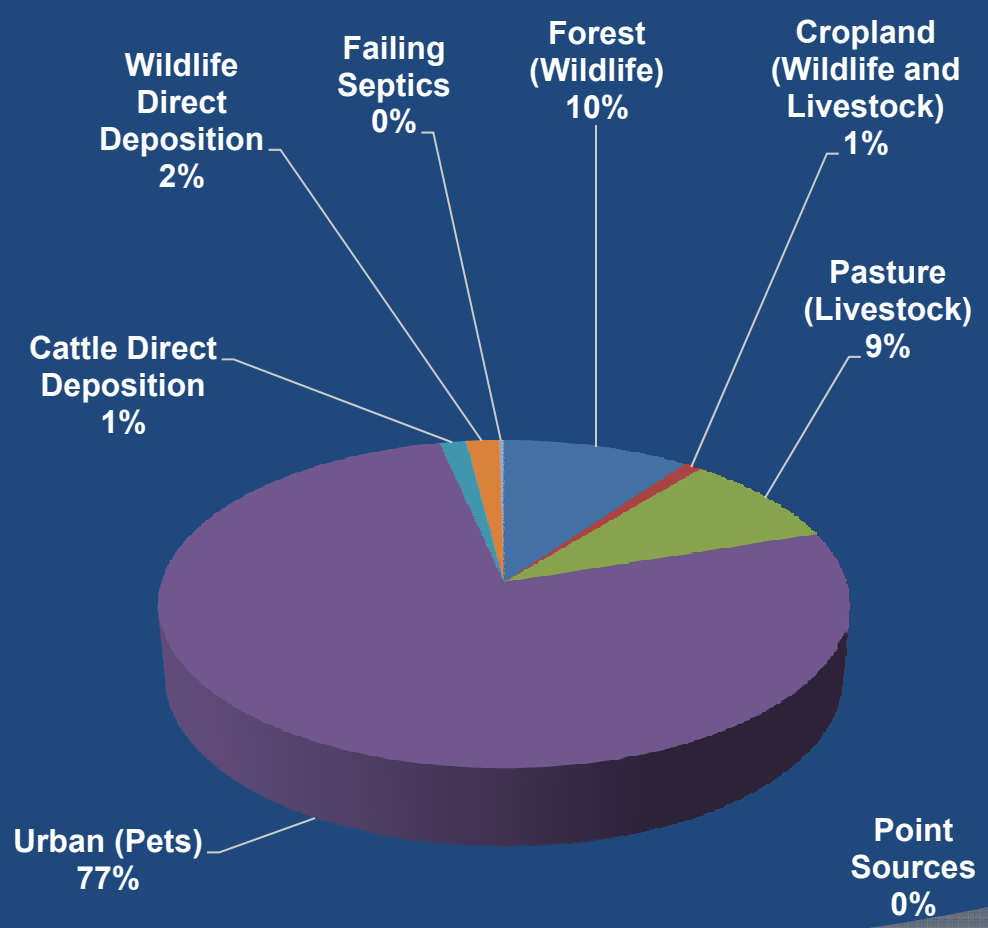
TMDL Results Slides

DRAFT Existing Bacteria Loads in the Powells Creek Watershed



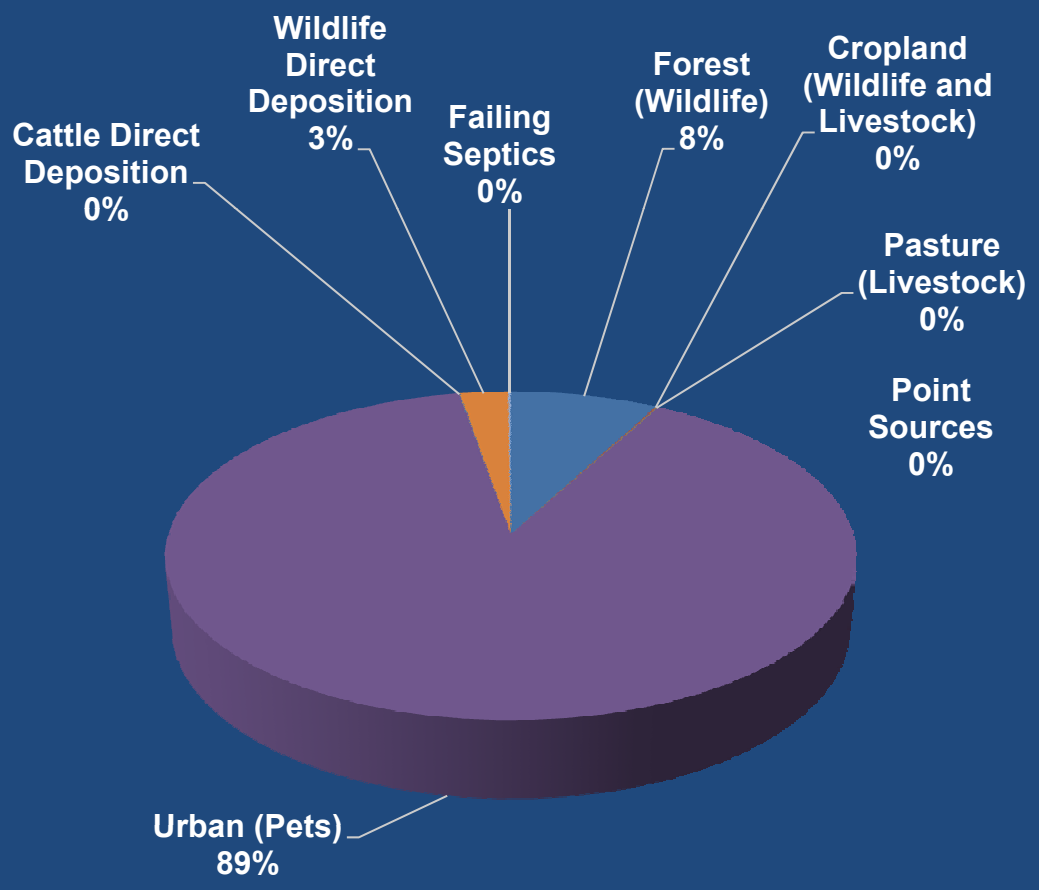
Source	Annual Average *E. coli* Existing Loads in the Powells Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	1.49E+13	10%
Cropland (Wildlife and Livestock)	1.44E+12	1%
Pasture (Livestock)	1.36E+13	9%
Urban (Pets)	1.15E+14	77%
Cattle Direct Deposition	2.09E+12	1%
Wildlife Direct Deposition	2.62E+12	2%
Failing Septics	4.04E+11	0%
Point Sources	0.00E+00	0%
Total	1.50E+14	100%

DRAFT Powells Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							55%	32%
1	100						55%	32%
2	100	50					46%	31%
3	100	100					30%	31%
4	100	100	100	100	100		0%	0%
5	100	100				50	15%	31%
6	100	100				75	4%	31%
7	100	100	95	95	95		1%	17%
8	100	100	85	85	85		7%	23%
9	100	100	90	90	90		3%	21%
10	100	50	50	50	50		32%	28%
11	100	75	75	75	75		18%	26%
12	100	100				100	0%	31%
13	100	100	98.0	98.0	84.4	0	0%	10%

DRAFT TMDL Equation for Powells Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
2.38E+12	**5.25E+12**	**Implicit**	**7.63E+12**

DRAFT Existing Bacteria Loads in the Quantico Creek Watershed



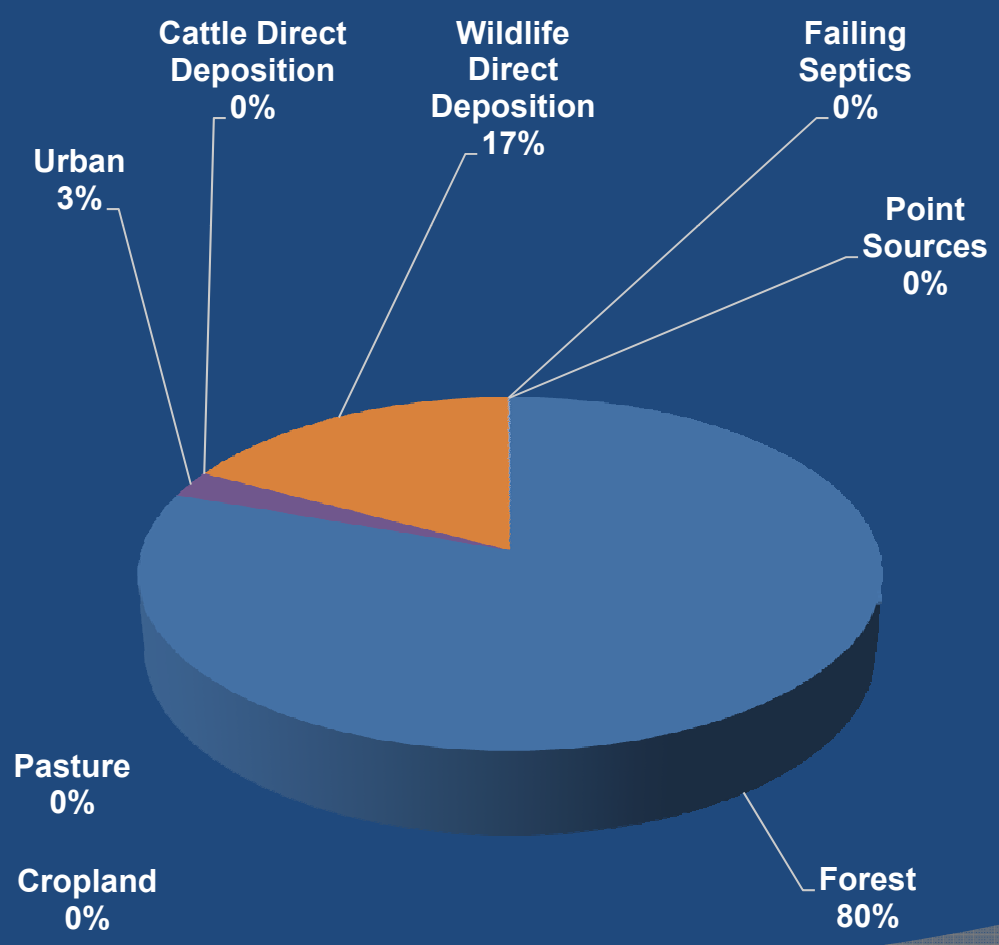
Source	Annual Average *E. coli* Existing Loads in the Quantico Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	7.59E+12	8%
Cropland (Wildlife and Livestock)	6.88E+10	0%
Pasture (Livestock)	4.21E+10	0%
Urban (Pets)	8.64E+13	89%
Cattle Direct Deposition	2.34E+10	0%
Wildlife Direct Deposition	2.47E+12	3%
Failing Septics	1.37E+11	0%
Point Sources	0.00E+00	0%
Total	9.67E+13	100%

DRAFT Quantico Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							18%	27%
1	100						18%	27%
2	100	50					17%	27%
3	100	100					16%	27%
4	100	100	100	100	100		0%	1%
5	100	100				50	0%	26%
6	100	100				75	0%	26%
7	100	100	95	95	95		0%	11%
8	100	100	85	85	85	0	1%	19%
9	100	100	90	90	90	0	0%	17%
10	100	50	50	50	50	0	9%	25%
11	100	75	75	75	75	0	1%	22%
12	100	100				100	0%	26%
13	**100**	**100**	**98.6**	**98.6**	**0**	**0**	**0%**	**9%**

DRAFT TMDL Equation for Quantico Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
1.32E+12	**1.01E+13**	**Implicit**	**1.14E+13**

DRAFT Existing Bacteria Loads in the South Fork Quantico Creek Watershed



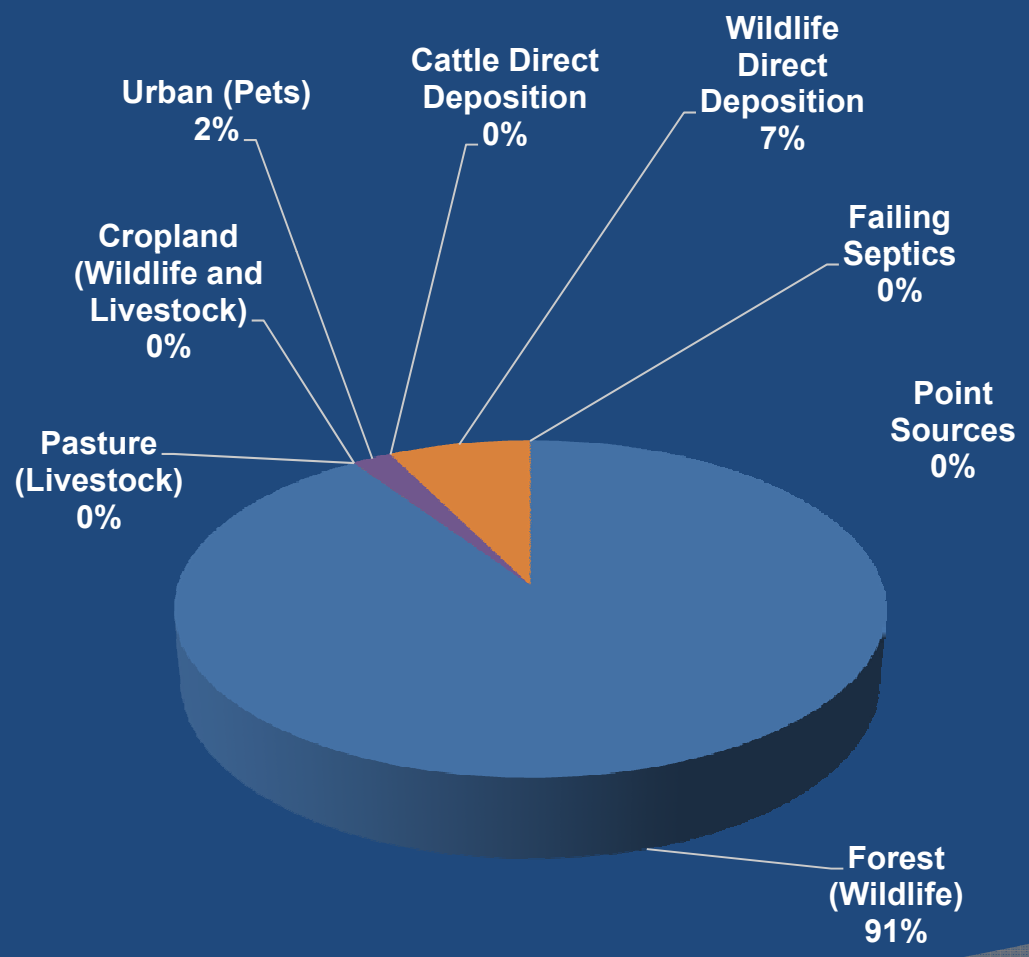
Source	Annual Average *E. coli* Existing Loads in the South Fork Quantico Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	6.09E+12	80.4%
Cropland (Wildlife and Livestock)	1.78E+09	0.0%
Pasture (Livestock)	3.94E+08	0.0%
Urban (Pets)	1.83E+11	2.4%
Cattle Direct Deposition	2.37E+09	0.0%
Wildlife Direct Deposition	1.30E+12	17.1%
Failing Septics	5.52E+09	0.1%
Point Sources	0.00E+00	0.0%
Total	7.58E+12	100%

DRAFT South Fork Quantico Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							13%	22%
1	100						13%	22%
2	100	50					12%	22%
3	100	100					12%	22%
4	100	100	100	100			3%	16%
5	100	100				50	1%	23%
6	100	100				75	1%	23%
7	100	100	95	95	95		0%	2%
8	100	100	85	85	85	0	0%	6%
9	100	100	90	90	90	0	0%	3%
10	100	50	50	50	50	0	2%	13%
11	100	75	75	75	75	0	0%	12%
12	100	100				100	0%	18%
13	100	100	95	95	76	0	0%	10%

DRAFT TMDL Equation for South Fork Quantico Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
3.69E+10	**2.76E+12**	**Implicit**	**2.80E+12**

DRAFT Existing Bacteria Loads in the North Branch Chopawamsic Creek Watershed



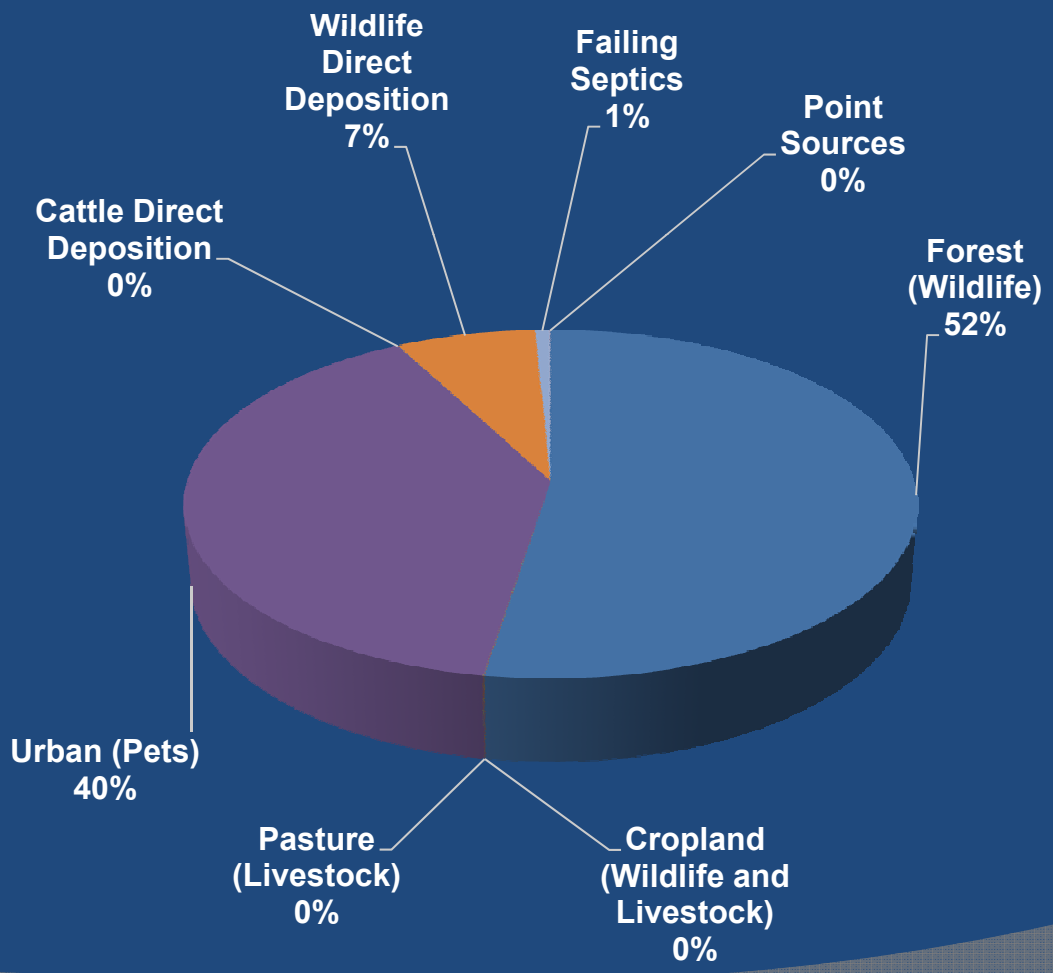
Source	Annual Average *E. coli* Existing Loads in the North Branch Chopawamsic Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	2.60E+13	91%
Cropland (Wildlife and Livestock)	1.98E+09	0%
Pasture (Livestock)	4.15E+08	0%
Urban (Pets)	5.93E+11	2%
Cattle Direct Deposition	0.00E+00	0%
Wildlife Direct Deposition	2.12E+12	7%
Failing Septics	0.00E+00	0%
Point Sources	0.00E+00	0%
Total	2.87E+13	100%

DRAFT North Branch Chopawamsic Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							25%	29%
1	100						25%	29%
2	100	50					25%	29%
3	100	100					25%	29%
4	100	100	100	100			23%	27%
5	100	100				50	4%	27%
6	100	100				75	1%	27%
7	100	100	95	95	95	0	0%	9%
8	100	100	85	85	85	0	2%	12%
9	100	100	90	90	90	0	0%	12%
10	100	50	50	50	50	0	6%	17%
11	100	75	75	75	75	0	4%	15%
12	100	100				100	0%	19%
13	**100**	**100**	**93.6**	**93.6**	**93.6**	**0**	**0%**	**10%**

DRAFT TMDL Equation for North Branch Chopawamsic Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
7.36E+10	**3.78E+12**	**Implicit**	**3.86E+12**

DRAFT Existing Bacteria Loads in an Unnamed Tributary (XLF) to the Potomac River



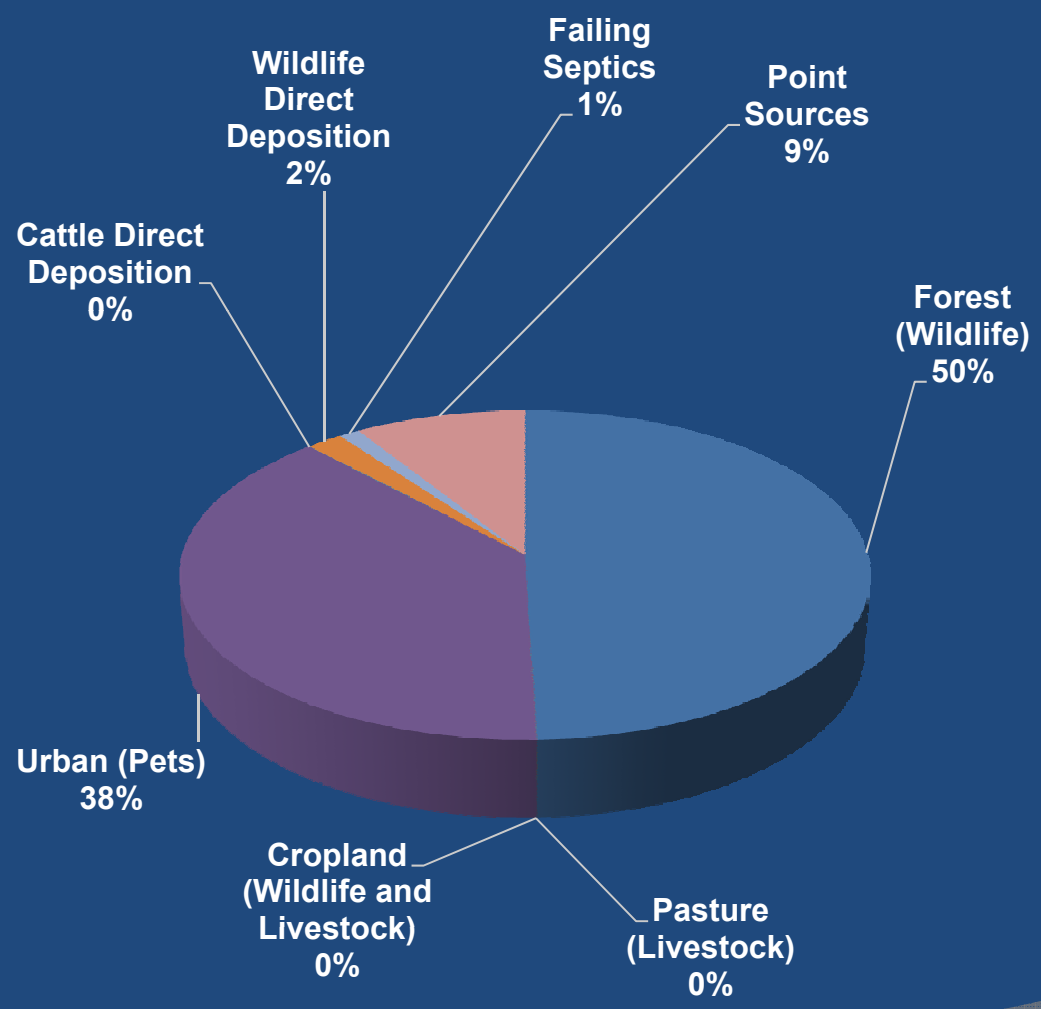
Source	Annual Average *E. coli* Existing Loads in an Unnamed Tributary (XLF) to the Potomac River	
	cfu/yr	%
Forest (Wildlife)	5.17E+12	52.5%
Cropland (Wildlife and Livestock)	1.70E+09	0.0%
Pasture (Livestock)	1.07E+09	0.0%
Urban (Pets)	3.90E+12	39.7%
Cattle Direct Deposition	1.08E+09	0.0%
Wildlife Direct Deposition	6.90E+11	7.0%
Failing Septics	7.45E+10	0.8%
Point Sources	1.74E+09	0.0%
Total	9.85E+12	100.0%

DRAFT Unnamed Tributary (XLF) to the Potomac River TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							19%	25%
1	100						18%	24%
2	100	50					18%	24%
3	100	100					16%	24%
4	100	100	100	100			6%	17%
5	100	100				50	0%	21%
6	100	100				75	0%	20%
7	100	100	95	95	95	0	0%	9%
8	100	100	85	85	85	0	0%	13%
9	100	100	90	90	90	0	0%	12%
10	100	50	50	50	50	0	3%	19%
11	100	75	75	75	75	0	1%	17%
12	100	100				100	0%	19%
13	**100**	**100**	**94.4**	**94.4**	**94.4**	**0**	**0%**	**10%**

DRAFT TMDL Equation Unnamed Tributary (XLF) to the Potomac River (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
2.22E+11	**9.91E+11**	**Implicit**	**1.21E+12**

DRAFT Existing Bacteria Loads in the Austin Run Watershed



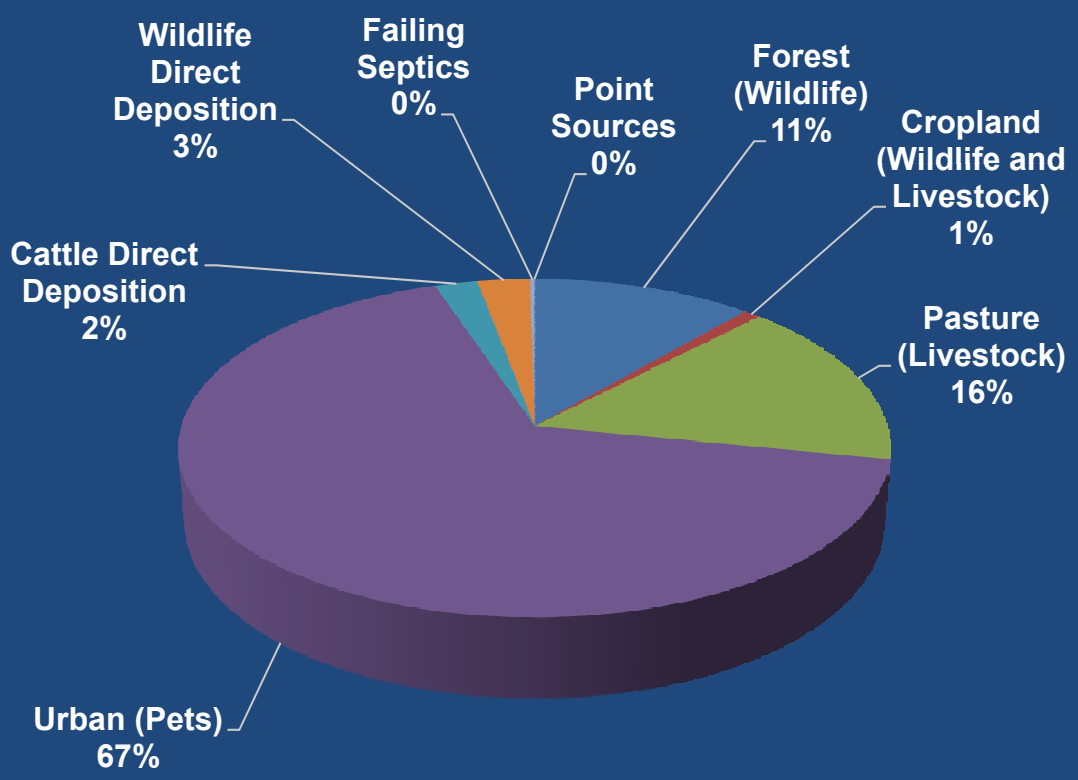
Source	Annual Average *E. coli* Existing Loads in the Austin Run Watershed	
	cfu/yr	%
Forest (Wildlife)	4.33E+13	49.5%
Cropland (Wildlife and Livestock)	7.42E+09	0.0%
Pasture (Livestock)	2.88E+09	0.0%
Urban (Pets)	3.36E+13	38.4%
Cattle Direct Deposition	2.48E+10	0.0%
Wildlife Direct Deposition	1.67E+12	1.9%
Failing Septics	9.62E+11	1.1%
Point Sources	7.87E+12	9.0%
Total	8.74E+13	100.0%

DRAFT Austin Run TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							98%	25%
1	100						98%	25%
2	100	50					98%	25%
3	100	100					98%	25%
4	100	100	100	100			10%	19%
5	100	100				50	65%	24%
6	100	100				75	61%	24%
7	100	100	85	85	85	0	8%	19%
8	100	100	90	90	90	0	7%	17%
9	100	50	50	50	50	0	12%	21%
10	100	75	75	75	75	0	10%	22%
11	100	100	95	95	95	0	0%	11%
12	**100**	**100**	**95.9**	**95.9**	**95.9**	**0**	**0%**	**10%**

DRAFT TMDL Equation for Austin Run (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
3.22E+13	**3.93E+12**	**Implicit**	**3.62E+13**

DRAFT Existing Bacteria Loads in the Accokeek Creek Watershed



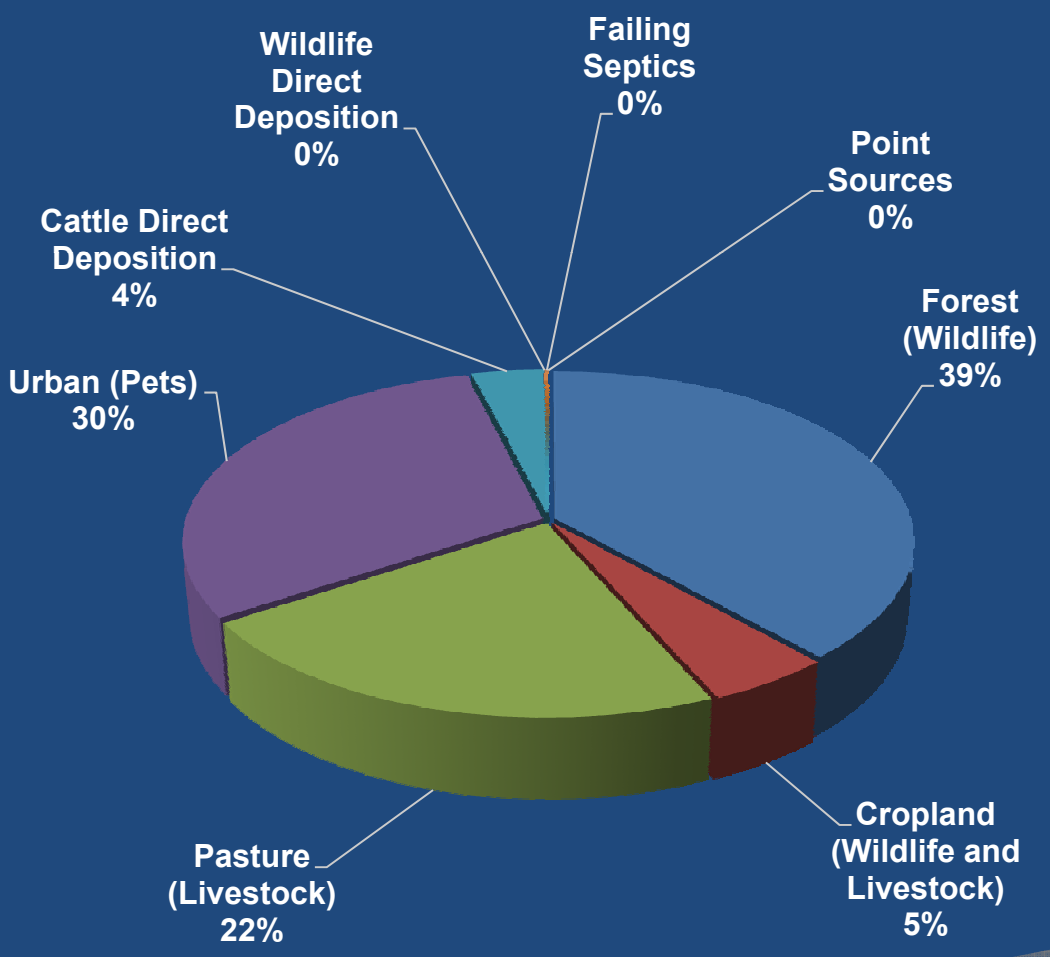
Source	Annual Average *E. coli* Existing Loads in the Accokeek Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	7.24E+12	11.4%
Cropland (Wildlife and Livestock)	5.52E+11	0.9%
Pasture (Livestock)	1.01E+13	15.9%
Urban (Pets)	4.24E+13	66.7%
Cattle Direct Deposition	1.40E+12	2.2%
Wildlife Direct Deposition	1.73E+12	2.7%
Failing Septics	1.33E+11	0.2%
Point Sources	3.13E+09	0.0%
Total	6.35E+13	100.0%

DRAFT Accokeek Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							38%	31%
1	100						33%	31%
2	100	50					25%	30%
3	100	100					18%	30%
4	100	100	100	100			1%	23%
5	100	100				50	4%	21%
6	100	100				75	2%	21%
7	100	100	95	95	95	0	0%	11%
8	100	100	85	85	85	0	1%	15%
9	100	100	90	90	90	0	1%	13%
10	100	50	50	50	50	0	17%	22%
11	100	75	75	75	75	0	7%	19%
12	100	100				100	0%	18%
13	**100**	**100**	**95.5**	**95.5**	**65.5**	**0**	**0%**	**10%**

DRAFT TMDL Equation for Accokeek Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
2.08E+11	**6.48E+12**	**Implicit**	**6.69E+12**

DRAFT Existing Bacteria Loads in the Potomac Creek Watershed



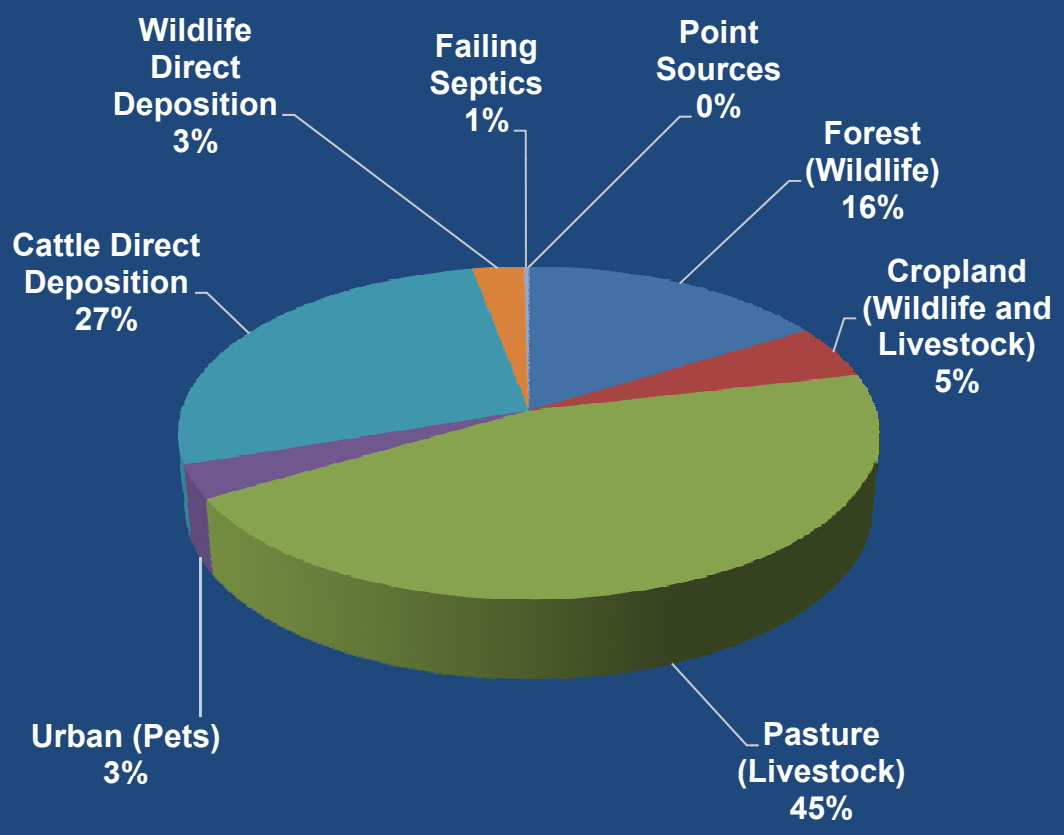
Source	Annual Average *E. coli* Existing Loads in the Potomac Creek Watershed	
	cfu/yr	%
Forest (Wildlife)	5.61E+13	38.4%
Cropland (Wildlife and Livestock)	7.27E+12	5.0%
Pasture (Livestock)	3.26E+13	22.3%
Urban (Pets)	4.44E+13	30.4%
Cattle Direct Deposition	5.37E+12	3.7%
Wildlife Direct Deposition	1.21E+11	0.1%
Failing Septics	2.18E+11	0.1%
Point Sources	0.00E+00	0.0%
Total	1.46E+14	100.0%

DRAFT Potomac Creek TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							32%	34%
1	100						32%	34%
2	100	50					28%	32%
3	100	100					17%	29%
4	100	100	100	100			5%	14%
5	100	100				50	5%	27%
6	100	100				75	5%	27%
7	100	100	95	95	95	0	0%	4%
8	100	100	85	85	85	0	0%	16%
9	100	100	90	90	90	0	0%	12%
10	100	50	50	50	50	0	15%	25%
11	100	75	75	75	75	0	5%	19%
12	100	100				100	4%	27%
13	**100**	**100**	**92.2**	**92.2**	**92.2**	**0**	**0%**	**10%**

DRAFT TMDL Equation for Potomac Creek (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
1.74E+11	**1.10E+13**	**Implicit**	**1.12E+13**

DRAFT Existing Bacteria Loads in the Potomac Run Watershed



Source	Annual Average *E. coli* Existing Loads in the Potomac Run Watershed	
	cfu/yr	%
Forest (Wildlife)	1.31E+13	16.3%
Cropland (Wildlife and Livestock)	4.14E+12	5.1%
Pasture (Livestock)	3.64E+13	45.2%
Urban (Pets)	2.63E+12	3.3%
Cattle Direct Deposition	2.19E+13	27.2%
Wildlife Direct Deposition	2.17E+12	2.7%
Failing Septics	2.16E+11	0.3%
Point Sources	0.00E+00	0.0%
Total	8.05E+13	100.0%

DRAFT Potomac Run TMDL Scenarios and DRAFT TMDL Equation

Scenario	Failing Sewage Disposal Systems	Direct Deposition from Cattle	Non-Point Source Agriculture	Non-Point Source Urban	Non-Point Source Forest (Wildlife)	Direct Deposition from Wildlife	Percent Exceedance of the *E. Coli* Geometric Mean Criterion	Percent Exceedance of the *E. Coli* Maximum Assessment Criterion
0							100%	85%
1	100						100%	85%
2	100	50					97%	77%
3	100	100					15%	34%
4	100	100	100	100			7%	20%
5	100	100				50	2%	25%
6	100	100				75	0%	25%
7	100	100	95	95	95	0	5%	18%
8	100	100	85	85	85	0	7%	21%
9	100	100	90	90	90	0	8%	21%
10	100	50	50	50	50	0	36%	43%
11	100	75	75	75	75	0	22%	34%
12	100	100				100	0%	24%
13	**100**	**100**	**98.0**	**98.0**	**98.0**	**59.0**	**0%**	**10%**

DRAFT TMDL Equation for Potomac Run (cfu/year)			
Wasteload Allocation (WLA)	**Load Allocation (LA)**	**Margin of Safety (MOS)**	**TMDL**
6.21E+10	**1.97E+12**	**Implicit**	**2.03E+12**