Flat Creek, Nibbs Creek, Deep Creek and West Creek TMDL Implementation Plan:

DRAFT

A Plan to Reduce Bacteria in the Flat, Nibbs, Deep & West Creeks Watersheds

Prepared for:
Virginia Department of Environmental Quality

Submitted January 17, 2008

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Agricultural BMPs

Streamside fencing is one of the best ways to reduce bacteria levels in the stream. This will remove direct livestock defecation in the stream and prevent the trampling of the stream banks.

The length of fencing required on perennial streams in the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds is approximately 22.8; 12.1; 23.3 and 11.7 miles respectively. Table E.1 shows the fencing systems, required for each impaired watershed, needed to meet the livestock exclusion goal. Both the grazing land (SL-6) and streambank protection (WP-2T) practices include a 35-ft buffer component. Therefore, these practices will provide some of the best water quality benefits in terms of reducing both direct (cows defacating in the stream) and land- based (runoff of manure into the stream during rain events) contributions of bacteria to the stream.

Table E.1 SL-6 and WP-2T fence exclusion systems required for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Watershed	SL-6 systems	WP-2T systems
Flat Creek	82	4
Nibbs Creek	44	2
Deep Creek	84	4
West Creek	42	2
Totals	**252**	**12**

Due to the large reductions needed on land-based loads of *E. coli* bacteria, additional Best Management Practices (BMPs) for pasture and cropland are also needed. Estimates of all agricultural BMPs needed for Stage I, the first five years (delisting from the 303(d) list) in the watershed are listed in Table E.2.

Table E.2 Agricultural land based reduction BMPs required for delisting.

Control Measure	Unit	Flat Creek	Nibbs Creek	Deep Creek	West Creek	Total
Improved Pasture Management	Acre	2,877	930	4,204	1,282	9,293
Small Acreage Grazing SL6-A	System	1	1	1	1	4
Loafing Lot Mnt. WP-4B	System	1	0	1	0	2
Poultry Waste Storage Facilities	System	4	0	0	0	4
Dairy Waste Storage Facilities	System	2	1	1	0	4
Manure Incorporation	Acre	838	578	1,571	614	3,601
Riparian Vegetated Buffers – Cropland	Acres	2	4.5	12	2	20.5

Residential BMPs

All failing septic systems and straight pipes must be identified and replaced during implementation since a 99 - 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goals. In addition, straight pipes are illegal in the Commonwealth of Virginia. The estimated numbers of straight pipes and failing septic systems were reported in the TMDL studies and are shown in Table E.3. Based on input from the county health department the number of straight pipes in the watersheds was reduced for the implementation plan and the number of failing septic systems was increased.

Table E.3 Estimated residential waste treatment systems required for delisting.

Watershed	Houses with Standard Septic Systems	Potential Failing Septic Systems - TMDL	Potential Straight Pipes - TMDL	Potential Failing Septic Systems – IP*	Potential Straight Pipes – IP*
Flat Creek	2,047	430	26	454	2
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West Creek	545	125	7	131	1
Total	**5,477**	**1,230**	**72**	**1,296**	**6**

* Implementation Plan

The Flat Creek, Nibbs Creek, Deep Creek and West Creek TMDL allocations call for large reductions to land-based residential loads. In order to achieve these reductions, the BMPs in Table E.4 must be implemented. The Pet Waste Program shown in the table includes distributing information on how pet waste should be disposed of. An additional approach is also proposed to help eliminate pet waste in homeowners yards and dog kennels instead of focusing only on public places. This focus includes the use of pet waste composters and includes the distribution of pet waste composters to households and kennels in the watersheds with dogs. This could be accomplished through partnerships with local stores selling pet food, the Amelia and Nottoway County Animal Shelters and the SPCA.

Table E.4 .All residential BMPs recommended to meet the delisting requirements (first 5 years of implementation).

Residential Control Measure Description	VA Cost-Share Practice Number	Flat Creek	Nibbs Creek	Deep Creek	West Creek	Total
Septic Systems Pump-outs	NA	1,024	258	1,185	273	2,740
Failing Septic System Corrections:						
Septic System - Repair	RB-3	215	58	279	63	615
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Residential Pet Waste Education Program*	NA	1*	1*	1*	1*	1*
Residential Pet Waste Composter	NA	600	240	1,227	219	2,286

*Only one pet waste education program will be used for all four watersheds.

Tables E.5 and E.6 show the estimated cost of installing the recommended agricultural and residential BMPs in Stages I and II. The total cost for Stage I for all four watersheds is $13.78 million. The total cost for full implementation in all four watersheds comes to $18.10 million (Table E.7). Timelines with pollutant reductions expected are shown in Figures E.1 – E.4.

Table E.5 Costs to implement Stage I (years 1 - 5) for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$1,812,000	$2,797,000	$156,100	$4,765,000
Nibbs Creek	$852,000	$769,800	$49,420	$1,672,000
Deep Creek	$1,854,000	$3,592,000	$230,200	$5,676,000
West Creek	$810,000	$794,600	$64,200	$1,668,000
Total	**$5,329,000**	**$7,953,000**	**$500,000**	**$13,780,000**

Numbers are rounded to four significant digits.

Table E.6 Costs to implement Stage II (years 6 - 10) for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$764,000	$230,200	$77,430	$1,072,000
Nibbs Creek	$393,800	$57,820	$25,320	$477,000
Deep Creek	$1,758,000	$266,600	$112,700	$2,137,000
West Creek	$539,300	$61,200	$34,560	$635,100
Total	**$3,455,000**	**$615,800**	**$250,000**	**$4,321,000**

Numbers are rounded to four significant digits.

Table E.7 Total cost for implementation in the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$2,577,000	$3,027,000	$233,600	$5,837,000
Nibbs Creek	$1,246,000	$827,600	$74,740	$2,149,000
Deep Creek	$3,612,000	$3,859,000	$342,900	$7,814,000
West Creek	$1,349,000	$855,800	$98,760	$2,304,000
Total	**$8,784,000**	**$8,569000**	**$750,000**	**$18,100,000**

Numbers are rounded to four significant digits.

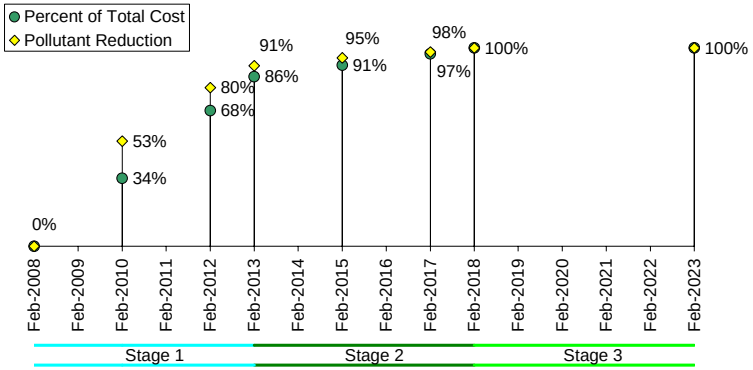

Figure E.1 Timeline for implementation in the Flat Creek watershed.

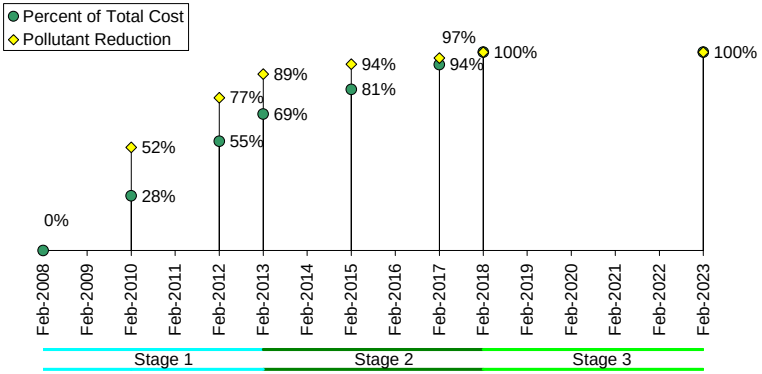

Figure E.2 Timeline for implementation in the Nibbs Creek watershed.

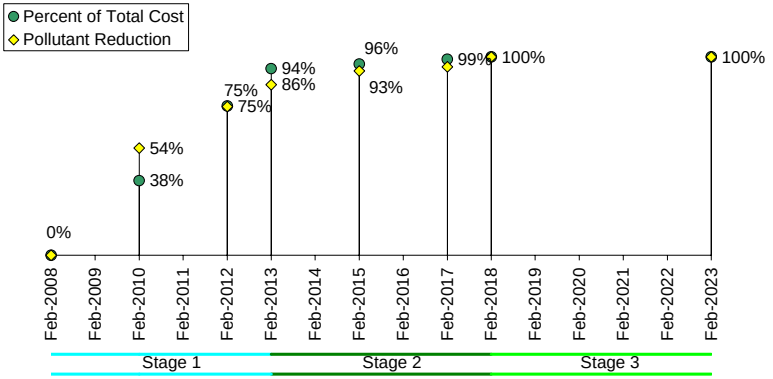

Figure E.3 Timeline for implementation in the Deep Creek watershed.

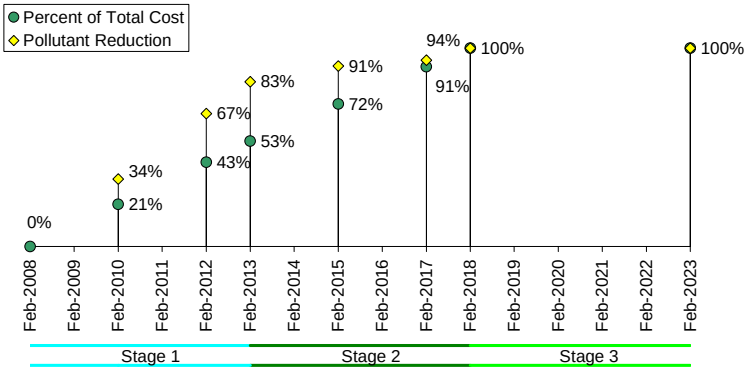

Figure E.4 Timeline for implementation in the West Creek watershed.

Introduction

The Federal Clean Water Act (CWA) that became law in 1972 requires that all U.S. streams, rivers, and lakes meet certain water quality standards. The CWA also requires that states conduct monitoring to identify polluted waters or those that do not meet standards. Through this required program, the state of Virginia has found that many stream segments do not meet state water quality standards for protection of the five beneficial uses: fishing, swimming, shellfish, aquatic life (benthic), and drinking.

When a stream fails to meet the standards, it is listed as impaired on the CWA's Section 303(d) list. Flat Creek (VAP-J08R-01), Nibbs Creek (VAP-J09-01), Deep Creek (VAP-J11R-01) and West Creek (VAP-J11R-06) were listed as impaired on Virginia's 1996, 1998, 2002 and 2004 303(d) Total Maximum Daily Load Priority List and Reports respectively due to violations of the State's water quality standards for fecal coliform. This standard was changed to *E. coli* in 2003 because there is stronger correlation between concentrations of *E. coli* bacteria and incidence of gastrointestinal illness than there is with fecal coliform. All four impairments remained on Virginia's 2006 Integrated 305(b)/303(d) report. The impaired segment on Flat Creek begins at the confluence with Nibbs Creek and continues downstream to the confluence with the Appomattox River (3.99 miles). The Nibbs Creek impaired segment begins at the Amelia Courthouse STP and continues downstream to the confluence with Flat Creek (5.43 miles). The Deep Creek impaired segment begins at the confluence with Spindlers Run and continues downstream to the confluence with Beaverpond Creek (7.41 miles). The impaired segment on West Creek begins at the Tanners Branch confluence and continues downstream to the confluence with Deep Creek (7.22 miles). The impaired segments are shown in Figure 1.

Flat Creek, Nibbs Creek, Deep Creek and West Creek are all part of the James River Basin and are located within USGS hydrologic unit code 02080207 (Appomattox River). The Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds are approximately 90,752; 16,566; 117,914 and 30,995 acres respectively.

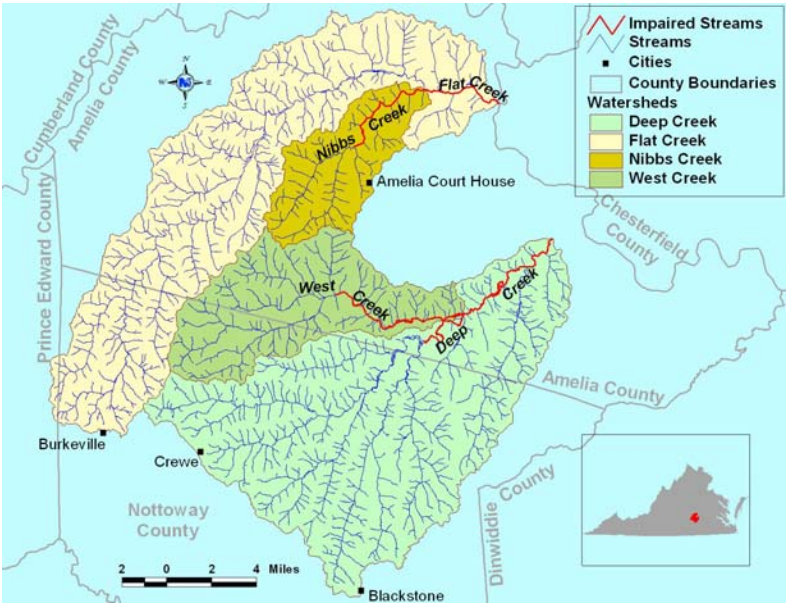

Figure 1. The impaired segments of Flat Creek, Nibbs Creek, Deep Creek and West Creek.

The CWA and the U.S. Environmental Protection Agency (EPA) (40 CFR Part 130) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. A TMDL accounts for seasonal variations and must include a margin of safety (MOS). The TMDL process includes 3 different steps after a stream is listed on the impaired waters or 303(d) list. The first step is to conduct a TMDL study. The TMDL study results are explained in the Review of the TMDL Development Study section of this booklet.

Once a TMDL is developed and approved by the EPA and the State Water Control Board (SWCB), measures must be taken to reduce pollution levels in the stream. The second step in the process is the development of an Implementation Plan (IP), which has now been completed for the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds. This plan outlines how the TMDL goals can be accomplished in the watersheds (drainage areas) with the impaired

streams. The IP describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process. This booklet summarizes the IP for the *E. coli* impairment in Flat Creek, Nibbs Creek, Deep Creek, and West Creek.

In fulfilling the state's requirement for the development of an Implementation Plan, a framework has been established for reducing *E. coli* levels, and achieving the water quality goals for the Flat Creek, Nibbs Creek, Deep Creek and West Creek impaired segments. With successful completion of the IP, we continue on to the third step in the TMDL process to meet these water quality goals, which is implementation of the plan. Approval of the IP will increase the opportunities for funding during implementation, and will provide residents of these four watersheds with a guide to improve water quality in their community and enhance their natural resources. The implementation of this plan will reduce levels of bacteria in Flat Creek, Nibbs Creek, Deep Creek, West Creek and their tributaries. The benefits of the implementation of this plan are described in detail in the Cost/Benefit Analysis chapter of this document. In short, the implementation of this plan may provide benefits to homeowners and farmers, as well as those that wish to swim in these creeks.

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the SWCB to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for IPs to be approved by the Commonwealth, they must meet the requirements as outlined by WQMIRA. WQMIRA requires that IPs include the following:

- date of expected achievement of water quality objectives,
- measurable goals,
- necessary corrective actions, and
- associated costs, benefits, and environmental impact of addressing the impairment.

Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. The EPA does, however, outline the minimum elements of an approvable IP in its 1999 Guidance for Water Quality-Based Decisions: The TMDL Process.
The listed elements include:

- a description of the implementation actions and management measures,
- a time line for implementing these measures,

- legal or regulatory controls,
- the time required to attain water quality standards, and
- a monitoring plan and milestones for attaining water quality standards.

It is strongly suggested that the EPA recommendations be addressed in the IP, in addition to the required components as described by WQMIRA.

This booklet is an abbreviated version of the full IP report, which can be obtained by contacting the Virginia Department of Environmental Quality (DEQ) or the Virginia Department of Conservation and Recreation (DCR) offices.

Key components of the implementation plan are discussed in the following sections:

- Review of the TMDL Development Study
- Process for Public Participation
- Assessment of Needs
- Implementation, and
- Cost/Benefit Analysis

Review of the TMDL Development Study

Flat Creek, Deep Creek and West watersheds are located in both Ameila and Nottoway Counties in Virginia. The Nibbs Creek watershed is located within Amelia County, Virginia. MapTech, Inc. was contracted to develop the *E. coli* bacteria TMDL for all of the impaired segments in the Appomattox River Basin. This TMDL was approved in August 2004 by the USEPA and is posted at www.deq.virginia.gov. The first step in developing the implementation plan was to review this TMDL study. The result of the TMDL study was used to determine the water quality goals and associated pollutant reductions that would need to be addressed in the implementation plan.

In addition to performing analyses of fecal bacteria and *E. coli* concentrations for the TMDL, a water quality analysis method called Bacteria Source Tracking (BST) was performed on water samples from Flat, Nibbs, Deep and West Creeks. BST is intended to aid in identifying the sources of fecal contamination in water bodies (*i.e.*, human, pets, livestock, or wildlife). The BST results provided insight into the likely sources of fecal contamination and the distribution of fecal bacteria in the creeks. Having this information will improve the

chances for success in implementing solutions by allowing better targeting of the sources of bacteria in the watersheds. Figures 2 - 6 show the load weighted average BST results for Flat Creek, Nibbs Creek, Deep Creek and West Creek respectively. These averages were calculated from the 12 monthly samples collected during TMDL development. The weighting process favors the values that are associated with highest *E. coli* concentrations because those concentrations often exceed the water quality standard and it is more important to know what the dominant sources of bacteria are when *E. coli* exceeds the water quality standard. A summary of the final *E. coli* allocations for the different sources in the watersheds that resulted from the TMDL study is given in Table 1. The correction of straight pipes and failing septic systems are a requirement of the *E. coli* TMDL. In addition, the majority of livestock in all four watersheds will need to be excluded from the creeks. Runoff carrying *E. coli* into the creeks after rain events must also be addressed. Reductions to wildlife fecal bacteria will not be addressed in this implementation plan. Rather, the objective of this plan is to address those sources of bacteria that can be attributed to human activities including land use and natural resource management.

These TMDL studies were conducted because Flat Creek, Nibbs Creek, Deep Creek and West Creek were not meeting state water quality standards for the recreation use (swimming). In order to meet the water quality goals established by the TMDL studies, any water sample from the stream must be equal to or less than 235 colony forming units per 100 milliliters (cfu/100mL) at all times. Over all the samples collected within a 30 day period the geometric mean of this data must be equal or less than 126 cfu/100mL.

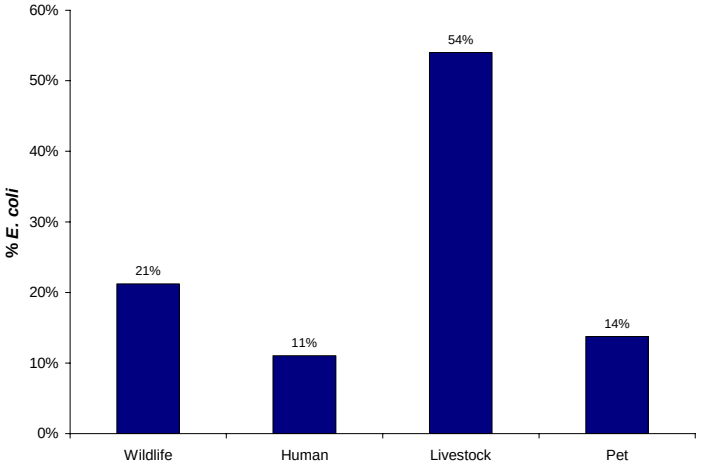

Figure 2. Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Flat Creek at station 2-FLA001.95.

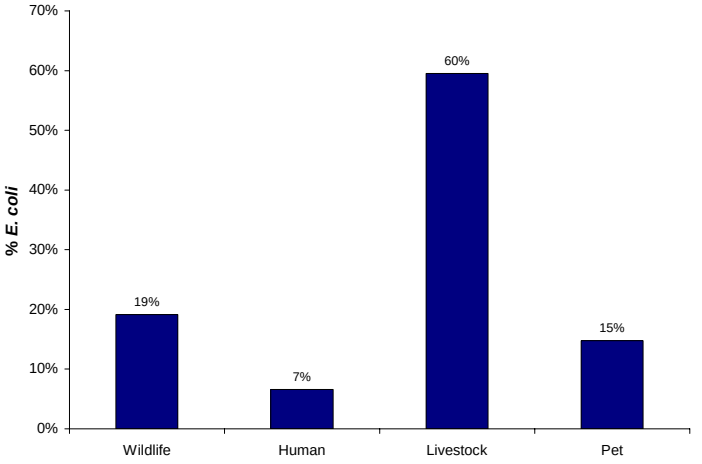

Figure 3. Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Nibbs Creek at station 2-NBB001.54.

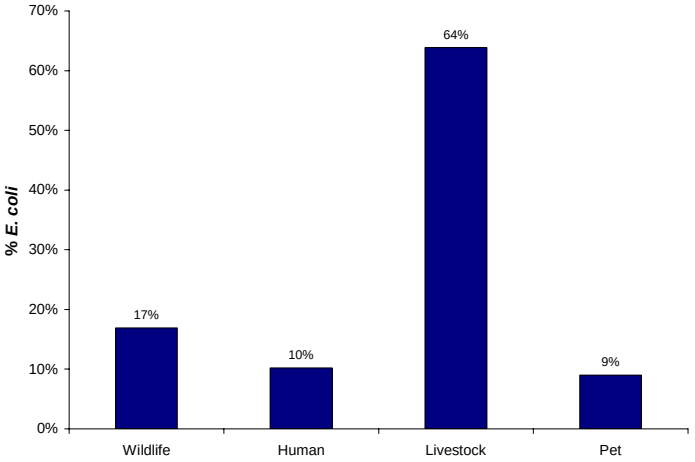

Figure 4. Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Nibbs Creek at station 2-NBB003.65.

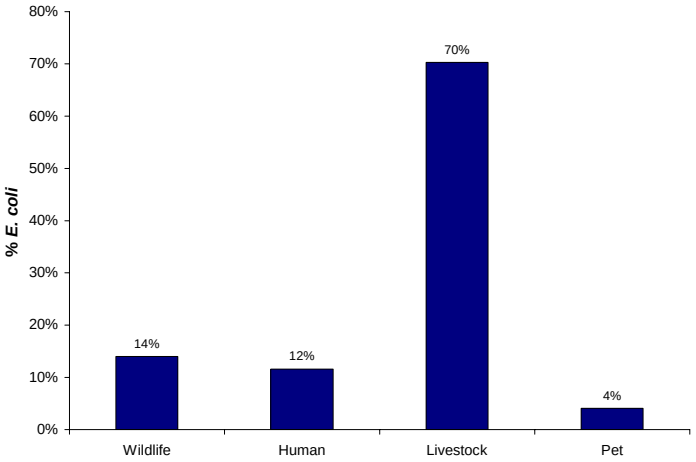

Figure 5. Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for Deep Creek at station 2-DPP005.20.

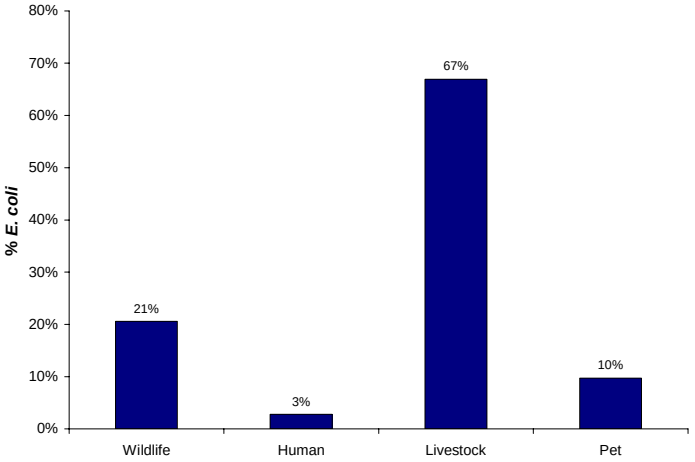

Figure 6. Load weighted averages for E. coli concentrations and fecal bacteria sources conducted by DEQ during development of the TMDL for West Creek at station 2-WET004.96.

Table 1. Load reductions allocated for Flat Creek, Nibbs Creek, Deep Creek, and West Creek TMDLs.

Impairment	Failed Septic Systems and Straight Pipes	Direct Livestock	Nonpoint Sources	Direct Wildlife*
Flat Creek	100%	100%	99%	51%
Nibbs Creek	100%	100%	99%	20%
Deep Creek	100%	100%	99%	70%
West Creek	100%	100%	99%	62%

*Direct deposition of waste into the stream from wildlife will not be explicitly addressed by this implementation plan (gray in table 1)

Process for Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watershed, county government, DEQ, DCR, Virginia Department of Health (VDH), Virginia Cooperative Extension (VCE), Virginia Department of

Forestry (DOF), Piedmont Soil and Water Conservation District (PSWCD), and MapTech, Inc. Every citizen and interested party in the watershed area is encouraged to become involved in the implementation process and contribute in any way that helps in restoring the health of the streams.

Public participation took place on three levels. First, open meetings were held to inform the public of the end goals and status of the project. Second, specialized working groups were assembled to discuss specific implementation strategies for different sources of bacteria in the watersheds. The working groups included: residential/urban, agricultural and government. Third, a Steering Committee was formed with representation from DEQ, DCR, VDH, PSWCD, DOF, Amelia and Nottoway County Government and representatives from the working groups.

Assessment of Needs: Recommended Actions

Agricultural BMPs

Streamside fencing is one of the best ways to reduce bacteria levels in the stream. This will remove direct livestock defecation in the stream and prevent the trampling of the stream banks. The quantity of streamside fencing needed was determined through spatial analyses of land uses, the stream network, and archived data. Additionally, input from local agency representatives and citizens were used to verify the analyses.

The length of fencing required on perennial streams in the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds is approximately

22.8; 12.1; 23.3 and 11.7 miles respectively. In order to accomplish these goals, the state cost-share program for agricultural best management practices (BMPs) was utilized in the implementation plan. The total fencing needed was divided up among the different BMPs offered through the state cost-share program that included a fencing component. Table 2 shows the fencing systems required for each impaired watershed needed to meet the livestock exclusion goal. Both the grazing land and stream protection practices include a 35-ft buffer component. These vegetated or forested buffers will provide an additional water quality benefit by trapping bacteria moving towards the streams through runoff. Therefore, these practices will provide some of the best water quality benefits in terms of reducing both direct (cows defacating in the stream) and land- based (runoff of manure into the stream during rain events) contributions of bacteria to the stream.

Table 2. SL-6 and WP-2T fence exclusion systems required for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Watershed	SL-6 systems	WP-2T systems
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Due to the large reductions needed from land-based loads of *E. coli* bacteria, additional BMPs for pasture and cropland are also necessary. Estimates of all agricultural BMPs needed for Stage I, the first five years (delisting from the 303(d) list) in the watershed are listed in Table 3.

Table 3. Agricultural land based reduction BMPs required for delisting.

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All failing septic systems and straight pipes must be identified and replaced during implementation since a 99 - 100% load reduction from direct and nonpoint source (NPS) human waste is required to meet the TMDL goals. In addition, straight pipes are illegal in the Commonwealth of Virginia. The estimated numbers of straight pipes and failing septic systems were reported in the TMDL studies and are shown in Table 4. Based on input from the county health department the number of straight pipes in the watersheds was reduced for the implementation plan and the number of failing septic systems was increased.

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Watershed	Houses with Standard Septic Systems	Potential Failing Septic Systems - TMDL	Potential Straight Pipes - TMDL	Potential Failing Septic Systems – IP*	Potential Straight Pipes – IP*
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The Flat Creek, Nibbs Creek, Deep Creek and West Creek TMDL allocations call for large reductions to land-based residential loads. In order to achieve these reductions, the BMPs in Table 5 must be implemented. The Pet Waste Program shown in the table includes distributing information on how pet waste should be disposed of. An additional approach is also proposed to help eliminate pet waste in homeowners yards and dog kennels instead of focusing only on public places. This focus includes the use of pet waste composters and includes the distribution of pet waste composters to households and kennels in the watersheds with dogs. This could be accomplished through partnerships with local stores selling pet food, the Amelia and Nottoway County Animal Shelters and the SPCA.

Additionally, financial assistance could be provided through grants to provide cost-share for homeowners to pump out their septic tanks. While it is not likely that sufficient grant funds will be available to assist every homeowner in the watersheds with a pumpout, it is expected that this type of outreach will raise local awareness and lead homeowners to assume responsibility for maintaining their systems. In turn, this will help to prevent septic system failures in the future.

Table 5. All residential BMPs recommended to meet the delisting requirements (first 5 years of implementation).

Residential Control Measure Description	VA Cost-Share Practice Number	Flat Creek	Nibbs Creek	Deep Creek	West Creek	Total
Septic Systems Pump-outs		1,024	258	1,185	273	2,740
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Residential Pet Waste Education Program	NA	1	1	1	1	1*
Residential Pet Waste Composters	NA	600	240	1,227	219	2,286

*Only one pet waste education program will be used for all four watersheds.

Technical Assistance

Technical assistance needed for the project was measured in full time equivalents (FTEs), with 1 FTE being equal to one full time position. Two (2) FTEs are needed per year during the first 5 years of the implementation period for this project. It is estimated that only 1 FTE will be needed in the second 5 years of the project primarily for the agricultural BMPs. The PSWCD currently has a full time position funded through the state to provide technical assistance for farmers to implement the agricultural BMPs identified in the implementation plan

Implementation

Costs

Potential funding sources available during implementation were identified during plan development. Detailed descriptions can be obtained from the PSWCD, DCR, NRCS, and VCE. Sources include:

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Agricultural Best Management Practices Loan Program
- Virginia Small Business Environmental Assistance Fund Loan Program
- Virginia Water Quality Improvement Fund
- Community Development Block Grant Program
- Conservation Reserve Program (CRP)
- Conservation Reserve Enhancement Program (CREP)
- Environmental Quality Incentives Program (EQIP)
- Wildlife Habitat Incentive Program (WHIP)
- Wetland Reserve Program (WRP)
- Clean Water State Revolving Fund

Timeline and Milestones

The end goals of implementation are restored water quality of Flat, Nibbs, Deep and West Creeks; and the removal of these streams from Virginia's Section 303(d) list. Progress toward end goals will be assessed during implementation through tracking of BMP installations and continued water quality monitoring.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of BMPs installed each year, while water quality milestones establish the corresponding improvements in water quality that can be expected. The milestones described here are intended to achieve full implementation within 10 years. Timelines with pollutant reductions expected are shown in Figures 7 - 10.

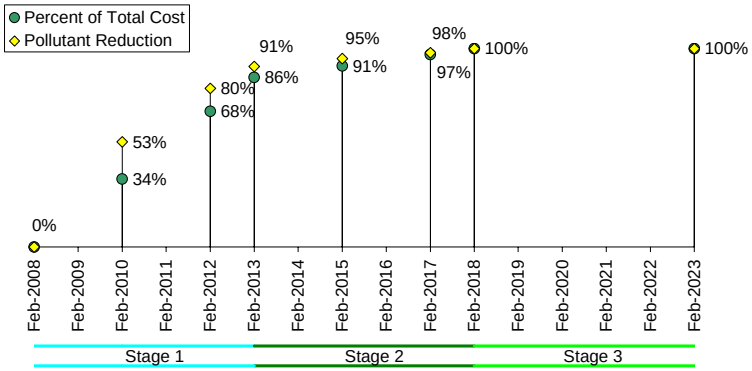

Figure 7. Timeline for implementation in the Flat Creek watershed.

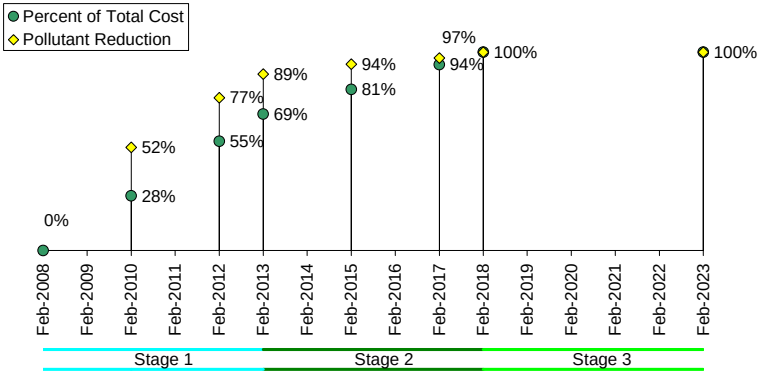

Figure 8. Timeline for implementation in the Nibbs Creek watershed.

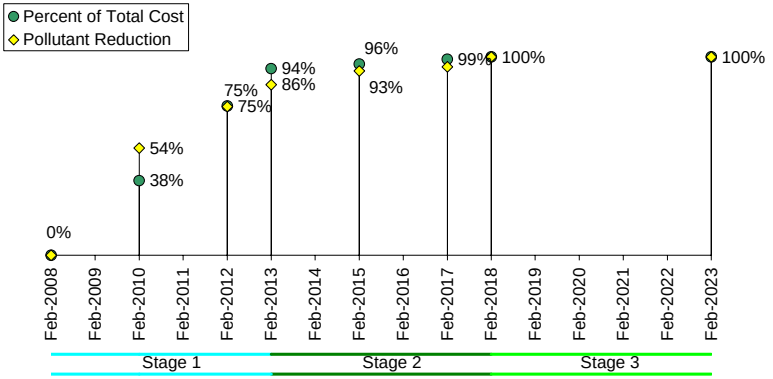

Figure 9. Timeline for implementation in the Deep Creek watershed.

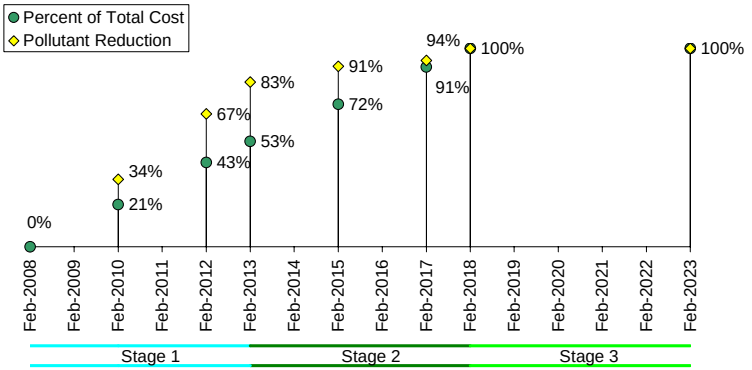

Figure 10. Timeline for implementation in the West Creek watershed.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures first. These measures will be the focus of Stage I. Following Stage I implementation, the Steering Committee should evaluate water quality improvements and determine how to proceed to complete implementation during Stage II. Stage II documents BMPs that are necessary for the stream to fully comply with the TMDL allocation requirements. The Department of Environmental Quality's *E. coli* bacterial standard states that there can be no exceedances of either the geometric mean (126 cfu/100 ml) or the instantaneous (235 cfu/100 ml) values. Complying with the standard requires BMPs that are more difficult to implement.

Tables 6 - 9 show the types and quantities of BMPs to be installed for each impairment during each stage. It is anticipated that the de-listing of the impaired segments from the Section 303(d) list will occur by 2018.

Table 6. Stage I and Stage II implementation goals for Flat Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Grazing Land Protection System (SL-6)	System	82	
Stream Protection System (WP-2T)	System	4	
Small Acreage Grazing (SL-6A)	System	1	
Improved Pasture Management	Acres	2,877	
Streamside Fence Maintenance	Feet	5,385	5,385
Poultry Waste Storage Facilities	System	4	
Dairy Waste Storage Facilities	System	2	
Loafing Lot Mnt. WP-4B	System	1	
Manure Incorporation	Acres	838	
Vegetated Buffers – Cropland	Acres	2	
Retention Ponds – Pasture	Acres		5,400
Residential			
Septic Systems Pump-outs*	System	1,024	1,023
Septic System Repair (RB-3)	System	215	
Septic System Installation/Replacement (RB-4)	System	217	
Alternative Waste Treatment System Installation (RB-5)	System	23	
Residential Pet Waste Program	Program	1	ongoing
Residential Pet Waste Composters	Composter	600	

* It is not anticipated that sufficient grant funds will be available to fund the septic tank pumpout program to the extent shown above. It is expected that it will be necessary to gain financial and technical support for the program from other private and public funding sources.

Table 7. Stage I and Stage II implementation goals for Nibbs Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Grazing Land Protection System (SL-6)	System	44	
Stream Protection System (WP-2T)	System	2	
Small Acreage Grazing SL-6A	System	1	
Improved Pasture Management	Acres	930	
Streamside Fence Maintenance	Feet	2,551	2,550
Poultry Waste Storage Facilities	System	0	
Dairy Waste Storage Facilities	System	1	
Loafing Lot Mnt. WP-4B	Acres	0	
Manure Incorporation	Acres	578	
Vegetated Buffers – Cropland	Acres	4.5	
Retention Ponds – Pasture	Acres	0	2,789
Residential			
Septic Systems Pump-outs*	System	258	257
Septic System Repair (RB-3)	System	58	
Septic System Installation/Replacement (RB-4)	System	59	
Alternative Waste Treatment System Installation (RB-5)	System	7	
Residential Pet Waste Program	Program	1	ongoing
Residential Pet Waste Composters	Composter	240	

* It is not anticipated that sufficient grant funds will be available to fully fund the septic tank pumpout program to the extent shown above. It is expected that it will be necessary to gain financial and technical support for the program from other private and public funding sources.

Table 8. Stage I and Stage II implementation goals for Deep Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Grazing Land Protection System (SL-6)	System	84	
Stream Protection System (WP-2T)	System	4	
Small Acreage Grazing SL-6A	System	1	
Improved Pasture Management	Acres	4,204	
Streamside Fence Maintenance	Feet	5,024	5,024
Poultry Waste Storage Facilities	System	0	
Dairy Waste Storage Facilities	System	1	
Loafing Lot Mnt. WP-4B	Acres	1	
Manure Incorporation	Acres	1,571	
Vegetated Buffers – Cropland	Acres	12.0	
Retention Ponds – Pasture	Acres		12,613
Residential			
Septic Systems Pump-outs*	System	1,185	1,185
Septic System Repair (RB-3)	System	279	
Septic System Installation/Replacement (RB-4)	System	280	
Alternative Waste Treatment System Installation (RB-5)	System	29	
Residential Pet Waste Program	Program	1	ongoing
Residential Pet Waste Composters	Composter	1,227	

* It is not anticipated that sufficient grant funds will be available to fully fund the septic tank pumpout program to the extent shown above. It is expected that it will be necessary to gain financial and technical support for the program from other private and public funding sources.

Table 9. Stage I and Stage II implementation goals for West Creek.

Control Measure	Unit	Stage I	Stage II
Agricultural			
Grazing Land Protection System (SL-6)	System	42	
Stream Protection System (WP-2T)	System	2	
Small Acreage Grazing SL-6A	System	1	
Improved Pasture Management	Acres	1,282	
Streamside Fence Maintenance	Feet	2,486	2,486
Poultry Waste Storage Facilities	System	0	
Dairy Waste Storage Facilities	System	0	
Loafing Lot Mnt. WP-4B	Acres	0	
Manure Incorporation	Acres	614	
Vegetated Buffers – Cropland	Acres	2	
Retention Ponds – Pasture	Acres		3,845
Residential			
Septic Systems Pump-outs*	System	273	272
Septic System Repair (RB-3)	System	63	
Septic System Installation/Replacement (RB-4)	System	63	
Alternative Waste Treatment System Installation (RB-5)	System	6	
Residential Pet Waste Program	Program	1	ongoing
Residential Pet Waste Composters	Composter	219	

* It is not anticipated that sufficient grant funds will be available to fully fund the septic tank pumpout program to the extent shown above. It is expected that it will be necessary to gain financial and technical support for the program from other private and public funding sources.

Targeting

The four impaired watersheds were divided into subwatersheds for TMDL modeling purposes and this also helps with the targeting of BMP practices (Figures 11 and 12). Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each subwatershed. The subwatersheds were ranked in descending order based on the ratio of animals per fence length. Failing septic systems were ranked based on the sum of the bacteria loads in each watershed. If feasible, efforts should be made to prioritize resources by subwatersheds in the order shown in Table 10.

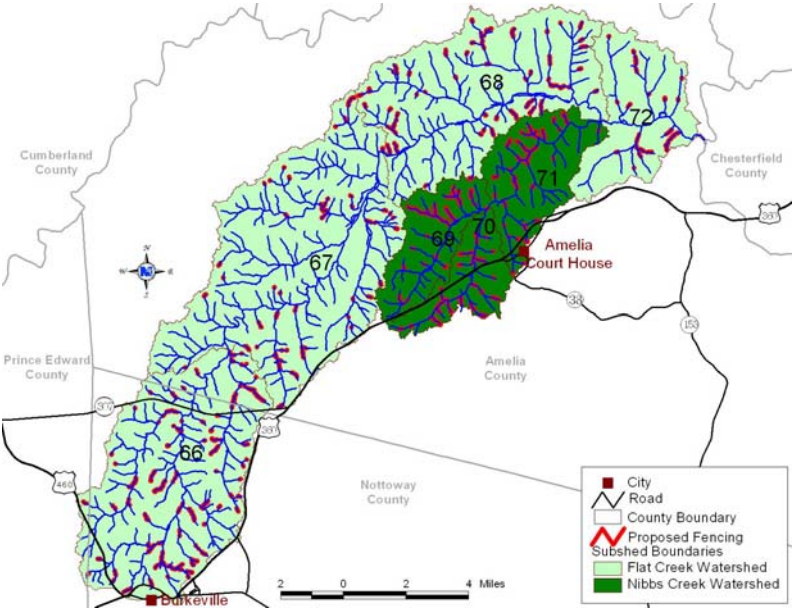

Figure 11. Area available for streamside fencing the Flat Creek and Nibbs Creek watersheds.

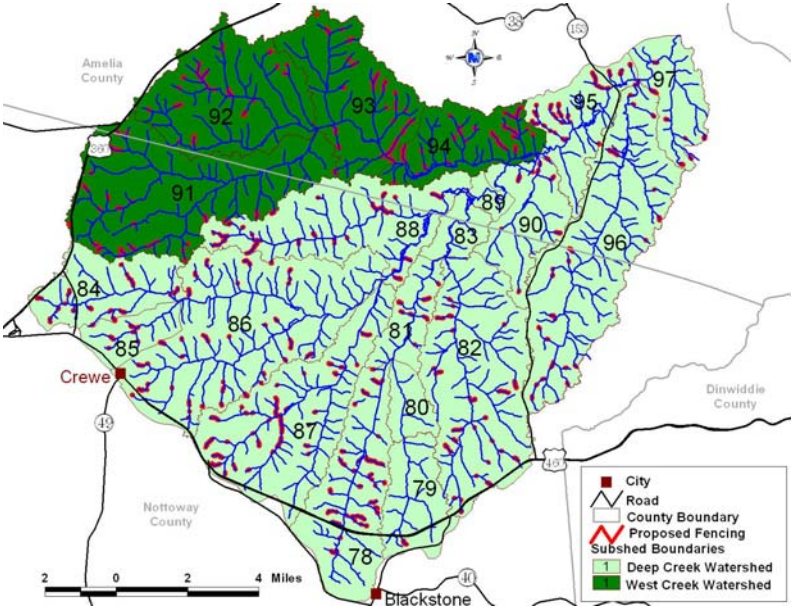

Figure 12. Area available for streamside fencing the Deep Creek and West Creek watersheds.

Table 10. Targeting subwatershed order for residential waste BMPs and streamside fencing.

Stream	Failing Septic Systems	Streamside Fencing
Flat Creek	66, 67, 68, 72	66, 67, 68, 72
Nibbs Creek	71, 70, 69	69, 71, 70
Deep Creek	86, 82, 96, 87, 78, 85, 84, 88, 95, 79, 97, 80, 81, 90, 83, 89	88, 87, 95, 97, 90, 81, 85, 78, 82, 86, 84, 96, 79, 80, 83, 89
West Creek	91, 93, 92, 94	94, 92, 93, 91

Cost / Benefit Analysis

Associated cost estimates of agricultural, residential, and urban BMPs were calculated by multiplying the unit cost by the number of units in each watershed.

Tables 11 and 12 show the estimated cost of installing the recommended agricultural and residential BMPs in Stages I and II. The total cost for Stage I for all four watersheds is $13.78 million.

It was determined by the PSWCD that it would require $50,000 to support the salary, benefits, travel, training, and incidentals for education of one technical FTE. With quantification analysis yielding a need for two technical FTEs per year for the first five years of implementation and one FTE per year for the subsequent ten years, the maximum total cost to provide technical assistance during implementation is expected to be $750,000 (Tables 10 and 11). Factoring in technical assistance costs, the total cost for full implementation in all four watersheds comes to $18.10 million (Table 13).

The primary benefit of this implementation is cleaner waters in Amelia and Nottoway Counties. Specifically, fecal bacteria contamination in Flat Creek, Nibbs Creek, Deep Creek and West Creek will be reduced to meet water quality standards and allow for safe recreational use. It is difficult to gauge the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources, through contact with surface waters, should be considerably reduced.

Additionally, because of streambank protection that will be provided through exclusion of livestock from streams, the aquatic habitat will be improved in these waters. The vegetated buffers that are established will also serve to reduce bacteria runoff to the stream from upslope locations. In addition, as trees and shrubs in vegetated buffers grow, they serve as excellent shade sources for streams. This in turn reduces water temperature in the stream and increases dissolved oxygen, thereby improving aquatic habitat for numerous aquatic organisms. In areas where pasture management is improved, less bacteria will be washed into streams following precipitation events. Bacteria concentrations in the stream should be at or below the state standards.

Table 11. Costs to implement Stage I (years 1 - 5) for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$1,812,000	$2,797,000	$156,100	$4,765,000
Nibbs Creek	$852,000	$769,800	$49,420	$1,672,000
Deep Creek	$1,854,000	$3,592,000	$230,200	$5,676,000
West Creek	$810,000	$794,600	$64,200	$1,668,000
Total	**$5,329,000**	**$7,953,000**	**$500,000**	**$13,780,000**

Numbers are rounded to four significant digits.

Table 12. Costs to implement Stage II (years 6 - 10) for Flat Creek, Nibbs Creek, Deep Creek and West Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$764,000	$230,200	$77,430	$1,072,000
Nibbs Creek	$393,800	$57,820	$25,320	$477,000
Deep Creek	$1,758,000	$266,600	$112,700	$2,137,000
West Creek	$539,300	$61,200	$34,560	$635,100
Total	**$3,455,000**	**$615,800**	**$250,000**	**$4,321,000**

Numbers are rounded to four significant digits.

Table 13. Total cost for implementation in the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total ($)
Flat Creek	$2,577,000	$3,027,000	$233,600	$5,837,000
Nibbs Creek	$1,246,000	$827,600	$74,740	$2,149,000
Deep Creek	$3,612,000	$3,859,000	$342,900	$7,814,000
West Creek	$1,349,000	$855,800	$98,760	$2,304,000
Total	**$8,784,000**	**$8,569000**	**$750,000**	**$18,100,000**

Numbers are rounded to four significant digits.

A clean water source has been shown to improve herd health. Fresh clean water is the primary nutrient for livestock. Many livestock illnesses can be spread through contaminated water supplies. A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills. Beef producers in several Virginia Counties have reported weight gains in cattle after providing alternative water sources. Studies also show increased milk and butterfat production from dairy cattle ingesting water from a clean source.

Taking the opportunity to initiate an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 - 40% and, consequently, improve the profitability of the operation. Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits by allowing higher stocking rates and increasing the amount of gain per acre. In general, many of the agricultural BMPs being recommended will provide both environmental benefits and economic benefits to the farmer.

The residential programs will play an important role in improving water quality, since human waste can carry human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry with it. In terms of economic benefits to homeowners, an improved understanding of private sewage systems (including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance) will give homeowners

the tools needed for extending the life of their systems and reducing the overall cost of ownership. Proper maintenance includes: knowing the location of the system components and protecting them (*e.g.*, not driving or parking on top of them, not planting trees where roots could damage the system), keeping hazardous chemicals out of the system, and pumping out the septic tank every three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing the entire system.

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians, and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document are expected to provide economic benefits, as well as environmental benefits, to the landowner.

Specifically, alternative (clean) water sources, exclusion of livestock from streams, intensive pasture management, and private sewage system maintenance will each provide economic benefits.

Monitoring

Water quality monitoring in support of TMDL implementation planning and best management practices (BMP) implementation will be conducted at up to 27 stations, one in each of 27 subwatersheds in the Flat, Nibbs, Deep and West Creek watersheds identified in the Appomattox River Basin TMDL. The goal is to collect monthly *E. coli* water quality samples below BMPs installed in each watershed and document the resulting changes in water quality, pending resource availability. Monitoring will begin in 12 of the 27 subwatersheds in January 2008 where BMPs have been installed or are planned in the near future. Citizen monitoring will be encouraged in as many subwatersheds as possible to reduce State Laboratory costs, however current funding for citizen coliscan monitoring has been eliminated for budget considerations. Field parameters (pH, temperature, DO and conductivity) and *E. coli* will be sampled monthly. The proposed monitoring stations are listed in Tables 14 and 15 and shown in Figure 13.

Table 14. DEQ's Proposed and Original Monitoring Stations in the Flat Creek, Nibbs Creek, Deep Creek and West Creek Watersheds.

Subwatershed/Map No	Description	Station Name	Location	Impaired Watershed
66	Flat Creek #4	2-FLA028.98	Flat Cr at Rt. 629	Flat Creek
67	Flat Creek #3	2-FLA013.95	Flat Cr at Rt 644	Flat Creek
68	Flat Creek #2	2-FLA006.49	Flat Cr at Rt. 609	Flat Creek
69	North Branch Nibbs Creek	2-NBC002.65	N Br Nibbs Cr at Rt. 687	Nibbs Creek
70	South Branch Nibbs Creek	2-NBX001.10	S Br Nibbs Cr at Rt. 656	Nibbs Creek
71	Nibbs Creek mouth	2-NBB001.54	Nibbs Cr at Rt. 636	Nibbs Creek
72	Flat Creek mouth #1	2-FLA001.95	Flat Cr at Rt 604	Flat Creek
78	Cellar Creek #3	2-CLR007.04	Cellar Cr at Rt. 607	Deep Creek
79	Lees Creek #2	2-LDJ002.96	Lees Cr 0.5 mi above Lake Nottoway	Deep Creek
80	Lees Creek#1	2-LDJ000.58	Lees Cr at Rt. 606 below dam	Deep Creek
81	Cellar Creek #2	2-CLR004.04	Cellar Cr at Rt. 610	Deep Creek
82	Bland Creek	2-BLO001.85	Bland Cr at Rt. 610	Deep Creek
83	Cellar Creek #1	2-CLR001.23	Cellar Cr off Paulett Lane	Deep Creek
84	Deep Creek #5	2-DPC024.68	Deep Cr at Rt. 630	Deep Creek
85	UT to Deep Creek	2-XGP001.80	UT to Deep Cr at Rt. 619 below STP	Deep Creek
86	Deep Creek #4	2-DPC019.03	Deep Cr at Rt. 611	Deep Creek
87	Woody Creek	2-WDY003.04	Woody Cr at Rt. 607	Deep Creek

Table 15. DEQ's Proposed and Original Monitoring Stations in the Flat Creek, Nibbs Creek, Deep Creek and West Creek Watersheds.(continued)

Subwatershed/Map No	Description	Station Name	Location	Impaired Watershed
88	Little Creek	2-LTA001.23	Little Cr at Rt. 614	Deep Creek
89	Deep Creek #3	2-DPC010.88	Deep Cr at Rt. 615	Deep Creek
90	Spindlers Run	2-SPD000.58	Spindlers Run at Rt. 615	Deep Creek
91	West Creek #2	2-WET008.31	West Cr at Rt. 649	West Creek
92	South Buckskin Creek	2-SBC001.15	S Buckskin Cr at rt. 640	West Creek
93	West Creek #1	2-WET004.96	West Cr at Rt. 614	West Creek
94	UT to West Creek	2-XZP000.54	Unnamed Trib to west Cr at Rt. 653	West Creek
95	Deep Creek #2	2-DPC005.20	Deep Cr at Rt. 153	Deep Creek
96	Sweathouse Creek	2-SWT000.81	Sweathouse Cr at Rt. 153	Deep Creek
97*	Deep Creek mouth #1	2-DPC000.59	Deep Cr at Rt. 612	Deep Creek

* Exisitng station located just downstream from subwatershed 97.

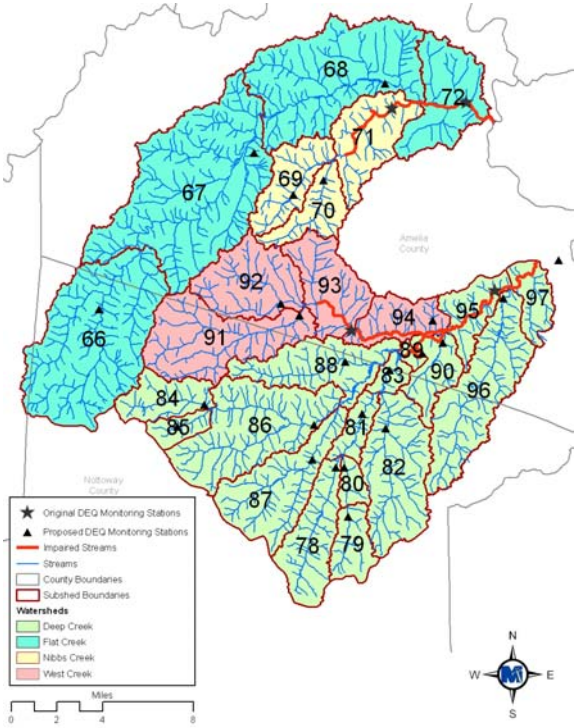

Figure 13. DEQ's Original and Proposed Monitoring Stations in the flat creek, Nibbs Creek, Deep Creek and West Creek Watersheds.

Education

Personnel from the Piedmont SWCD will initiate contact with farmers in all four watersheds to encourage the installation of agricultural BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The technical staff for the IP will conduct a number of outreach activities in the watershed to raise local awareness, encourage community support and participation in reaching the implementation plan milestones. Such activities will include information exchange through newsletters, postcard mailings, field days and, presentations at local Ruritan and Rotary Clubs. The technical staff will work with organizations such as Virginia Cooperative Extension to sponsor farm tours and field days.

Stakeholders' Roles and Responsibilities

Achieving the goals of this effort (*i.e.,* improving water quality and removing these waters from the impaired waters list) is dependent on stakeholder participation. Both the local stakeholders who are charged with the implementation of control measures and the stakeholders who are responsible for overseeing our nation's human health and environmental programs must first acknowledge there *is* a water quality problem, and then make the needed changes in our operations, programs, and legislations to address these pollutants.

The EPA has the responsibility for overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are six state agencies responsible for regulating activities that impact water quality with regard to this implementation plan. These agencies include: DEQ, DCR, VDH, VCE, DOF, and Virginia Department of Agriculture and Consumer Services (VDACS).

DEQ has responsibility for monitoring state waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999 the Virginia General Assembly passed legislation requiring DEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008 DEQ assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids as a directed by the Virginia General Assembly in 2007. DEQ's Office of Land Application Programs within the Water Quality Division manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied.

DCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. Historically, most DCR programs have dealt with agricultural NPS pollution through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the TMDL which required 100% participation of stakeholders. To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs must be reevaluated to account for 100% participation. It should be noted that DCR does not have regulatory authority over the majority of NPS issues addressed here.

The Piedmont SWCD will provide outreach, technical and financial assistance to farmers and homeowners in the Flat Creek, Nibbs Creek, Deep Creek and West Creek watersheds through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural and residential BMPs. Education and outreach activities are a significant portion of their responsibilities. The Piedmont SWCD is currently receiving technical assistance funding to support their duties in these four watersheds.

Through Virginia's Agricultural Stewardship Act, the VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. The enforcement of the Agricultural Stewardship Act is entirely complaint-driven.

VDH is responsible for maintaining safe drinking water measured by standards set by EPA. Their duties also include septic system regulation and, historically, regulation of biosolids land application. Like VDACS, VDH's program is complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In the scheme of

this TMDL IP, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes, respectively.

State government has the authority to establish state laws that control delivery of pollutants to local waters. In addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. In hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality.

Local governments can play a very active role in the implementation process. For example they could promote a septic system maintenance program. This could be done by handing out literature when individuals apply for a building permit. Some county governments require that additional land on a homeowner's property be set aside for a new drainfield in case of a septic system failure. County governments could also play an active role in the proper disposal of pet waste. There are approximately 183 20-dog kennels and 61 50-dog kennels in Amelia and Nottoway Counties combined. When licenses for dog kennels are issued the owners should be required to produce a plan for the proper disposal of waste from the facility. Future subdivisions should be developed with sustainable growth practices that minimize or eliminate storm water runoff. Local governments can also, in conjunction with the state, develop ordinances involving pollution prevention measures.

Successful implementation depends on stakeholders taking responsibility for their role in the process. While the primary role falls on the landowner, local, state and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. While it is unreasonable to expect that the natural environment (*e.g.*, streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to minimize anthropogenic problems. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives. However, if progress is not made toward restoring water quality using this voluntary approach, regulatory controls may be established and enforced.

Each watershed in the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographic boundaries and goals. These include but are not limited to TMDLs, Roundtables, Water Quality

Management Plans, erosion and sediment control regulations, stormwater management, Source Water Protection Program, and local comprehensive plans. Coordination of the implementation project with these existing programs could result in additional resources and increased participation.

List of Acronyms

BMP	Best Management Practice
CREP	Conservation Reserve and Enhancement Program
CWA	Clean Water Act
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FTE	Full Time Equivalent
GWG	Government Working Group
IP	Implementation Plan
NPS	Non Point Source Pollution
NRCS	Natural Resources Conservation Service
RWG	Residential Working Group
SL-6	Grazing Land Protection System
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
DCR	Virginia Department of Conservation and Recreation
DEQ	Virginia Department of Environmental Quality
VCE	Virginia Cooperative Extension
VDACS	Virginia Department of Agriculture and Consumer Services
VDH	Virginia Department of Health
DOF	Virginia Department of Forestry
WP-2T	Streambank Protection

List of Contacts

Virginia Dept. of Environmental Quality 4949-A Cox Road Glen Allen, VA 23060	(804) 527 - 5021
Virginia Dept. of Conservation and Recreation 101 N. 14th St., 11th Floor, Monroe Building Richmond, VA. 23219	(804) 225-4468
Virginia Dept. of Health Piedmont Health District 111 South Street 1st Floor Farmville, VA 23901	(434)-392-3984
Virginia Cooperative Extension Service 16360 Dunn Street Suite 202 Amelia, VA 23002	(804)-561-2481
Virginia Cooperative Extension Service 88 West Courthouse Road Nottoway, VA 23955	(434)-645-9315
Natural Resources Conservation Service Farmville Service Center 100 Dominion Drive Farmville, VA 23901	(434) 392-4906
Piedmont Soil and Water Conservation Service 100 Dominion Drive Farmville, VA 23901	(434) 392-378
Virginia Dept. of Agriculture and Consumer Services P.O. Box 1163 Richmond, VA 23218	(804) 786-3501
MapTech, Inc. 3154 State Street Blacksburg, VA 24060	(540) 961-7864