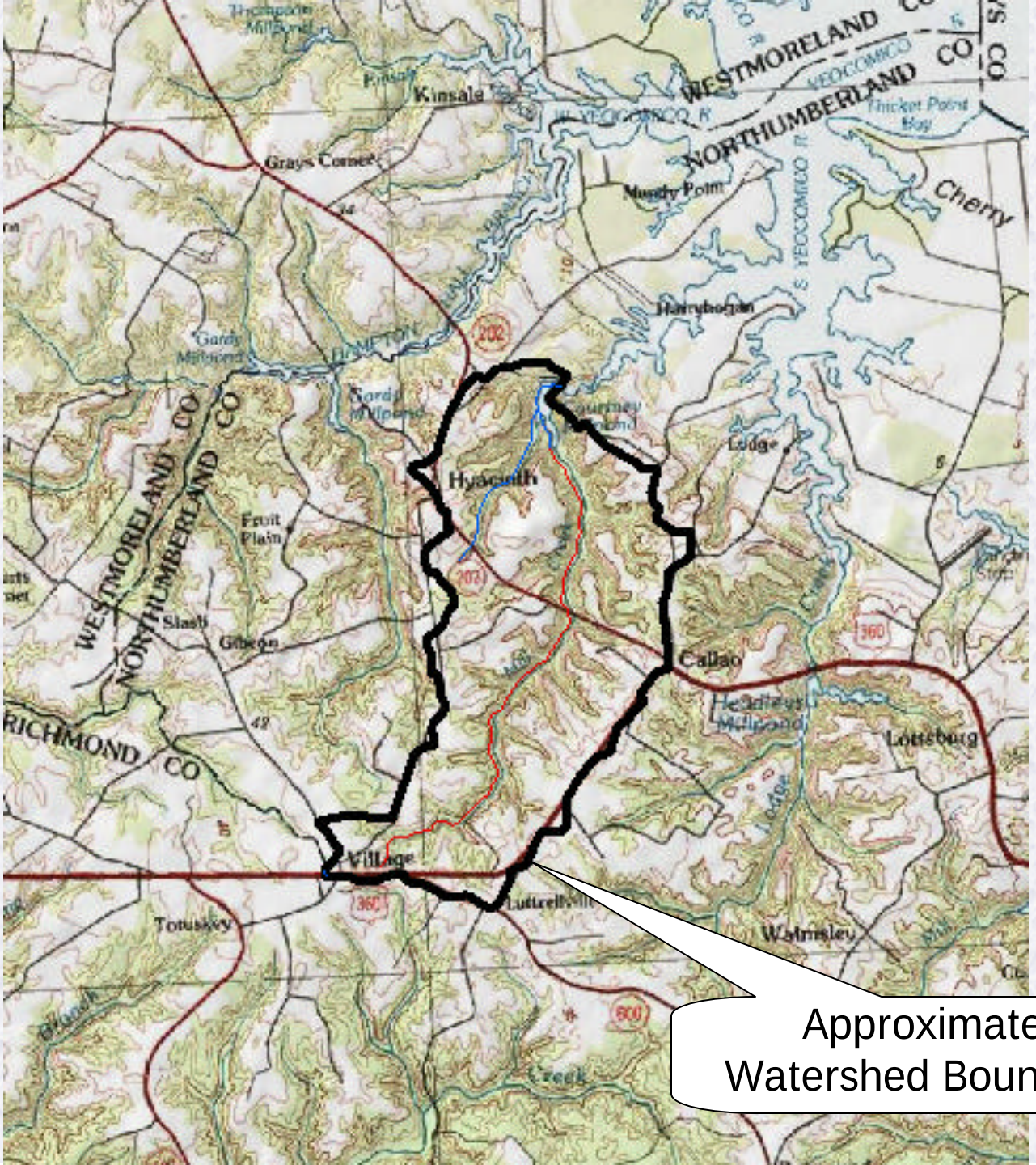
Bacteria Total Maximum Daily Load (TMDL) Preliminary Data Analysis for Mill Creek and Courtney Millpond Watershed

First Public TMDL Development Meetings

December 16, 2009

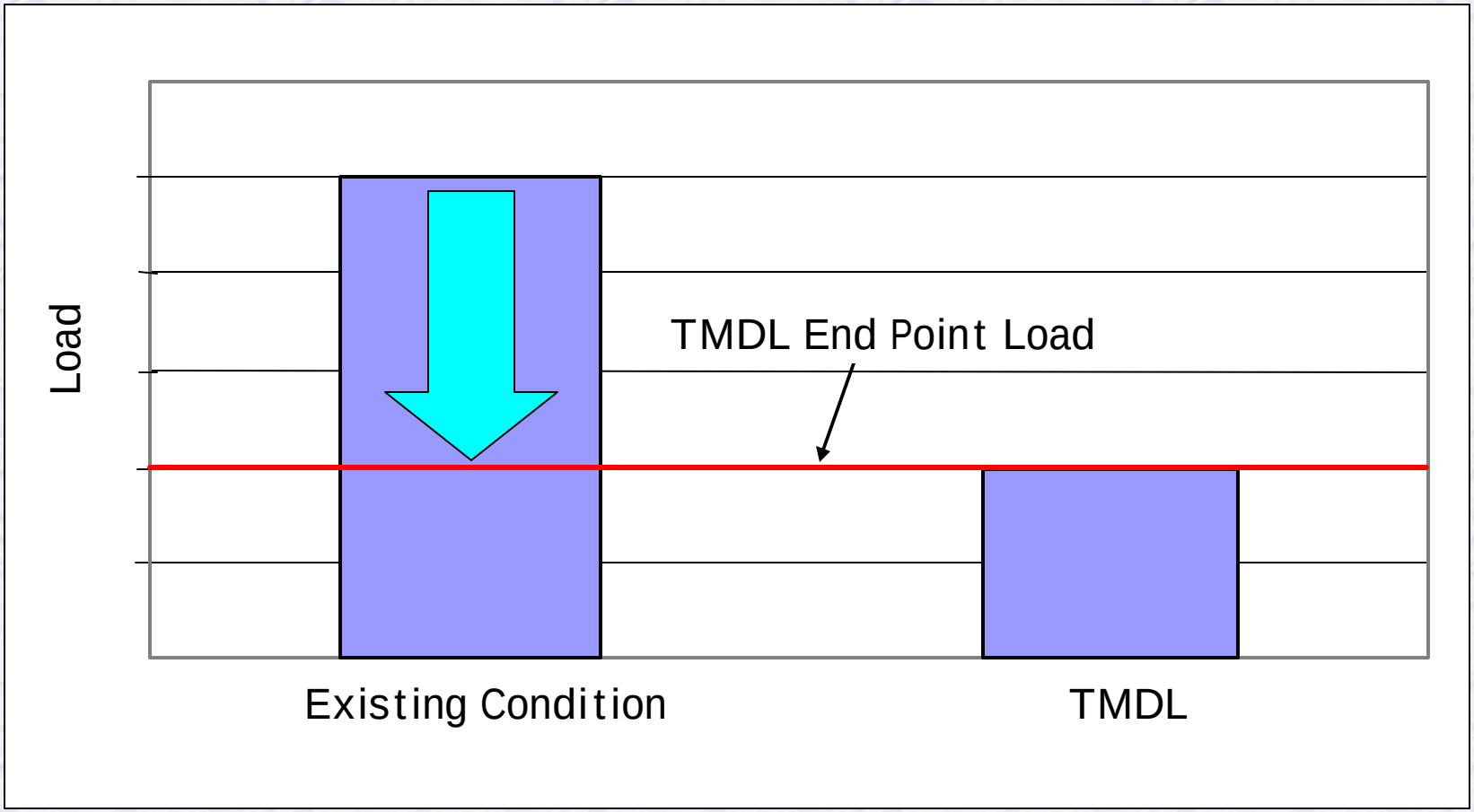
Virginia Department of Environmental Quality


Kinsale
Grays Corner
WESTMORELAND CO
NORTHUMBERLAND CO
YEOCOMICO R
Thicket Point Bay
Muddy Point
Cherry
Harrybogan
Gordy Millpond
Hyacinth
Lodge
Fruit Plain
Slash
Gibson
Callao
Lottsburg
RICHMOND CO
Village
Totuskey
Lutrellville
Walnsley
Approximate
Watershed Boundary

What is a TMDL?

- **TMDL** = Total Maximum Daily Load = maximum amount of a pollutant that can exist in a waterbody without violating water quality standards (WQS)
- **WQS** = numeric or narrative limits on pollutants that ensure the protection of human health and of aquatic life

Visual Example of a TMDL



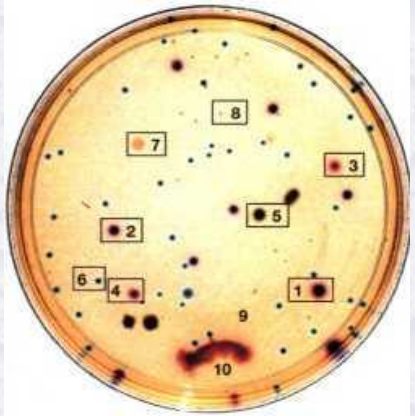
Reducing existing bacteria load to the TMDL end point load is expected to restore water quality.

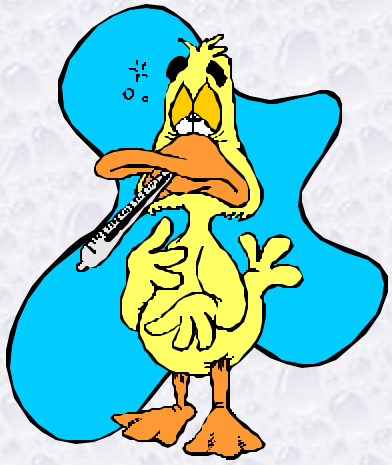
Why are TMDL studies necessary?

- TMDLs must be developed for water bodies that do not meet water quality standards for their designated use (impaired waters). Federal and State Laws:
  - 1972 Clean Water Act (CWA), Section 303(d)
  - 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA)
  - 1999 Consent Decree due to American Canoeist Association Lawsuit
- Examples of Designated Uses:
  - ***Primary Contact (Swimming)***
  - Aquatic life
  - Fish consumption
  - Public water supply
  - Shellfish consumption
  - Wildlife
- Impaired waters occur throughout Virginia in lakes, streams, and tidal waters.
  - Visit http://www.deq.virginia.gov/wqa/ir2008.html for DEQ's 2008 Integrated Assessment Report
- Based on DEQ 2008 Report >1100 TMDLs due by 2022

Pollutant of Concern: *E. Coli*

- **Bacteria** Present in the Intestines of Warm Blooded Animals, E.G. Human, Livestock, Wildlife
- **Indicator** of the Potential Presence of Pathogens in Water Bodies
- Possible Pathogen itself





E.Coli Water Quality Criteria

- Single sample max: **235 cfu/100mL**
  - applies for all samples collected
  - Cannot violate the standard more than 10.5% of the time
- Geometric mean: **126 cfu/100mL**
  - applies for two or more samples taken during any calendar month

Water Quality Impairment Summary

- **Current Violation Rate for both *E.coli* stations ~22%** (total of 5 out of 23)
- Station 1AMIA004.12:

  Mean = 175 cfu/100ml, SD = 124.5

  Min = 100 cfu/100ml (min detection limit = 100)

  Max = 400 cfu/100ml (max detection limit = 8000)

- Station 1AMIA002.34:

  Mean = 155 cfu/100ml, SD = 300

  Min = 100cfu/100ml (min detection limit = 100)

  Max = 400 cfu/100ml (max detection limit = 8000)

Mill Creek E.coli Data

DEQ Sample Station ID/Location	Sample Date	Instantaneous Maximum Bacteria Standard (N/100ml)	E.coli (N/100ml) Sample Result	Exceeds Instantaneous Max Standard?
1AMIA004.12 Mill Creek at Route 202 Bridge	7/23/2008	235	200	No
	8/18/2008		400	Yes
	9/16/2008		100	No
	10/29/2008		100	No
	11/18/2008		100	No
	12/22/2008		100	No
	1/29/2009		100	No
	2/17/2009		100	No
	3/18/2009		100	No
	4/21/2009		100	No
	5/13/2009		300	Yes
	6/17/2009		400	Yes
1AMIA002.34 below Courtney Mill Pond at Route 620	7/23/2008		100	No
	8/18/2008		100	No
	9/16/2008		100	No
	10/29/2008		400	Yes
	11/18/2008		400	Yes
	12/22/2008		100	No
	1/29/2009		100	No
	2/17/2009		100	No
	3/18/2009		100	No
	4/21/2009		100	No
	5/13/2009		100	No

3/12 = **23%**

violation rate

2/11 = **18%**
violation rate

Total Watershed
= 22%

E.Coli – MTEC-MF Method

Water Quality Impairment Summary

Fecal Coliform Data:

- Mill Creek 1st Listed in 2002 on DEQ's 303(d) Impaired Waters List

- 2002 - **Violation Rate of 15%**
  (4 out of 26 samples exceeded the then Fecal Coliform standard of 1000 MPN/100ML)

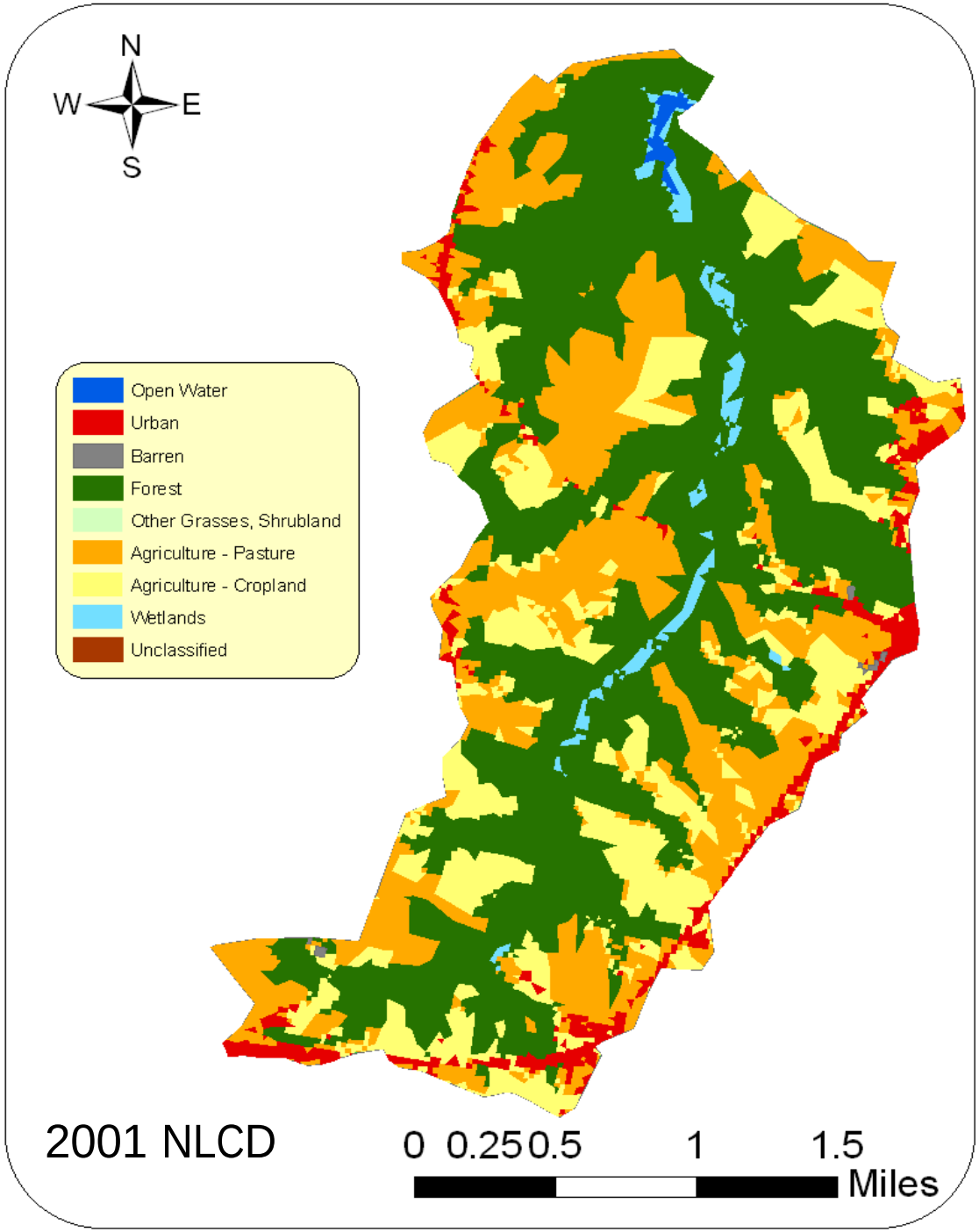
- **2002 Fecal Coliform Instantaneous Maximum (Single Sample Maximum) Standard = 1000 cfu/100ml**
  - Also had the rule where standard could be exceeded 10.5% of the time.

- **ALL** Data to include this older fecal coliform data, will be used to develop this TMDL

DEQ Sample Station ID/Location	Sample Date	Instantaneous Maximum Fecal Coliform Bacteria Standard (MPN/100ml)	Fecal Coliform (MPN/100ml) Sample Result	Exceeds Instantaneous Max Standard?
1AMIA004.12 Mill Creek at Route 202 Bridge	5/23/1996	1000	490	No
	8/20/1996		5400	Yes
	11/18/1996		170	No
	2/12/1997		18	No
	5/5/1997		40	No
	8/25/1997		310	No
	10/14/1997		130	No
	12/11/1997		230	No
	2/11/1998		45	No
	4/13/1998		230	No
	6/4/1998		210	No
	8/13/1998		16000	Yes
	10/14/1998		490	No
	12/9/1998		9200	No
	2/8/1999		130	No
	4/12/1999		78	No
	6/9/1999		68	No
	8/11/1999		490	Yes
	10/4/1999		170	No
	12/28/1999		110	No
	2/24/2000		100	No
	4/25/2000		700	No
	6/7/2000		100	No
	8/14/2000		2100	Yes
	10/11/2000		100	No
	12/4/2000		100	No
	2/15/2001	1000	100	No
	4/4/2001		100	No

Samples from 5/1996 – 12/4/00 were included in the 2002 Assessment Report. The last 2 samples were included in the 2004 Assessment Report.

4/26 = 15% Violation Rate

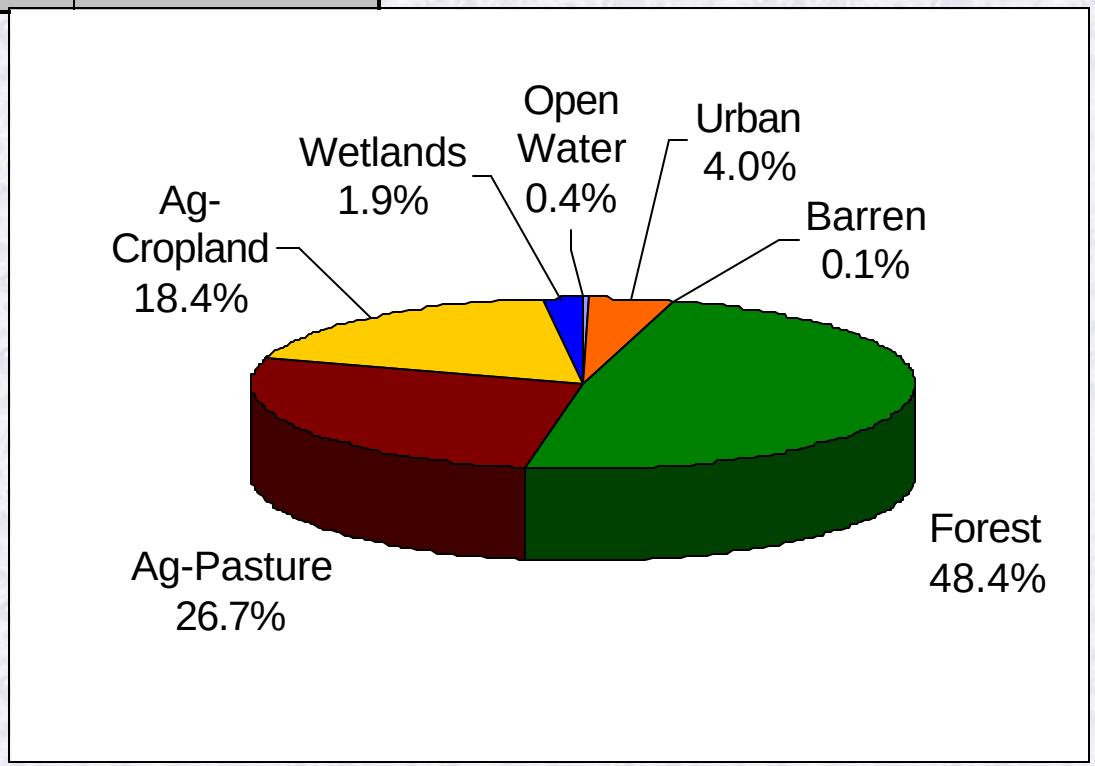


Land Use

48.4% Forest
26.7% Ag-Pasture
18.4% Ag-Cropland
1.9% Wetlands
4% Urban
0.1% Barren
0.4% Open Water

Land Use Chart and Graph for Mill Creek Watershed

Land Use Type	Acres	Square Miles	Percent
Open Water	12	0.02	0.4%
Urban	135	0.21	4.0%
Barren or Mining	4	0.01	0.1%
Forest	1610	2.52	48.4%
Agri - Pasture	889	1.39	26.7%
Agri - Cropland	613	0.96	18.4%
Wetland	65	0.10	1.9%
Totals:	**3327**	**5.20**	**100%**



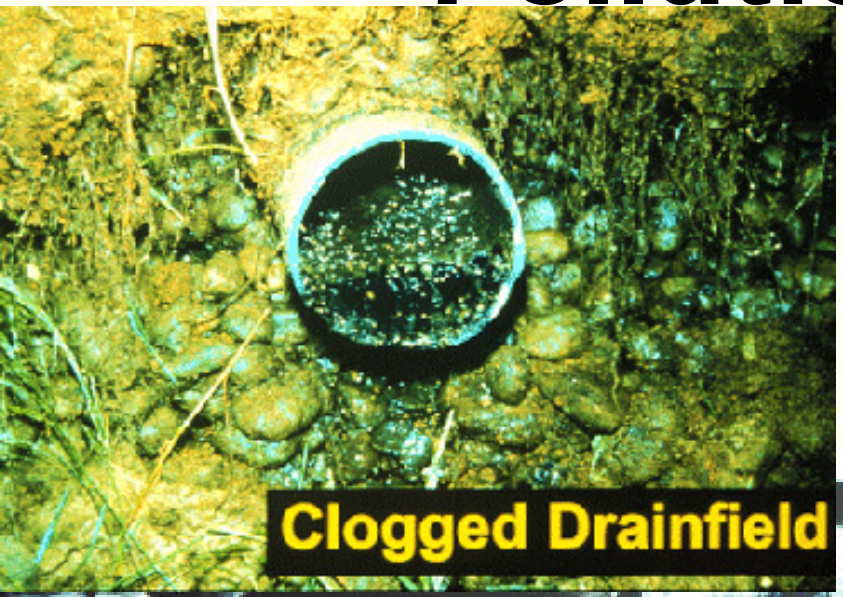
To Reduce the Bacteria Loads,

...we must first know what bacteria sources are in the watershed...

2 Basic Source Types:

- **Point source** pollution is discharged from a discrete location such as a pipe, tank, pit, or ditch
- **Non-point source** pollution originates from runoff from diffuse areas (land surface or atmosphere) having no well-defined source
  - 4 Categories of non-point sources: Humans, Pets, Livestock, and Wildlife

Potential Sources of Bacteria Pollution: Human



Human Source Estimates

- Count of Homes from NAIP Aerial Photography = 152 “homes” in watershed

152 homes x 2.5 people/household = **380** resident humans in watershed
(2006 US Population Survey Estimated 2.5 People per household)

- Septic Failure Rate = 12% (literature value)
  - 12% x 152 homes = **18** septic failures in watershed
  - One **known** active failure – homeowners working with VDH to correct (failing as of ~Spring 2009)

- Biosolids – not considered a source when properly applied
  - Approximately 51 acres within watershed have a permit for biosolid application – awaiting application information for the last five years from applicator.

Potential Sources of Bacteria Pollution: Pets

Pet Source Estimates

- Using Veterinary Medical Association Pet Calculator* of 0.372 dogs/household:

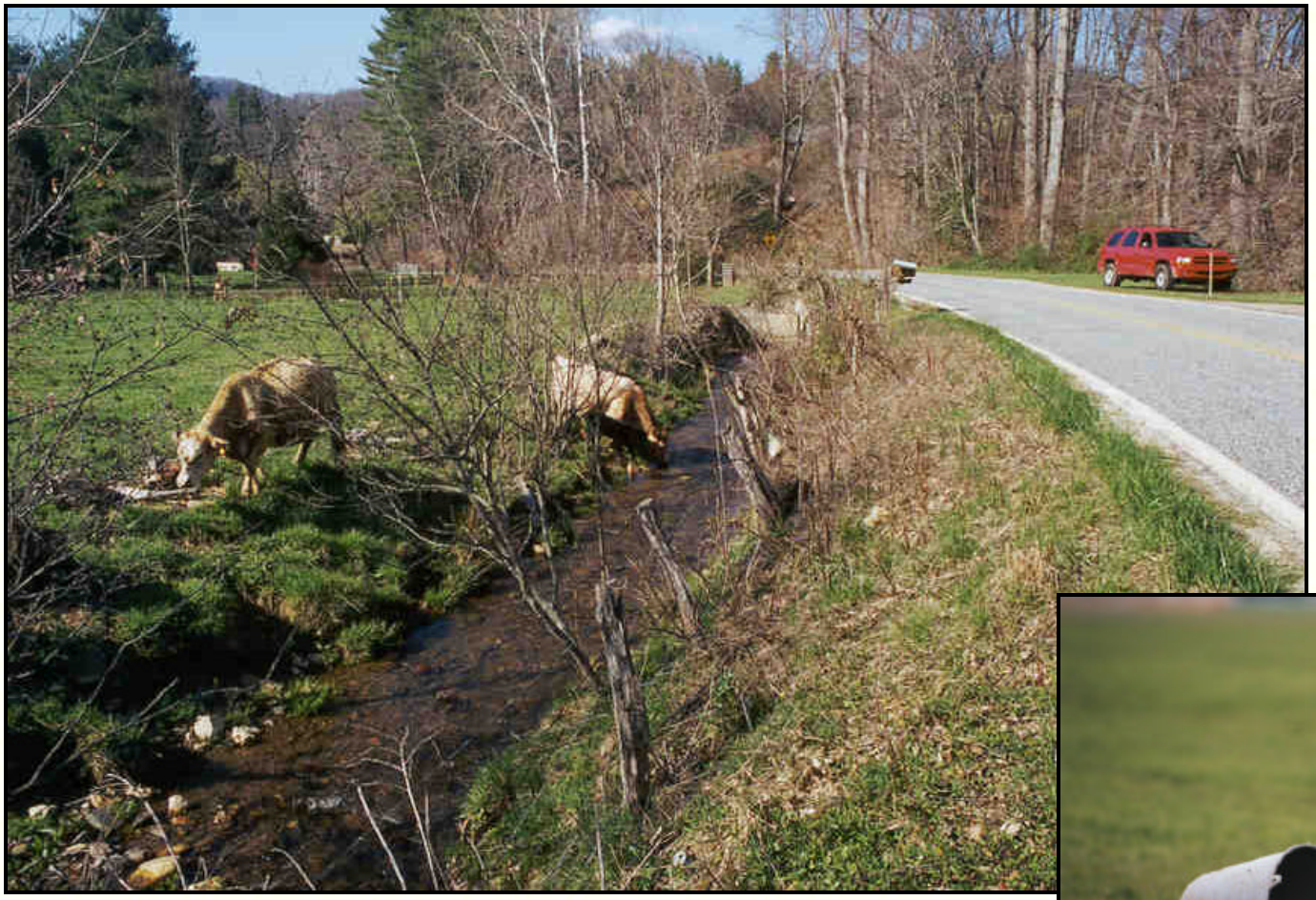
  152 households x 0.372 = 56 dogs

- Animal Control officials site large transient dog population (hunting dogs, seasonal)

- CCRM estimates 80 dogs for watershed

*http://www.avma.org/reference/marketstats/ownership_calculator.asp

Potential Sources of Bacteria Pollution: Livestock



Livestock Source Estimates

Based on density analysis from VIMS…

Cattle	Pigs	Chickens	Horses	Sheep
28	0	7	2	0

- Estimated Livestock Populations have been verified by local Soil and Water Conservation District staff (suggested 40 cattle and ~dozen chickens)

- DEQ has requested Northumberland County Staff review of livestock population data

- Reviewed Poultry Litter Transfer Records – no records for this watershed

Potential Sources of Bacteria Pollution: Wildlife

Wildlife Source Estimates

Based on CCRM Estimated Data (densities by DGIF)…

Ducks	Geese	Deer	Racoons
0	50*	75	112

- Monitoring Data does not suggest a nuisance bird issue however the geese and duck numbers provided by CCRM/VIMS could be underestimated.
- Will be sending numbers to DGIF for review and comment

*50 Geese observed by DEQ employee Fall 2008

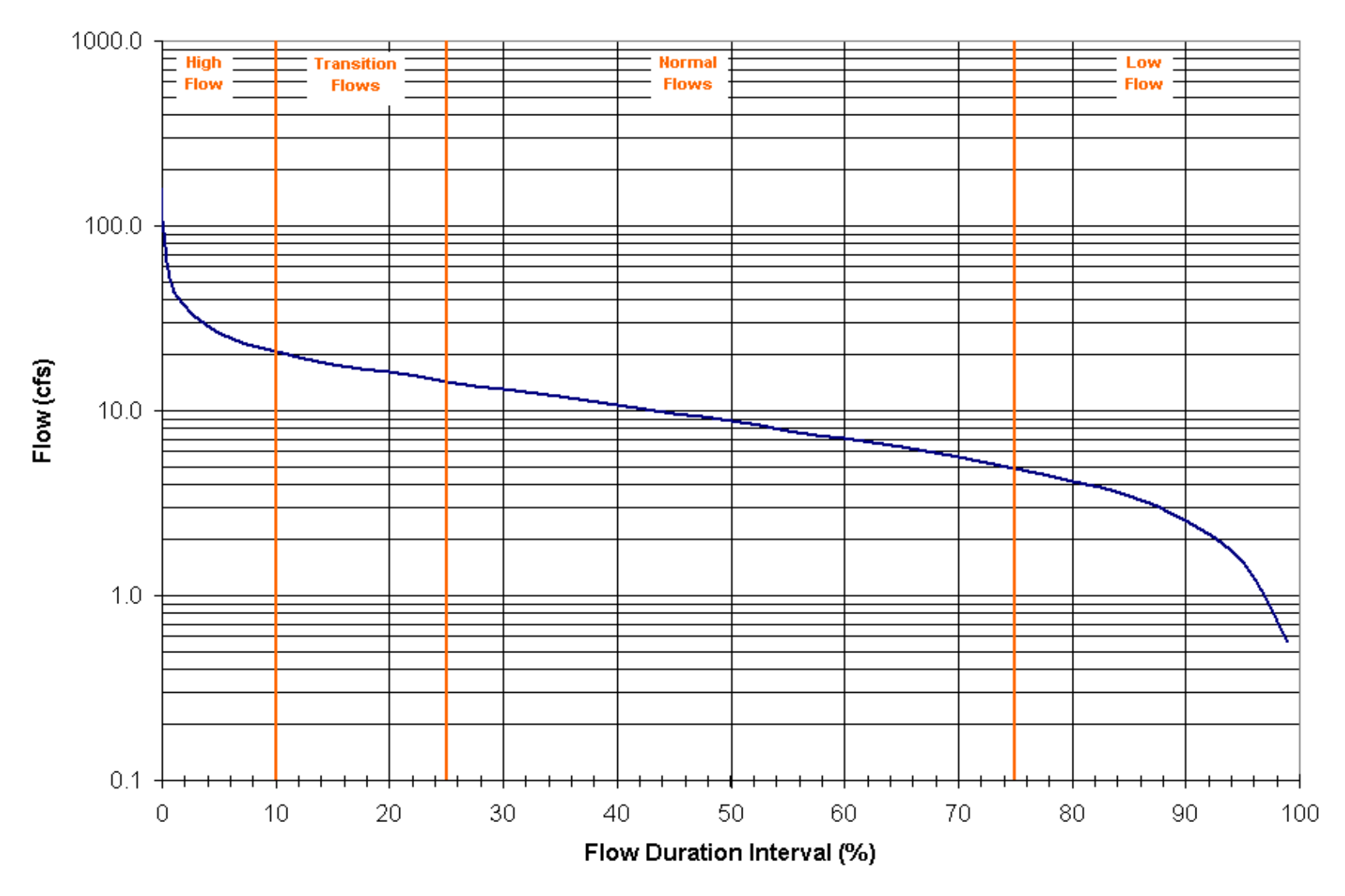
What is a “Load Duration” TMDL?

- Less complex spreadsheet model for TMDL development
- Approach used for bacteria TMDLs
- Model requires stream flow data, water quality data, and population estimates for source allocation

Flow Duration Curve

- No long-term flow gage on Mill Creek
- Choose stream to use as a reference gage
  - Stream chosen will depend on correlation with stream flows measured on Mill Creek.
- Get Mill Creek (y) flows from reference gage (x)
- Plot Mill Creek flows vs. flow frequency

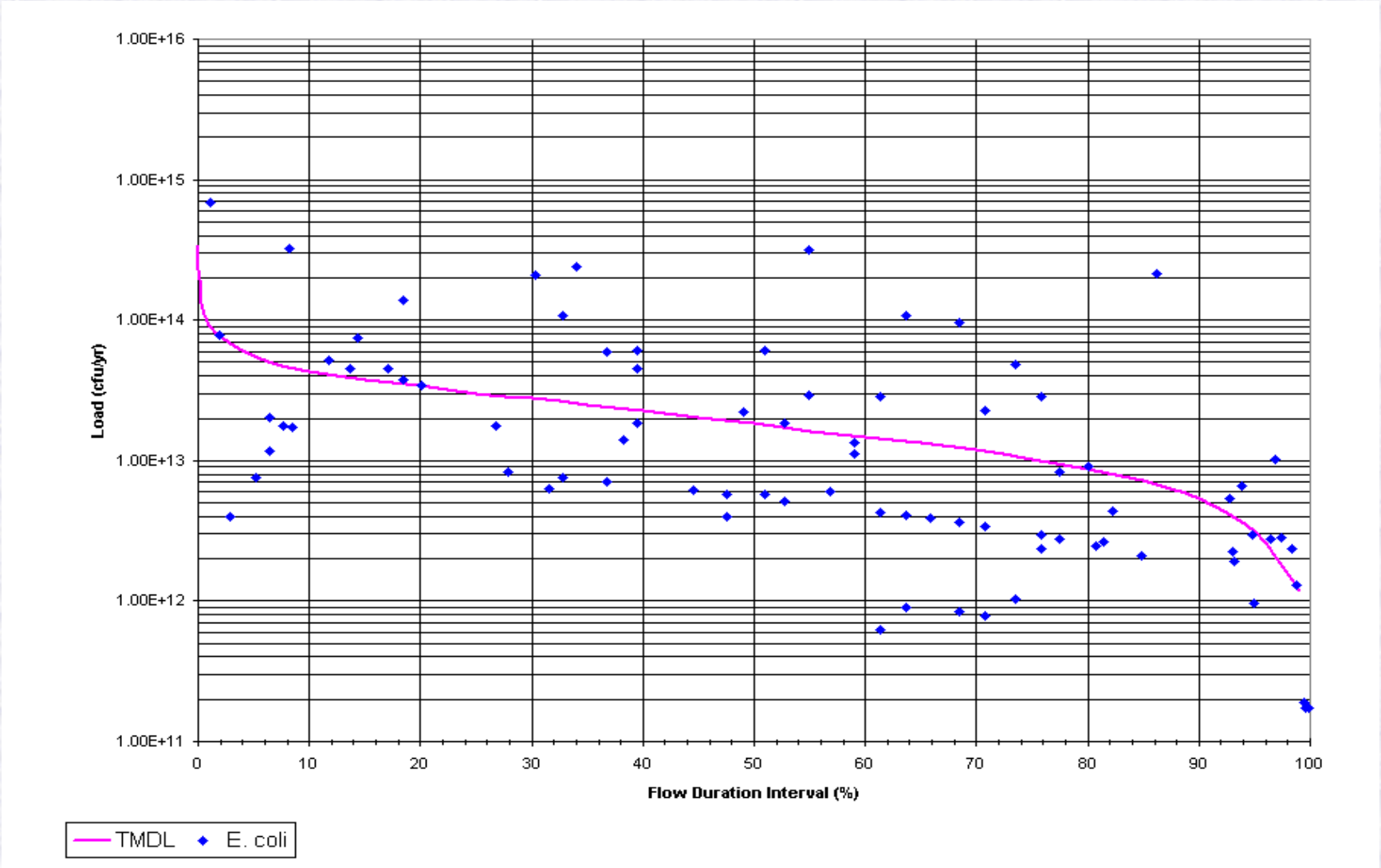
Example Flow Duration Curve



Load Duration Curve

- Multiply Mill Creek flow by E.coli water quality standard (WQS) for allowable load
- Multiply worst case bacteria violation by Mill Creek flows for worst case load condition

Example Load Duration Curve with E. coli load Datapoints



TMDL Required Reduction

- Ensures Water Quality is Protected During Times When Stream is Most Vulnerable
- E.*coli* reduction equals difference b/w worst case E.*coli* load and allowable load
- The Flow Duration Curve will also indicate at which flow the greatest water quality violation occurred (low, medium, or high)

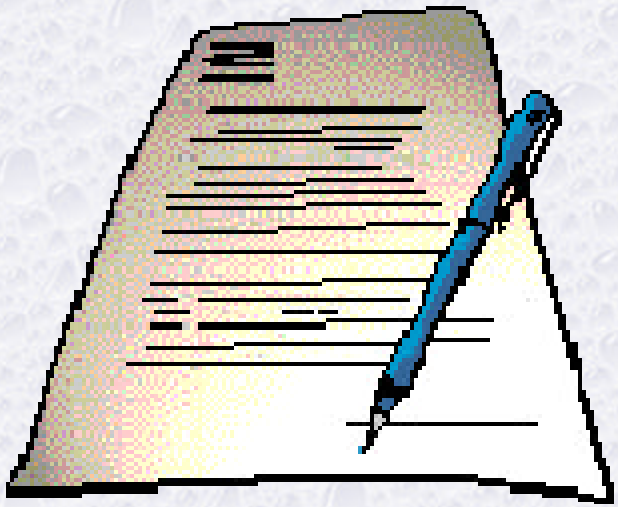
How can you help?

PARTICIPATE IN THE DEVELOPMENT OF TMDL AND IMPLEMENTATION PLANNING!

- Verify our data
- Comment during first 30 day public comment period
- Attend the next public meeting
- Comment on the draft TMDL report during second 30 day public comment period
- Attend meetings on implementation planning
- Minimize runoff from your property
- Pick up after pets
- Maintain septic systems

Next Steps…

- **30 Day Public Comment Period**
  - Ends January 19th, 2010
  - Include name, address, and telephone number please!
- **Draft Report presented at Final TMDL Public Meetings** (aiming for Early-Mid Spring)
- **Final Comment Period**
- **Final Draft Report sent to EPA & SWCB**
- **Implementation Planning & Implementation with DCR**



Questions?

Presentation available online at:

http://www.deq.virginia.gov/tmdl/mtgppt.html

Please Send Comments To:

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