THREE CREEK, MILL SWAMP, AND DARDEN MILL RUN WATERSHEDS TMDL IMPLEMENTATION PLAN

TECHNICAL REPORT

Submitted to:

The Stakeholders of the Three Creek, Mill Swamp and Darden Mill Run Watersheds

Prepared by:

Three Creek, Mill Swamp and Darden Mill Run IP Working Group

In Cooperation With:

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Virginia Department of Environmental Quality,

and

Virginia Department of Conservation and Recreation

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List of Abbreviations

The following abbreviations are used throughout this document. To better aid the reader in comprehension of the document each abbreviation is defined here.

BMP – Best Management Practice
BSE – Biological Systems Engineering Department (Virginia Tech)
CPP – Continuing Planning Process
CREP – Conservation Reserve Enhancement Program
CRP- Conservation Reserve Program
CWA – Clean Water Act, the origin of the Total Maximum Daily Load Program
CWSRF – Clean Water State Revolving Fund
EQIP – Environmental Quality Incentives Program
FTE – Full Time Equivalent
HSPF – Hydrological Simulation Program-FORTRAN
IP – Implementation Plan
LA – Load Allocation, the load allocated to nonpoint and background sources in the Total Maximum Daily Load Study
LIP – Landowner Incentive Program
MOS – Margin of Safety, a load that represents uncertainty in the modeling process
NPS – nonpoint source, referring to diffuse sources of pollution, such as from runoff
NRCS – Natural Resources Conservation Service
RR – Rockfish River
SWCB – State Water Control Board
SWCD –Soil and Water Conservation District
TMDL – Total Maximum Daily Load (Study)
USEPA – United States Environmental Protection Agency
VAC – Virginia Administrative Code
VCE – Virginia Cooperative Extension
VADCR – Virginia Department of Conservation and Recreation
VADEQ – Virginia Department of Environmental Quality
VDH – Virginia Department of Health
VDOF – Virginia Department of Forestry
VDGIF – Virginia Department of Game and Inland Fisheries
VDOT – Virginia Department of Transportation
VPDES – Virginia Pollutant Detection and Elimination System
VT – Virginia Tech
WLA – Waste Load Allocation, the load allocated to point sources
WQIF – Water Quality Improvement Fund
WQMIRA – Water Quality Monitoring, Information and Restoration Act

EXECUTIVE SUMMARY

The Mill Swamp and Darden Mill Run watersheds are located within Southampton County. The Three Creek watershed is located within the counties of Southampton, Sussex, Greensville, and Brunswick. A portion of the impaired segment of Three Creek identified as K27R-02-BAC (extending from the confluence with Chatman Branch to the confluence with the Nottoway River) was first listed as impaired in 2002 due to water quality violations of the fecal coliform bacteria standard and the remainder of this impaired segment was first listed as impaired in 2006 due to water quality violations of the *E. coli* standard. Darden Mill Run (K30R-01-BAC) was first listed as impaired in 2004 due to water quality violations of the fecal coliform bacteria standard. Mill Swamp (K28R-01-BAC) was first listed as impaired in 2006 due to water quality violations of the fecal coliform standard. The impaired segment of Three Creek extending from Otterdam Swamp to Browns Branch (K26R-02_BAC) was first listed as impaired due to water quality violations of the *E. coli* standard in 2006. An additional segment of Three Creek from Cattail Creek downstream to Slagles Dam (K26R-03-BAC) was first listed as impaired in 2008.

When streams fail to meet standards they are placed on the state's impaired waters list, and the state must then develop a Total Maximum Daily Load (TMDL) for the pollutant. TMDL studies were completed for Mill Swamp, Darden Mill Run and Three Creek in 2012. After a TMDL is developed for an impaired water, an Implementation Plan (IP) must be developed and implemented with the goal of meeting the water quality standards for the water body. The purpose of this IP is to describe the implementation actions that will achieve the water quality goals in the Mill Swamp, Darden Mill Run and Three Creek watersheds.

Review of the TMDL Study

The Three Creek watershed is located in Brunswick, Greensville, Sussex, and Southampton Counties and the City of Emporia. The Mill Swamp and Darden Mill Run watersheds are located in Southampton County. Darden Mill Run flows into Mill Creek; Mill Creek, Three Creek, and Mill Swamp flow into the Nottoway River. Nottoway River discharges into the Chowan River near the North Carolina state line. The land use distribution in the TMDL watersheds consist mainly of forested area (64%) but with a significant portion of cropland (22%); less significant land uses include pasture (6%), residential (3%), and wetlands (6%). Potential nonpoint sources of bacteria considered during TMDL development include failing septic systems and straight pipes, domestic pets, livestock, and wildlife. The primary sources of bacteria were identified as direct

deposition of fecal matter in streams by wildlife and livestock, and surface runoff from pervious land during storm events.

Various pollutant reduction scenarios were evaluated to meet the state 30-day geometric mean water quality standard for E. coli (126 cfu/100 mL). The Mill Swamp, Darden Mill Run and Three Creek TMDLs call for reductions of bacteria from straight pipes and failing septic systems; and for Darden Mill Run and Three Creek, reductions are also needed from livestock and wildlife direct deposit and kennel wash-off to meet the TMDLs. In addition, reductions to bacteria sources from pervious land are also needed in the Three Creek watershed. The final allocation scenarios for each watershed are shown in Table ES-1.

Table ES. 1. Required fecal coliform loading reductions (%) to meet the *E. coli* standard.

Impaired Segment	Cattle Direct Deposit	Loads from Pasture	Loads from Cropland	Straight Pipes & Failing Septic Systems	Loads from Residential Areas*	Hunt Club 'Direct Deposit'	Wildlife Direct Deposit
Darden Mill Run	95	0	0	100	0	75	65
Mill Swamp	0	0	0	100	0	0	0
Three Creek (K26R-03)	75	75	75	100	75	55	50
Three Creek (K26R-02)‡	90	0	0	100	0	45	85
Three Creek (K27R-02)¶	0	0	0	100	0	0	0

*in addition to failing septic systems

Implementation Actions

Potential control measures, their costs, and pollutant removal effectiveness estimates were identified through a review of the TMDL report, through input from the TMDL IP Work Groups, from a literature review, and from modeling. Because the TMDL watersheds contains a combination of agricultural and residential land uses, implementation actions to address the required pollutant reductions include a variety of control measures which target each pollutant source.

The quantity of corrective measures, or implementation actions, needed to meet the source load reductions was determined through spatial analysis and the model used in the TMDL study. The recommended agricultural and residential management practices needed to attain the Stage 1 goal are

- installing 0.58 miles of livestock exclusion fencing in the Three Creek watershed and 2.50 miles of fencing in the Darden Mill Run watershed,
- installing 5 livestock exclusion systems in the Three Creek watershed and 14 systems in the Darden Mill Run watershed,
- pumping out 223 septic tanks,
- identifying and replacing 2 straight pipes in the Mill Swamp watershed with approved on-site sewage disposal systems,
- repairing or replacing 106 failing septic systems,
- implementing a pet waste education program, and
- installing 7 kennel wash-off diversions in each the Three Creek and Darden Mill Run watersheds.

Associated costs for each implementation action were estimated from the Virginia Department of Conservation and Recreation (VADCR) agricultural BMP database, from TMDL IPs in neighboring counties, and from discussions with and from discussions with Chowan Basin Soil and Water Conservation District (SWCD) and the Natural Resource Conservation Service (NRCS) District Conservationist. The total estimated cost for Stage 1 implementation, including technical assistance, is $1,109,250.

Measurable Goals and Milestones

The goals of TMDL implementation are to restore the water quality in the impaired stream segments in the Mill Swamp, Darden Mill Run and Three Creek watersheds so that they comply with water quality standards and to de-list these segments from the Commonwealth of Virginia's 303(d) List of Impaired Waters. Progress towards these goals can be assessed during the implementation process by tracking the number/type of control measures that are installed and programs or policies developed and executed (implementation actions) and continued water quality monitoring. Improvements in water quality will be measured through monitoring of bacteria concentrations throughout the watersheds.

The implementation of control measures will be accomplished in stages. This staged approach is based on meeting water quality goals over a ten-year period. Implementation during Stage 1 (years one through five) focuses on installing livestock exclusion systems, pumping septic tanks, removing straight pipes, repairing or replacing failing septic systems, implementing a pet waste education program, and installing kennel wash-off diversions. Voluntary implementation of Stage 1 control measures is expected to reduce the bacteria loadings from controllable sources so that the impaired stream segments can be removed from the state's impaired waters list. The next 5 years of the implementation period are defined as Stage 2. If needed, the

remaining control measures will be installed during Stage 2 (years six through ten) to continue toward the reductions needed to meet the TMDLs.

Stakeholders' Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (i.e., improving water quality and removing streams from the impaired waters list).

The Chowan Basin SWCD will provide cost-share funds, lead education and technical efforts, and track the agricultural and residential implementation practices. The USDA Natural Resources Conservation Service (NRCS) will also assist private landowners by providing funding through federal programs and offering technical assistance with installation of implementation practices.

The Virginia Department of Environmental Quality (VADEQ) is the lead state agency in the TMDL process. VADEQ will monitor six locations in the watersheds to evaluate the water quality throughout the implementation period.

While successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens within the watershed. Local community watershed groups (for example, Blackwater Nottoway Riverkeeper Program and the Historic Southside Chapter of the Virginia Master Naturalist) have a valuable knowledge of the local watershed and river habitat that is important to the implementation process. Active community watershed groups can be a good resource for procuring and distributing grant funds to assist in financing implementation actions. Depending on their missions, they also present opportunities for educating residents and other stakeholders about the TMDL and implementation plan.

Potential Funding Sources

Funding sources that may be available to support implementation include:

- Clean Water State Revolving Fund
- Conservation Reserve Enhancement Program
- Environmental Quality Incentives Program
- EPA Section 319 Grant Incremental Funds
- Landowner Incentive Program (Non-Tribal)
- National Fish and Wildlife Foundation

- Southeast Rural Community Assistance Project
- Virginia Aquatic Resources Trust Fund
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Loan Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Environmental Endowment
- Virginia Open-Space Lands Preservation Trust Fund
- Virginia Small Business Environmental Assistance Fund Loan Program
- Virginia Water Quality Improvement Fund
- Wildlife Habitat Incentive Program
- Wetland and Stream Mitigation Banking
- Wetland Reserve Program

1. INTRODUCTION

1.1. Background

In 1972, the US Congress enacted the Federal Water Pollution Control Act known as the "Clean Water Act" (CWA). The founding objective of that legislation is well defined in its opening paragraph,

"to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The legislation covers a range of water quality efforts aimed at reaching this objective. Immediately relevant to this project are the requirements that states develop and promulgate water quality standards for waters within their jurisdictions. In section 303(d) of the Act, the federal government requires states to identify those water bodies not meeting the published water quality standards for any given pollutant. This list is often called the "303(d) list" or the "impaired waters list." Virginia's first impaired waters list was published and reported to the United States Environmental Protection Agency (USEPA) in 1994. Recently, the 303(d) list has been combined with the 305(b) water quality assessment report which describes the overall quality of a state's waters. Virginia publishes and submits this "305(b)/303(d) Integrated Report" to USEPA every two years.

Section 303(d) requires that, if a particular water body is listed as "impaired," the state must develop a "total maximum daily load" for any pollutant that exceeds water quality standards in that water body. The "total maximum daily load" or TMDL is essentially a "water pollution budget." A TMDL study defines the maximum amount of pollutant each source in the watershed can contribute to the water body, so that the water body remains in compliance with applicable water quality standards.

Virginia's 1997 Water Quality Monitoring, Information and Restoration Act states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters." This means that after a TMDL is developed for an impaired water, an Implementation Plan (IP) must be developed and implemented with the goal of meeting the water quality standards for the water body. The IP presented in this document characterizes implementation actions that will achieve the water quality goals in Three Creek, Mill Swamp, and Darden Mill Run.

1.2. Designated Use and the Applicable Water Quality Standard

According to 9 VAC 25-260-5 of Virginia's State Water Control Board Water Quality Standards, the term ‘water quality standards’ means

"…provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law and the federal Clean Water Act."

The ’Designation of Uses’ of all waters in Virginia is defined in the Code of Virginia (9 VAC 25-260-10) (SWCB, 2011):

All state waters, including wetlands, are designated for the following uses: recreational uses, e.g. swimming and boating; the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish.

The applicable water quality criteria for fecal bacteria impairments are contained in Section 9 VAC 25-260-170. At the time these selected tributary stream segments were first placed on the 303(d) list, the criteria for bacteria included two parts: (1) the *Escherichia coli* (*E. coli*) bacteria concentrations for fresh water shall not exceed a geometric mean of 126 colony forming units (cfu) per 100 mL of water, and (2) the *E. coli* concentrations for freshwater shall not exceed 235 cfu per 100 mL at any time (single-sample criteria). If the water body exceeds the single sample maximum more than 10.5% of the time, the water body is classified as impaired and a TMDL must be developed and implemented to bring the water body into compliance with the water quality standard. If the sampling frequency is one sample or less per 30 days, the single-sample criterion is applied; for a greater sampling frequency, the geometric mean criterion is applied. Most of the ambient water quality monitoring conducted by the Virginia Department of Environmental Quality (VADEQ) is done on a monthly or bimonthly basis. This sampling frequency does not provide the two or more samples within 30 days needed for use of the geometric mean part of the standard. Therefore, VADEQ used the 235 per 100 mL part of the standard in the assessment of the *E. coli* bacteria monitoring data.

The current bacteria standard for freshwater streams in Virginia declares that *E. coli* bacteria concentrations for freshwater shall not exceed a monthly geometric mean of 126 cfu per 100 mL. To ensure compliance with the standard, bacteria TMDLs for the impaired stream segments

in Three Creek, Mill Swamp, and Darden Mill Run watersheds were developed, as part of a larger study, to meet this *E. coli* criterion.

2. STATE AND FEDERAL REQUIREMENTS FOR TMDL IMPLEMENTATION PLANS

2.1. Background

Once a water body is listed as impaired and a subsequent TMDL study has been conducted, then the state, in conjunction with watershed stakeholders, must develop and implement a strategy that will limit the pollutant loadings to those levels allocated in the TMDL. Such a strategy, also known as an Implementation Plan (IP), must contain corrective actions that when implemented will reduce pollutant loadings to bring the water body into compliance with the relevant standard(s).

2.2. State Requirements

The State's Water Quality Monitoring, Information and Restoration Act (WQMIRA) directs the VADEQ to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for an IP to be approved by the State Water Control Board, the IP must include the following required components, as outlined in WQMIRA:

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

2.3. Federal Recommendations

Section 303(d) of the CWA and current USEPA regulations do not require the development of implementation strategies, though their guidance clearly describes this as the next step leading to the attainment of water quality objectives. In its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process," USEPA recommends the following minimum elements for an approvable IP:

- 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.

These recommendations closely track the State's WQMIRA requirements.

2.4. Requirements for Section 319 Fund Eligibility

Beyond the regulatory requirements listed above, the CWA was amended in 1987 to establish the Nonpoint Source (NPS) Management Program in Section 319 of that act. Through that program, States, Territories, and Native American Tribes can receive grant monies for a variety of activities, including the restoration of impaired stream segments. Although there are several sources of money to help with the TMDL implementation process, Section 319 funds are most relevant to TMDL implementation. Therefore, the requirements to obtain these funds are discussed in this chapter. The Virginia Department of Conservation and Recreation (VADCR) strongly suggests that these USEPA recommendations be addressed in the IP (in addition to the required components as described by WQMIRA).

The USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 NPS grants to States. The guidance is subject to revision and the most recent version should be considered for IP development. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine elements that must be included in the IP to meet the 319 requirements:

1. Identify the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan;
2. Estimate the load reductions expected from NPS management measures;
3. Describe the NPS management measures that will need to be implemented to achieve the identified load reductions;
4. Estimate the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the watershed-based plan;
5. Provide an information/education component that will be used to enhance public understanding of the project and encourage the public's participation in selecting, designing, and implementing NPS management measures;
6. Provide a schedule for implementing the NPS management measures identified in the watershed-based plan;
7. Describe interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented;

8. Identify a set of criteria for determining if load reductions are being achieved and progress is being made towards attaining water quality standards, and if not, the criteria for determining if the watershed-based plan needs to be revised; and
9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

2.5. Staged Implementation

In general, the Commonwealth of Virginia intends for NPS pollutant TMDL reductions to be implemented in a staged or phased fashion. Staged implementation is an iterative process whereby management measures are implemented incrementally, initially targeting those sources and/or practices that are expected to produce the greatest water quality improvement. Staged implementation includes on-going monitoring to continuously assess progress toward attaining water quality standards. For example, a promising best management practice in agricultural areas of a watershed with a bacteria impairment is livestock exclusion from streams. This has been shown to be very effective in lowering bacteria concentrations in streams, by reducing the opportunity for cattle to defecate directly in the stream and by providing additional buffering in the riparian zone. This practice has the additional benefit of reducing stream bank erosion.

There are many benefits of staged implementation, including:

1. tracking water quality improvements as they occur;
2. providing a measure of quality control, given the uncertainties that exist in any implementation plan;
3. providing a mechanism for developing public support;
4. helping to ensure the most cost-effective practices are implemented initially; and
5. allowing for the evaluation of the adequacy of the TMDL in achieving the water quality standard.

With successful development and implementation of IPs, Virginia will be well on the way to restoring impaired waters and enhancing the value of this important resource. Additionally, development of an approved IP will improve a locality's chances for obtaining monetary assistance during implementation.

3. REVIEW OF THE THREE CREEK, MILL SWAMP, AND DARDEN MILL RUN BACTERIAL TMDL STUDY

3.1. Background

A TMDL is calculated as follows:

$$TMDL = \sum WLA + \sum LA + MOS \quad (3.1)$$

where WLA is the waste load allocation (point sources), LA is the load allocation (NPSs), and MOS is the margin of safety. A TMDL study determines the TMDL for the pollutant and, after accounting for MOS, allocates that loading between point sources (WLA) and NPSs (LA).

This chapter reviews the development of TMDLs and corresponding load allocations for Three Creek, Mill Swamp, and Darden Mill Run. The TMDLs are described in the 2012 TMDL report: *Bacteria Total Maximum Daily Load Development for Three Creek, Flat Swamp, Tarrara Creek, Mill Swamp, and Darden Mill Run in Southampton, Sussex, Greensville, Brunswick Counties and the City of Emporia, Virginia*. During the TMDL study TMDLs were also developed for Flat Swamp and Tarrara Creek in Southampton County, but these TMDLs will not be addressed in this IP.

3.2. Description of Impairments

As a result of monitoring performed by VADEQ, Three Creek, Mill Swamp, and Darden Mill Run are currently listed on Virginia's 303(d) list of impaired waters. A portion of Three Creek (part of K27R-02-BAC) was first listed as impaired on Virginia's *2002 303(d) Report on Impaired Waters* due to water quality violations of the fecal coliform bacteria standard. Darden Mill Run (K30R-01-BAC) was first listed as impaired on Virginia's *Final 2004 305(b)/303(d) Water Quality Assessment Integrated Report* due to water quality violations of the fecal coliform bacteria standard. Mill Swamp (K28R-01-BAC) and two segments of Three Creek (K26R-02-BAC and the remainder of K27R-02-BAC) were first listed as impaired on Virginia's *Final 2006 305(b)/303(d) Water Quality Assessment Integrated Report* due to water quality violations of the fecal coliform and *E. coli* standards, respectively. An additional segment of Three Creek (K26R-03-BAC) was first listed as impaired on Virginia's *Final 2008 305(b)/303(d) Water Quality Assessment Integrated Report* due to water quality violations of the *E. coli* standard (VADEQ, 2010). The impairments are summarized in Table 3-1 and Figure 3-1.

Table 3-1. Selected impaired segments from the 2012 TMDL Report.

Stream	Original Listing Date	Description
Three Creek (K27R-02-BAC)	2002	from the confluence of Chatman Branch (RM 20.95) downstream to the confluence with Nottoway River (RM 0.00)
Three Creek (K26R-02-BAC)	2006	from Otterdam Swamp downstream to Browns Branch
Three Creek (K26R-03-BAC)	2008	from Cattail Creek downstream to Slagles Dam
Mill Swamp (K28R-01-BAC)	2006	from the headwaters downstream to the confluence with the Nottoway River
Darden Mill Run (K30R-01-BAC)	2004	from the headwaters near Newsoms downstream to Windbourne Millpond, near VA/NC state line

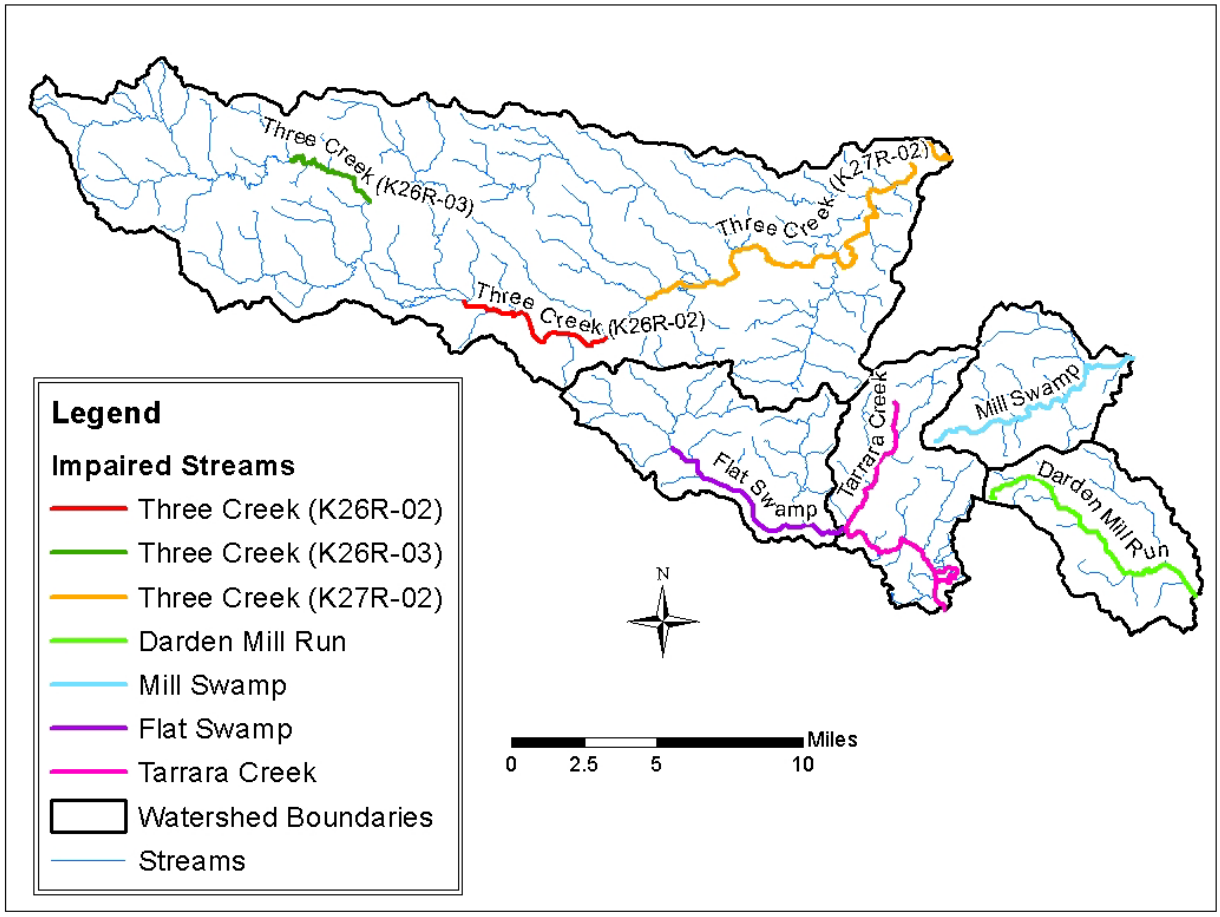

Figure 3-1. Impaired segments in Three Creek, Darden Mill Run, Mill Swamp, Flat Swamp, and Tarrara Creek watersheds.

3.3. Watershed Characteristics

The Three Creek (K26, K27) watershed is located in Brunswick, Greensville, Sussex, and Southampton Counties and the City of Emporia. The Mill Swamp (K28) and Darden Mill Run (K30) watersheds are located in Southampton County. Darden Mill Run flows into Mill Creek; Mill Creek, Three Creek, and Mill Swamp flow into the Nottoway River (USGS Hydrologic Unit Code 03010201). Nottoway River discharges into the Chowan River near the North Carolina state line. The Chowan River flows into the Albemarle Sound in North Carolina. The land use distribution in the TMDL watersheds consist mainly of forested area (64%) but with a significant portion of cropland (22%); less significant land uses include pasture (6%), residential (3%), and wetlands (6%) (Figure 3-2).

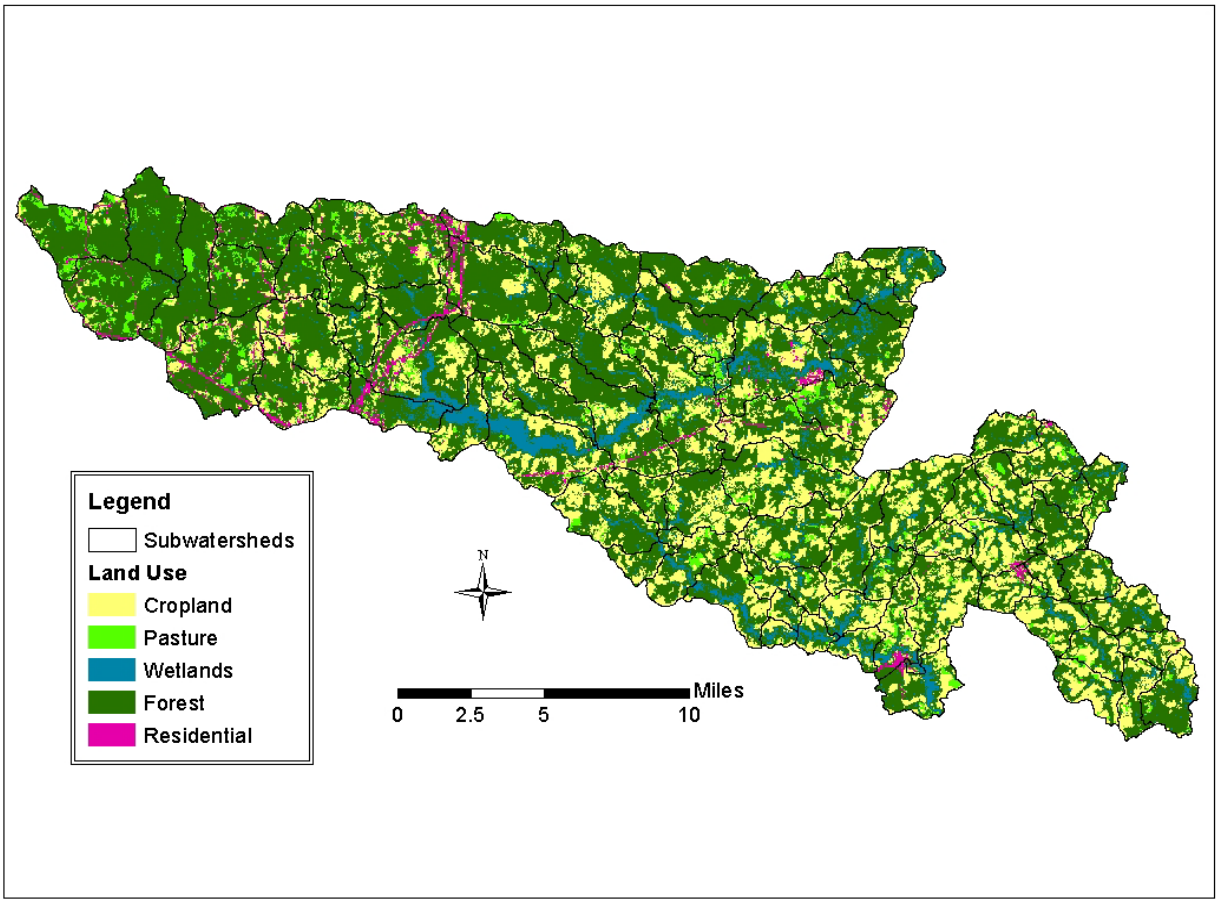

Figure 3-2. Land use in the Three Creek, Darden Mill Run, Mill Swamp, Flat Swamp, and Tarrara Creek watersheds.

3.4. Water Quality Monitoring

The Virginia Department of Environmental Quality (VADEQ) regularly and recently monitored Three Creek water quality at five stations, and Mill Swamp and Darden Mill Run water quality at

one station each. Table 3-2 lists the stations, the violation rate of the appropriate instantaneous water quality criterion (fecal coliform - 200 cfu/100 mL; *E. coli* - 235 cfu/100 mL), and the period of record. Two additional stations on Three Creek collected only one sample or stopped collecting in 1979. Of the seven stations, 5ADMR008.42, 5ATRE008.48, and 5ATRE016.02 were chosen for model calibration and validation to provide meaningful evaluations of seasonality.

Table 3-2. Selected (IP) subset of Monitoring Stations used in TMDL Development

Station ID	Stream Name	Station Description	Indicator Organism Measured	Number of Samples	Violation Rate‡	Period of Record
5ADMR008.42	Darden Mill Run	Route 673 Bridge	Fecal Coliform	114	18.4%	1995 – 2010
			E. coli	47	25.5%	2002 – 2010
5AMSP000.16	Mill Swamp	Route 731 Bridge	Fecal Coliform	12	16.7%	2001 – 2003
			E. coli	11	36.4%	2009 – 2010
5ATRE008.48	Three Creek	Route 655 Bridge	Fecal Coliform	105	14.3%	1994 – 2010
			E. coli	51	19.6%	2002 – 2010
5ATRE016.02	Three Creek	Route 649 Bridge	Fecal Coliform	106	14.2%	1994 – 2010
			E. coli	51	17.6%	2002 – 2010
5ATRE022.05	Three Creek	Three Creek at Route 615	*E. coli*	23	13.0%	2003 – 2008
5ATRE026.75	Three Creek	Route 622 Bridge at County Line (Sussex/Greensville)	Fecal Coliform	51	15.7%	1990 – 2001
5ATRE038.07	Three Creek	Three Creek, Route 610 Bridge	*E. coli*	22	18.2%	2005 – 2008

‡of the instantaneous standard

3.5. Water Quality Modeling

The Hydrological Simulation Program-FORTRAN (HSPF) was used to simulate the fate and transport of fecal coliform bacteria for the TMDL study. Modeling was conducted in phases. Output from the HSPF model was generated as an hourly time series and daily average time series of fecal coliform concentration at sub-watershed outlets, including those demarcated at the monitoring stations chosen for model calibration and validation.

The Expert System for Calibration of HSPF (HSPEXP) decision support software was used to develop a calibrated hydrologic HSPF input dataset for the watersheds. As there are no continuous flow gages within the impaired watersheds, it was necessary to find a similar, gauged, 'surrogate' watershed on which to perform the hydrologic calibration. Because the Three Creek watershed covers two very different ecoregions, two surrogate watersheds were identified. The USGS gage station (02047500) on Blackwater River, near Dendron, VA was chosen for Mill Swamp, Darden Mill Run, and the portion of Three Creek east of the Fall Line (roughly equivalent to the area east of Slagles Lake). The USGS gage station (02051000) on North Meherrin River, near Lunenburg, VA, was chosen for the portion of Three Creek west of

the Fall Line. The water quality component of HSPF was calibrated using observed fecal coliform and E. coli data collected at the stations listed in Table 3-2.

While developing allocation scenarios, an implicit margin of safety (MOS) was used. Conservative assumptions, the use of a detailed watershed model (HSPF), and other considerations were used in developing the bacteria TMDL, such that an explicit MOS was not necessary.

3.6. Sources of Bacteria

To identify localized sources of fecal coliform, the TMDL watersheds were divided into sub-watersheds (Figure 3-3 and Figure 3-4). Potential sources of bacteria considered in the development of the TMDL included both point source and non-point source (NPS) contributions.

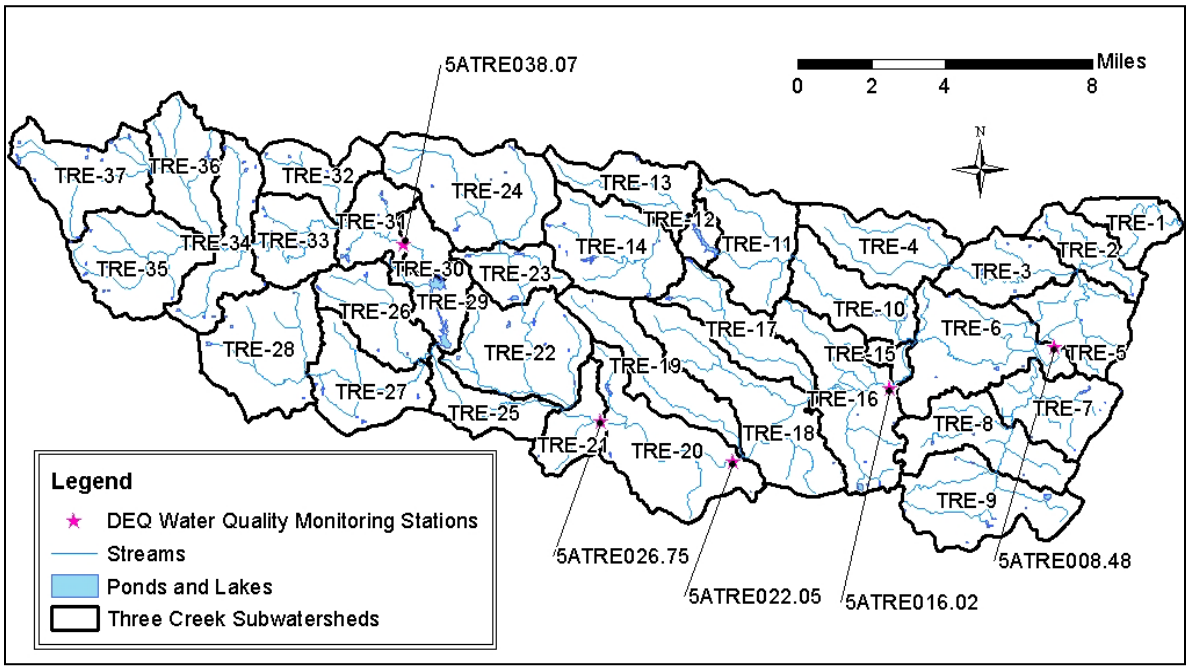

Figure 3-3. Sub-watersheds in the Three Creek (TRE) watershed.

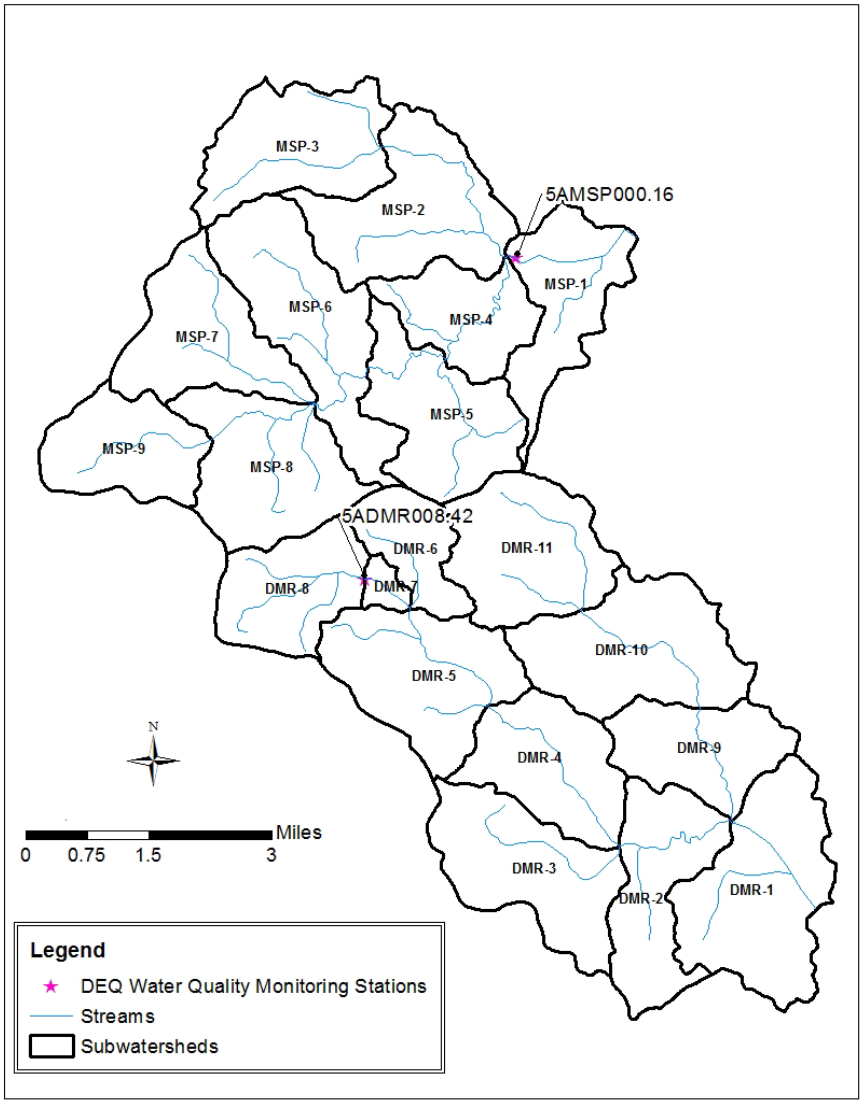

Figure 3-4. Sub-watersheds in Darden Mill Run (DMR) and Mill Swamp (MSP).

3.6.1. Point Sources

The TMDL WLA accounts for the portion of a receiving water's loading capacity that is allocated to one of its existing or future permitted point sources of pollution. Point sources of fecal coliform bacteria include all municipal and industrial plants that treat human waste and are issued individual permits by VADEQ, as well as private residences that fall under Virginia Pollutant Discharge Elimination System (VPDES) general permits. The only permitted point sources of bacteria in the IP watersheds were in Three Creek and are listed in Table 3-3, along with their permitted discharges and load allocations in the TMDLs. The WLA for each point source was set at the permitted load.

Table 3-3. Permitted facilities discharging into the streams of the Three Creek watershed.

Permit Number	Facility Name	Sub-watershed	Design Flow (mgd*)	Permitted *E. coli* Conc. (cfu/100 mL)	*E. coli* Load (cfu/year)
VA0062499	VDOC Southampton Correctional Center	TRE-6	0.45	126	7.84×10^{11}
VA0077259	Three Creek STP	TRE-25	0.75	126	1.31×10^{12}
VA0020761	Town of Jarratt STP	TRE-24	0.16	126	2.79×10^{11}
VAG404036	Residence	TRE-30	0.0005	126	8.71×10^{8}
VAG403043	Drewryville Fas-Shop	TRE-8	0.000621	126	1.08×10^{9}

*million gallons per day

3.6.2. Nonpoint Sources

NPS pollution originates from diffuse sources on the landscape (e.g., agriculture and urban) and is strongly affected by precipitation events – runoff from rain or snowmelt. In some cases, a precipitation event is not required to deliver NPS pollution to a stream (e.g., direct deposition of fecal matter by wildlife or livestock and contamination from leaking sewer lines or straight pipes). NPSs were assessed during TMDL development through an extensive analysis of land use coupled with a consideration for delivery mechanisms (e.g., direct loadings to the stream or land-based loadings that require a precipitation event for delivery of the pollutants to the stream from pervious and impervious surfaces).

In general, wildlife contribute bacteria to all land uses and to streams via defecating directly in streams (direct deposit); livestock contribute bacteria to pasture areas and streams via direct deposit and indirectly to crop areas through manure application; humans contribute bacteria to residential areas via failing septic systems and to streams via straight pipes; and pets contribute bacteria directly to residential areas. The estimated NPS loads from each of the sources of bacteria are summarized for Three Creek, Mill Swamp, and Darden Mill Run (Table 3-4, Table 3-5, Table 3-6).

Table 3-4. Estimated annual fecal coliform loadings to the stream and the various land use categories for the Three Creek watershed.

Source	Fecal coliform loading ($x10^{12}$ cfu/yr)	Percent of total loading
Direct loading to streams		
Livestock in stream	13	<1%
Kennel Wash-off	2	<1%
Wildlife in stream	327	3%
Point Sources	<1	<1%
Loading to land surfaces		
Cropland	627	6%
Pasture	7,810	71%
Residential	593	5%
Forest	1,454	13%
Wetlands	125	1%
Total	**10,954**	

Table 3-5. Estimated annual fecal coliform loadings to the stream and the various land use categories for the Mill Swamp watershed.

Source	Fecal coliform loading ($x10^{12}$ cfu/yr)	Percent of total loading
Direct loading to streams		
Livestock in stream	<1	<1%
Kennel Wash-off	<1	<1%
Wildlife in stream	41	7%
Straight pipes	4	1%
Loading to land surfaces		
Cropland	79	13%
Pasture	259	43%
Residential	64	11%
Forest	146	24%
Wetlands	8	1%
Total	**601**	

Table 3-6. Estimated annual fecal coliform loadings to the stream and the various land use categories for the Darden Mill Run watershed.

Source	Fecal coliform loading ($x10^{12}$ cfu/yr)	Percent of total loading
Direct loading to streams		
Livestock in stream	10	<1%
Kennel Wash-off	<1	<1%
Wildlife in stream	48	1%
Loading to land surfaces		
Cropland	140	4%
Pasture	3,106	87%
Residential	88	2%
Forest	159	4%
Wetlands	10	<1%
Total	**3,561**	

3.7. TMDL Allocations and Load Reductions

Various pollutant reduction scenarios were evaluated to meet the state water quality standard for *E. coli*, the 30-day geometric mean target (126 cfu/100 mL), with zero violations (a requirement of the TMDL). An implicit MOS was used in these bacteria TMDLs by using conservative estimations of factors that would affect bacteria loadings in the watershed (e.g., animal numbers, production rates, contributions to the stream). These factors were estimated in such a way as to represent the greatest amount of bacteria from each source in the watershed.

The final allocation scenarios from each watershed are shown in Table 3-7. All five TMDLs call for reductions from straight pipes, with additional reductions from agricultural lands, hunt club kennel wash-off and wildlife in Three Creek and Darden Mill Run. Reductions to wildlife fecal bacteria are not addressed in this implementation plan.

Table 3-7. Required fecal coliform loading reductions (%) to meet the *E. coli* standard for the Three Creek, Mill Swamp, and Darden Mill Run watersheds.

Impaired Watershed	Livestock Direct Deposit	Loads from Pasture	Loads from Cropland	Straight Pipes and Failing Septic Systems	Loads from Residential Areas*	Kennel Wash-off	Wildlife Direct Deposit
Three Creek (K26R-03)	75	75	75	100	75	55	50
Three Creek (K26R-02)	90	0	0	100	0	45	85
Three Creek (K27R-02)	0	0	0	100	0	0	0
Mill Swamp	0	0	0	100	0	0	0
Darden Mill Run	95	0	0	100	0	75	65

*in addition to failing septic systems

In addition to the final pollutant source reduction scenarios, a transitional (Stage 1) pollutant source reduction scenario was developed during the TMDL study, Table 3-8. The Stage 1 implementation goal was developed with a target of a 10.5% violation rate of the applicable single-sample *E. coli* criterion (235 cfu/100 mL), resulting in removal of these streams from the impaired waters list, or to get as close to a 10.5% violation rate without requiring reductions from wildlife. Implementation of the Stage 1 scenario permits an evaluation of the modeling assumptions and the effectiveness of management practices.

Table 3-8. Allocation scenario for Stage 1 TMDL implementation for Three Creek, Mill Swamp, and Darden Mill Run.

Impaired Watershed	Livestock Direct Deposit	Loads from Cropland	Loads from Pasture	Household Straight Pipes and Failing Septic Systems	Non-Human Loads from Residential Areas	Kennel Wash-off	Wildlife Direct Deposit	% Violation of E. coli Single Sample Standard
Three Creek (K26R-03)	0	0	0	100	0	0	0	8
Three Creek (K26R-02)	90	0	0	100	0	45	0	27
Three Creek (K27R-02)	0	0	0	100	0	0	0	1
Mill Swamp	0	0	0	100	0	0	0	1
Darden Mill Run	95	0	0	100	0	75	0	27

4. PUBLIC PARTICIPATION

4.1. Introduction

An essential step in crafting a TMDL implementation plan and then implementing that plan is input from and engagement of a broad range of stakeholders (individuals, agencies, organizations, and businesses who have an interest in improving water quality and a familiarity with local conditions). Public participation involves a dialogue between local stakeholders and government agencies and a discussion of available resources that can be devoted to TMDL implementation, such as funding and technical support.

The stakeholders involved in developing the TMDL IP for Three Creek, Mill Swamp, and Darden Mill Run included a Working Group, and the general public. The Working Group focused on agricultural, residential, funding, and technical resource issues. The Working Group was comprised of representatives from VADEQ, Virginia Tech, VADCR, Virginia Department of Game and Inland Fisheries (VDGIF), Chowan Basin Soil and Water Conservation District (SWCD), Blackwater Nottoway Riverkeeper Program, the Virginia Master Naturalist Historic Southside Chapter, Natural Resources Conservation Service (NRCS), and local watershed stakeholders. Public participation occurred via a series of Working Group meetings, Table 4-1. These meetings are described in the following section.

Table 4-1. TMDL Implementation Planning Meetings

Meeting Date	Meeting Type
February 15, 2012	Final TMDL Public Meeting and IP Informational Kick-off Meeting
March 30, 2012	Working Group
September 14, 2012	Working Group
January 11, 2013	Working Group
March 21, 2013	Final TMDL IP Public Meeting

4.2. Synopsis of TMDL Implementation Planning Meetings

The first of two public-noticed public meetings for implementation planning occurred on February 15, 2012 at the Southampton County Board Room in Courtland, Virginia. This public meeting served as both the final TMDL meeting and the kick-off meeting for implementation planning. The goals of the public meeting were:

- to present the bacteria TMDLs for Three Creek, Flat Swamp, Tarrara Creek, Mill Swamp, and Darden Mill Run;
- to provide a basic introduction to the process of implementing TMDLs;
- to engage the community through the Working Group; and

- to explain the roles and responsibilities of the Working Group and the commitment needed for a successful process.

The Working Group was developed to include stakeholders with common interests and concerns about the implementation process. The Working Group was charged with discussing, analyzing, and prioritizing potential bacteria pollutant source reduction corrective measures. The Working Group was also responsible for developing educational and outreach strategies, and considering available funding and technical resources to be used during implementation.

Working Group meetings occurred on March 30, 2012, September 14, 2012 and January 11, 2013. The Working Group meetings provided an opportunity for participants to give direct feedback about potential sources of problems and appropriate solutions to impairments. The goals of these meetings were:

- to review the IP purpose and development process;
- to identify locations of known or suspected water quality problems due to bacteria; and
- to identify corrective measures (BMPs and other approaches) for reducing bacteria loads.

The second and final public meeting for Implementation Plan development occurred on March 21, 2013 at the Southampton County Board Room in Courtland, Virginia. The goals of the meeting were:

- to review the TMDL implementation planning process and the implementation chronology laid out in the TMDL IP;
- to introduce opportunities of assistance available to landowners for practices to reduce bacteria; and
- to solicit stakeholder feedback (a formal 30-day public comment period following the final public meeting).

5. IMPLEMENTATION ACTIONS

An important element of the TMDL implementation plan is to encourage voluntary implementation of control measures designed to reduce pollutant loads. To encourage voluntary implementation, information must be obtained on the types of control measures that can achieve the pollutant reduction goals specified in the TMDL as practically and cost-effectively as possible. In other words, control measures that provide "the biggest bang for the buck" are targeted.

5.1. Selection of Appropriate Control Measures

Potential control measures, their costs, and pollutant removal effectiveness estimates were identified through a review of the TMDL report, through input from the TMDL IP Working Group, from a literature review, and from modeling. Because the Three Creek, Mill Swamp, and Darden Mill Run watersheds contain a combination of agricultural and residential land uses, implementation actions to address the required pollutant reductions include a variety of control measures which target each pollutant source. Control measure selection was based on the ability to control specific pollutant sources, the required pollutant load reductions, the potential for cost-sharing, the likelihood of implementation by landowners, and stakeholder input. Pollutant sources fall into two basic categories: those contributing directly to the stream and those contributing indirectly to the stream from land sources via runoff. A list of potential control measures and their effectiveness values are listed in Table 5-1.

5.1.1. Control Measures for Direct Stream Sources

Control measures were needed to reduce pollutant sources that contribute directly to the stream, "Direct Stream Sources". The Direct Stream Sources that need to be controlled in Three Creek and Darden Mill Run include livestock direct deposit and direct residential wastewater discharges (straight pipes). Mill Swamp only needs reductions of direct deposit from direct residential wastewater discharges to meet the TMDL. To meet the reductions in direct deposits from livestock specified in the TMDL, some form of stream exclusion is necessary. The 100% reduction in bacteria loads from the direct residential wastewater discharges is a pre-existing legal requirement, further reinforced by the TMDL and this TMDL IP. Control measures used to address residential wastewater discharges include new septic systems or alternative on-site sewage treatment systems.

Table 5-1. Potential Control Measure Efficiencies for Bacteria.

Control Measures	Associated Cost-shared BMPs	Bacterial Reduction Effectiveness (%)	Effectiveness Source
Agricultural Control Measures			
Grass riparian buffers~	CP-21, WQ-1	56%	1
Forested riparian buffers~	CP-22, CRFR-3, FR-3	56%	1
Reforestation of erodible pasture	FR-1	simulated	2
Livestock exclusion fencing	CRSL-6, LE-1T, LE-2T, WP-2T	100%	3
Livestock exclusion buffers or setbacks~	CRSL-6, LE-1T, LE-2T, WP-2T	60%	1
Improved pasture management	EQIP 528, EQIP 512	30%	1
Water control structure	WP-1	60%	1
Continuous no-till system	SL-15A	70%	1
Cover crop	SL-8B, SL-8H	10%	1
Residential Control Measures			
Septic System pump-out	RB-1	5%	4
New Sewer hook-ups	RB-2	100%	3
Septic System repairs	RB-3	100%	3
New septic systems	RB-4	100%	3
New septic systems w/ pumps	RB-4P	100%	3
Alternative on-site waste treatment systems	RB-5	100%	3
Pet waste education program		25%	5
Kennel wash-off diversions		100%	3

~ Includes additional reductions from upstream runoff loads: buffers - 2x buffer area.
1 - EPA-CBP sediment effectiveness, 2010. (Bacteria efficiency assumed equal to sediment efficiency.)
2 - Based on unit bacteria load from wildlife.
3 - By definition.
4 - EPA-CBP nutrient effectiveness, 2010. (Bacteria efficiency assumed equal to nutrient efficiency.)
5 – Modified from Swann, 1999.

5.1.2. Control Measures for Indirect Land Sources

Control measures were also needed to reduce pollutant sources that are distributed across the land surface, whose loads are then transported to streams via surface runoff, “Indirect Land Sources”. Control measures may reduce bacteria loads to the land surface, or may reduce bacteria transport via surface runoff by increasing infiltration, improving filtration, or causing deposition (reductions in flow velocity). The Indirect Land Sources that need to be controlled in the Three Creek, Darden Mill Run and Mill Swamp watersheds include runoff from failing septic systems. Darden Mill Run and the Three Creek watershed upstream of the confluence with Browns Branch also need reductions from dog kennel wash-off. The Three Creek watershed

upstream of Slagles Dam also needs reductions to pasture (livestock), cropland, and additional residential (pets).

Appendix A provides a glossary of BMP and other control measure definitions. Appendix B contains a list of BMP codes and practice names.

5.2. Quantification of Control Measures by Pollutant Source

The extent of existing control measures previously implemented in the Three Creek, Mill Swamp, and Darden Mill Run watersheds were quantified using the VADCR database, which includes practices financially supported through VADCR or USDA Conservation Reserve Enhancement Program (CREP). The initial list of control measures considered for this TMDL IP included those practices already installed in the watersheds, given that there is already some degree of acceptability for these types of control measures. An analysis was then performed to identify the maximum extent of each measure needed to meet the pollutant reduction goals. The initial list of control measures was supplemented with additional measures through discussions with stakeholders. The suite of control measures available to meet the TMDL bacteria reduction targets were identified through discussions with the Working Group participants and quantified using a combination of GIS analysis and modeling, followed by spreadsheet analyses to calculate load reductions from each control measure as applied to each pollutant type and source category. This section provides a summary of the final set of control measures and extents needed to achieve the pollutant load reductions specified in the bacteria TMDLs. Load reductions were based on bacteria source loads simulated for the TMDL study and control measure effectiveness estimates.

5.2.1. Agricultural Sources

5.2.1.1 Livestock Direct Deposit

Eliminating unrestricted livestock access to streams (livestock exclusion) is assumed to provide 100% reduction in livestock direct deposits. A GIS analysis was performed to delineate stream lengths adjacent to, or included in, pasture areas in the Three Creek and Darden Mill Run watersheds. NLCD land use data layers were used for this analysis. The National Hydrography Dataset (NHD) streams layer was used to represent streams and to classify them as either perennial or intermittent.

“Incentive-based livestock exclusion fencing” is defined as fencing that meets VADCR or USDA-NRCS’s CREP (Conservation Reserve Enhancement Program) cost-share requirements with a minimum of a 10 ft. setback or 35 ft. buffer. Table 5-2 summarizes the total fencing needs

estimated to achieve the reductions in bacteria loads from livestock direct deposits in the Three Creek and Darden Mill Run watersheds, as specified in the TMDLs. Stage 1 refers to the first 5 years of implementation and Stage 2 refers to the next 5-year period.

Table 5-2. Total Stream Fencing Estimates.

Sub-Basin	Total Possible Pasture Fencing for Perennial Streams* (miles)	Fencing Needed			
		Stage 1		Stage 2	
		%	miles	%	miles
Three Creek (K26R-03)	0.55	0	0	75	0.41
Three Creek (K26R-02)	0.18	90	0.17	0	0
Darden Mill Run	2.63	95	2.50	0	0
Total	**3.37**		**2.67**		**0.41**

* May have pasture on one or both sides.
† Estimated length of exclusion fencing – sources: VADCR BMP database, Working Group.

Agricultural producers have an array of voluntary water protection measures to choose from that include financial incentives. Some applicable cost-shared BMPs for livestock exclusion in the Three Creek and Darden Mill Run watersheds are the LE-1T (Livestock Exclusion with Riparian Buffers for TMDL Implementation), the LE-2T (Livestock Exclusion with Reduced Setback for TMDL Implementation), the WP-2T (Stream Protection for TMDL Implementation) offered through the Virginia BMP Cost-Share Program, and the CRSL-6 (CREP Stream Exclusion). The LE-1T practice includes streamside fencing, cross fencing, alternative water system(s), hardened crossing(s) when needed, and a 35-ft buffer from the stream. The LE-2T practice is similar to the LE-1T practice, except the stream exclusion fencing must be placed a minimum of 10 feet from the stream and the cost-share rate is less than for LE-1T. The WP-2T practice is similar to the LE-1T practice, except the cost-share rate is less and it does not provide cost share for an alternative watering system. The WP-2T system may be a suitable option where a watering system already exists. The CRSL-6 practice includes cost share for fencing, planting materials, and alternative water source development, and requires a 35-ft buffer or larger with trees planted in the buffer.

Based on Working Group discussions and the small amount of fencing needed in these watersheds, it is expected that targeted implementation of the LE-1T systems will address the majority of the livestock exclusion fencing needs in the watershed (60%, length basis). The remaining fencing needs will be met through implementation of LE-2T practices (15%) and CRSL-6 practices (25%). This IP quantifies fencing along perennial streams because highest priority should be given to livestock exclusion systems on perennial streams to achieve the most

impact on reducing bacteria loads. However, the use of livestock exclusion practices should also be encouraged on intermittent streams to reduce fecal bacteria from direct livestock sources in Three Creek and Darden Mill Run. The control measures needed to meet TMDL load reductions for bacteria from livestock direct deposits are shown in Table 5-3.

Based on data from the VADCR Agricultural BMP database, 66 CRSL-6 and SL-6 practices were installed in Brunswick, Greensville, Southampton, and Sussex Counties since 1998 with an average length and cost of 1,916 linear feet and $10,414, respectively. No LE-1T, LE-2 or LE-2T practices have been recorded for the Three Creek watershed or the neighboring counties, 374 practices have been installed in the state since 2009, using 321 LE-1T, 18 LE-2, and 35 LE-2T. Of these, the average length and cost of an LE-1T system was 2,809 linear feet and $26,595, respectively. For the LE-2 and LE-2T systems, the average length was 1,670 feet and average cost was $10,946. Using this information for this project, the CRSL-6 and LE-1T systems were defined as having 2,000 feet of fencing and cost of $15,000. An LE-2T system was defined as having 1,600 feet of fencing and cost of $11,000.

5.2.1.2 Pasture

Runoff from pasture is a source of bacteria loads. Bacteria loads to pasture areas come from grazing livestock, the spreading of stored manure, and wildlife. To meet the water quality standard, reductions of bacteria load from pasture are only needed in the Three Creek watershed upstream of Slagles Dam. After accounting for load reductions from currently installed control measures, load reductions resulting from filtering effects of buffers associated with livestock exclusion fencing were quantified. Participants in the Working Group felt that rotational grazing would be beneficial in the watershed and farmers were likely to implement this practice. Therefore, improved pasture management was included on pasture acreage as a companion to livestock exclusion control measures. The Environmental Quality Incentives Program (EQIP), a voluntary program offered by NRCS, provides financial and technical assistance for improved pasture management under the EQIP 512 (Pasture and Hayland Planting) and EQIP 528 (Prescribed Grazing) practices. Load reductions realized by reforestation of erodible pasture land (FR-1), permanent vegetative cover on critical areas (SL-11), and water control structures (WP-1) were also quantified to reduce bacteria loads from upland pasture areas. The control measures needed to meet TMDL load reductions for bacteria from pasture are shown in Table 5-3.

Table 5-3. Agriculture control measures recommended for implementation in the Darden Mill Run and Three Creek watersheds.

Control Measure	BMP Code	Units	Average Unit Cost	Extent Required			
				Darden Mill Run	Three Creek (K26R-02)	Three Creek (K26R-03)	Total
Livestock Exclusion							
Livestock Exclusion with Riparian Buffers	LE-1T	system	$15,000	9	1	2	12
Livestock Exclusion with Reduced Setback	LE-2T	system	$11,000	1	-	-	1
CREP Stream Exclusion	CRSL-6	system	$15,000	4	1	1	6
Pasture							
Improved Pasture Management	EQIP 512, EQIP 528	acres	$110	-	-	2,067	2,067
Reforestation of Erodible Pasture	FR-1	acres	$95	-	-	689	689
Permanent Vegetative Cover on Critical Areas	SL-11	acres	$2,800	-	-	6	6
Water Control Structures	WP-1	acres-treated	$360	-	-	930	930
Cropland							
Field Borders/Wildlife Option	WL-1	acres	$260	-	-	33	33
Idle Land/Wildlife Option	WL-2	acres	$150	-	-	34	34
Fescue Conversion/Wildlife Option	WL-3	acres	$300	-	-	33	33
Continuous No-till	SL-15A	acres	$95	-	-	472	472
Harvestable Cover Crop	SL-8H	acres	$35	-	-	378	378
Small Grain Cover Crop	SL-8B	acres	$35	-	-	377	377
Grass Buffers	WQ-1	acres	$180	-	-	2	2
CREP Grass Buffers	CRWQ-1	acres	$180	-	-	3	3

Based on data from the VADCR Agricultural BMP database, 25 FR-1 practices have been installed in Brunswick County since 1999. Of these, the average cost per acre is $94.33. For this project, the cost of the FR-1 practice was calculated as $90/acre to plant conifers and $100/acre to plant hardwood trees. It is assumed that half of the acres will be planted in conifers and the other half in hardwood trees, with an average cost of this practice as $95/acre. Twenty-seven SL-11 practices have been installed in Brunswick, Greensville, Southampton, and Sussex Counties since 1998 with an average cost of $2,763.80 per acre. For this project the cost of the SL-11 practice was calculated as $2,800/acre. Six WP-1 practices have been installed in Southampton County since 1998 with an average cost of $355.68 per acre treated. For this project the cost of the WP-1 practice was calculated as $360/acre-treated.

5.2.1.3 Cropland

Runoff from cropland is also a source of bacteria loads. Bacteria loads to the land come from the spreading of manure and biosolids, and from wildlife. Bacteria from manure and biosolids application can be reduced either by source reduction or filtering measures (buffers). To meet the water quality standard, reductions of bacteria load from cropland are only needed in the Three Creek watershed upstream of Slagles Dam. After accounting for load reductions from currently installed control measures, load reductions resulting from filtering effects of buffers were quantified. The Working Group suggested the use of voluntary cost-share practices associated with the Virginia Quail Recovery Initiative, WL-1 (Field Borders/Wildlife Option), WL-2 (Idle Land/Wildlife Option), and WL-3 (Fescue Conversion/Wildlife Option) to reduce the bacteria load on cropland. They also suggested a continuous no-till system (SL-15A) on any conventional-till cropland receiving manure or biosolids in the watershed. Cover crop practices SL-8H (Harvestable Cover Crop) and SL-8B (Small Grain Cover Crop) were recommended to maintain a vegetative cover on cropland over the winter. Grass buffers (WQ-1 and CRWQ-1) were included to reduce the pollutant loads associated with cropland adjacent to streams. The control measures needed to meet TMDL load reductions for bacteria from cropland are shown in Table 5-3.

Based on data from the VADCR Agricultural BMP database, 24 WL-1 practices and 49 WL-2 practices have been installed in Brunswick, Greensville, Sussex, and Southampton Counties since 1998. Of these, the average cost per acre for the WL-1 practice is $256.00 and $147.06 for the WL-2 practice. For this project, the costs of the WL-1 and WL-2 practices were calculated as $260/acre and $150/acre, respectively. No WL-3 practices have been recorded for the Three Creek watershed or the neighboring counties, 69 practices have been installed in the

state since 1998 with an average cost of $285.72 per acre. For this project the cost of the WL-3 practice was calculated as $300/acre. Sixty-six SL-15A practices have been used in Greensville, Sussex, and Southampton Counties since 2006. Of these practices, the average cost is $90.59/acre. For this project, the cost of the SL-15A practice was calculated as $95/acre. Nine hundred eighty-one SL-8H and SL-8B practices have been installed in the Three Creek watershed since 2000. Of these, the average cost per acre was $33.84. For this project the costs of the SL-8H and SL-8B practices were calculated as $35/acre. Ten WQ-1 practices have been installed in the Three Creek watershed since 2002 with an average cost of $206.20 per acre. Eleven CRWQ-1 practices have been installed in Greensville and Southampton Counties since 2010 with an average cost of $121.79 per acre. For this project the costs of the WQ-1 and CRWQ-1 practices were calculated as $180/acre. The control measures needed to meet TMDL load reductions for bacteria from livestock direct deposit are shown in Table 5-3.

5.2.2. Residential Sources

5.2.2.1 Failing Septic Systems and Straight Pipes

According to the TMDL report, the estimated percentage of the total non-sewered population with failing septic systems and straight pipes in the Mill Swamp watershed were 4.1% and 0.8%, respectively. The estimated percentage of the total non-sewered population with failing septic systems in the Darden Mill Run and Three Creek watersheds were 7.5% and 4.3%, respectively. There were no estimated straight pipes in the Darden Mill Run or Three Creek watersheds. The TMDLs call for the removal of all straight pipes in the impaired watershed in order to meet the TMDL load reductions. Addressing failing septic systems will reduce the bacteria load from residential runoff. Based on estimates from the Working Group and input from local Virginia Department of Health (VDH) representatives it was assumed that 75% of failing septic systems could be repaired without installing a new system. Of those failing systems needing to be replaced, most of those are assumed to be on soils that do not meet current siting requirements for septic systems, therefore it was estimated that 75% would need to be replaced with alternative waste treatment systems and the remainder replaced with a conventional septic system. It is assumed that 50% of straight pipe corrections will be conventional septic systems and 50% will be alternative waste treatment systems. Table 5-4 gives a summary of control measures estimated to remediate this source of bacteria. In addition to these control measures, an educational effort that targets septic system awareness and basic maintenance will be important for successful implementation.

Table 5-4. Residential control measures recommended for implementation in the Darden Mill Run, Mill Swamp, and Three Creek watersheds.

Control Measure	BMP Code	Units	Average Unit Cost	Extent Required					
				Mill Swamp	Darden Mill Run	Three Creek (K27R-02)	Three Creek (K26R-02)	Three Creek (K26R-03)	Total
Failing Septic Systems									
Septic Tank Pump-out	RB-1	system	$250	24	24	81	60	34	223
Septic Tank System Repair	RB-3	system	$3,500	7	14	20	28	10	79
Septic Tank System Installation/Replacement	RB-4	system	$8,000	1	1	2	2	1	7
Alternative On-site Waste Treatment System	RB-5	system	$20,000	2	3	5	7	3	20
Straight Pipes									
Septic Tank System Installation/Replacement	RB-2	system	$8,000	1	-	-	-	-	1
Alternative On-site Waste Treatment System	RB-5	system	$20,000	1	-	-	-	-	1
Dog Waste Management									
Pet Waste Education Program		program	$5,000	-	*	-	*	*	1
Kennel Wash-off Diversion		system	$100	-	7	-	7	7	21

* One pet waste education program for Darden Mill Run and the upper Three Creek watershed.

Septic tank pump-outs were discussed at the Working Group meetings. The consensus was that some residents in non-sewered houses would volunteer to schedule pump-outs if they were made aware of the necessity and benefits of septic pump-outs. A septic tank pump-out can be used as a first step in identifying failing septic systems in the watershed. It was estimated that 10% of residents on septic systems would participate in a septic tank pump-out program if available.

Typical costs in the region show that a septic tank pump-out costs $250, septic system repair costs an estimated $3,500, a conventional septic system is estimated at $8,000, and an alternative waste treatment system is estimated at $20,000 to replace a failing septic system or straight pipe. Cost share assistance is provided for the above-mentioned residential BMPs. These practices include Septic Tank Pump-out (RB-1), the Connection of Malfunctioning On-site Sewage Disposal System or Straight Pipe to Public Sewer (RB-2), Septic Tank System Repair (RB-3), Septic Tank System Installation/Replacement (RB-4), Septic Tank System Installation/Replacement with Pump (RB-4P), and Alternative On-Site Waste Treatment Systems (RB-5).

5.2.2.2 Dog Waste

Dog waste, primarily from wash-off from hosing down kennels at hunt clubs, is a significant source of bacteria loading on dog-inhabited areas in the Darden Mill Run and Three Creek watersheds. The consensus at the Working Group meetings was that a Pet Waste Education Program be developed to educate homeowners and kennel owners in the watersheds about how to dispose of dog waste properly. This information could be distributed to pet owners and hunt clubs through brochures included with County dog licenses or County tax information. Brochures could also be made available at local veterinary offices and pet supply stores. The Working Group also suggested that a partnership with the Virginia Dog Hunting Alliance would be beneficial to distribute information to hunt clubs.

The Working Group discussed different options to reduce the fecal bacteria in wash-off from dog kennels from getting into nearby streams. Suggested Kennel Wash-off Diversion practices include

- a trench around the concrete pad to divert wash-off away from a stream or swamp,
- simple composting of dog waste by shoveling the waste to a compost pile surrounded by hay or straw bales to keep the fecal matter from running off into a stream or swamp, and
- commercial pet waste digesters.

Based on information of the sale of dog licenses provided by the County Treasurers during TMDL development, there is an estimated average of 18 dogs per kennel in the Darden Mill Run and Three Creek watersheds. Using this estimate, kennel wash-off diversion practices need to be applied to seven kennels in the Darden Mill Run watershed and fourteen kennels in the Three Creek watershed upstream of the confluence with Browns Branch to meet the kennel wash-off reductions specified in the TMDL study. The control measures needed to meet TMDL load reductions for bacteria from dog waste are shown in Table 5-4.

Costs for a Pet Waste Education Program have been estimated from $1,250 to $5,000 in other TMDL Implementation Plans in the state. Pet Waste Digesters have been estimated from $50 to $100 in other Implementation Plans. For this project, the cost of a Pet Waste Education Program to be used in both the Darden Mill Run and Three Creek watersheds is estimated at $5,000. The cost of a Kennel Wash-off Diversion (a trench, a buffered compost pile, or a pet waste digester) is estimated as $500.

5.3. Technical Assistance Needs

Technical assistance is needed for design and installation of selected control measures, as well as for educational outreach. Two full-time-equivalent (FTE) employees per year for the first 5 years of implementation are needed to address agricultural and residential issues. It is estimated that only one FTE per year will be needed for the next 5 years (Stage 2). These estimates were based on similar projects and experience. Educational outreach will include strategies identified by stakeholders for facilitating installation and execution of implementation actions.

5.4. Education and Outreach

Staffs from the Chowan Basin SWCD and NRCS have already been contacting farmers in the watersheds providing outreach, technical and financial assistance to farmers to encourage the installation of agricultural BMPs. The Working Group suggested that information about agricultural implementation practices could also be distributed through Virginia Cooperative Extension producer meetings, the SWCD website, and at the Franklin-Southampton County Fair. Bulk mailings to target zip codes where specific practices are needed would also be an inexpensive and effective way to reach the farming community.

The Working Group suggested that an outreach campaign could be presented to or through organizations such as Ruritan Clubs, churches, and schools to educate homeowners of the possibility of failing septic systems. The school system was identified as a commonality where

many homeowners and renters could be reached either through their children's school programs, "back to school" nights, Parent Teacher Association (PTA) service announcements and other methods. The Chowan Basin SWCD provides packets for 2nd and 3rd grade elementary school students at Farm Day every year. These packets could include information on implementation practices to protect water quality. Heritage Day, held every September in Courtland, is also a venue for distributing information about residential and kennel practices.

The Working Group recommended working closely with VDH and Social Services to locate failing septic systems and straight pipes, and to find funding for their repair or replacement. They also suggested a partnership with the USDA Rural Development Program to find funding for the repair and replacement of failing septic systems and straight pipes. It may also be possible to contact a local septic tank pump-out service to partner in offering reduced rates for septic tank pump-outs.

Educational and outreach opportunities discussed by the Working Group to address pet waste were brochures distributed with County dog licenses to educate pet owners and hunt clubs of the importance of picking up after their dogs to protect water quality, partnering with the Virginia Hunting Dog Alliance to educate the hunting community on best practices for removing dog waste from kennels, posting flyers at local veterinary offices. The Working Group also suggested that the local Boy Scout Troops and 4-H Clubs may be willing to provide hands-on help with kennel wash-off diversions as service projects.

The Virginia Master Naturalists Historic Southside Chapter has developed a brochure showing the fecal bacteria impairments in Darden Mill Run, Mill Swamp and Three Creek and providing suggestions for reducing the fecal bacteria in these streams. The brochure also provides contact information to learn more about the cost-share programs available for these impaired streams.

5.5. Cost/Benefit Analysis

5.5.1. Costs

The extent/quantity of the agricultural control measures needed to meet the TMDL pollutant reductions are summarized in Table 5-5, together with their unit costs. Unit costs were estimated from the VADCR agricultural BMP database, from TMDL IPs in neighboring counties and throughout the state, and from discussions with Chowan Basin SWCD and the NRCS District Conservationist. The total estimated cost for full implementation of agricultural control measures in the watersheds is $1,471,170.

The needed residential control measures and their costs are summarized in Table 5-6. Typical costs in the region show that a septic tank pump-out costs an estimated $250, a septic system repair costs an estimated $3,500, a conventional septic system is estimated at $8,000, and an alternative waste treatment system is estimated at $20,000 to replace a failing septic system or straight pipe. One Pet Waste Education Program will be used for the Darden Mill Run and Three Creek watersheds at an estimated cost of $5,000.The Kennel Wash-off Diversions are estimated to cost $500 each. The total estimated cost for full implementation of residential control measures in the Three Creek, Darden Mill Run, and Mill Swamp watersheds is $1,281,750.

5.5.2. Benefits

It is hard to gage 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 reduced considerably.

The primary benefit of implementation is improving water quality in Virginia by reducing the fecal contamination in the Three Creek, Darden Mill Run, and Mill Swamp watersheds. Many of the control measures intended to reduce bacteria also increase infiltration, which will decrease peak flows downstream.

During implementation planning, it is important to recognize 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 will provide economic benefits to the community, as well as the expected environmental benefits.

Table 5-5. Total cost estimates for agricultural control measures in the Three Creek and Darden Mill Run watersheds.

Control Measure	Unit	Quantity	Cost/ Unit	Total Cost
Livestock Exclusion – Riparian Buffers (LE-1T)*	system	12	$15,000	$180,000
Livestock Exclusion – Reduced Setback (LE-2T)*	system	1	$11,000	$11,000
CREP Stream Exclusion (CRSL-6)*	system	6	$15,000	$90,000
Improved Pasture Management (EQIP 512, EQIP 528)	acre	2,067	$110	$227,370
Reforestation of Erodible Pasture (FR-1)	acre	689	$95	$65,455
Permanent Vegetative Cover on Critical Areas (SL-11)	acre	6	$2,800	$16,800
Water Control Structures (WP-1)	acres-treated	930	$360	$334,800
Field Borders/Wildlife Option (WL-1)	acre	33	$260	$8,580
Idle Land/Wildlife Option (WL-2)	acre	34	$150	$5,100
Fescue Conversion/Wildlife Option (WL-3)	acre	33	$300	$9,900
Continuous No-till (SL-15A)	acre	472	$95	$44,840
Harvestable Cover Crop (SL-8H)	acre	378	$35	$13,230
Small Grain Cover Crop (SL-8B)	acre	377	$35	$13,195
Grass Buffers (WQ-1)	acre	2	$180	$360
CREP Grass Buffers (CRWQ-1)	acre	3	$180	$540
Technical Assistance	person-years	7.5	$60,000	$450,000
Total				**$1,471,170**

* estimate includes BMP-defined components and component costs.

Table 5-6. Total cost estimates for residential control measures in the Three Creek, Darden Mill Run, and Mill Swamp watersheds.

Control Measure	Estimated no. of systems needed	Cost/System	Total Cost
Septic Tank Pump-out (RB-1)	223	$250	$55,750
Replacing Straight Pipes			
Conventional Septic System (RB-4)	1	$8,000	$8,000
Alternative Waste Treatment System (RB-5)	1	$20,000	$20,000
Repairing Failing Septic Systems (RB-3)	79	$3,500	$276,500
Replacing Failing Septic Systems			
Conventional Septic System (RB-4)	7	$8,000	$56,000
Alternative Waste Treatment System (RB-5)	20	$20,000	$400,000
Pet Waste Education Program	1	$5,000	$5,000
Kennel Wash-off Diversions	21	$500	$10,500
Technical Assistance (person-years)	7.5	$60,000	$450,000
Total			**$1,281,750**

Specifically, alternative (clean) water sources, exclusion of cattle from streams, improved pasture management, and private sewage system maintenance will each provide economic benefits to land owners. Money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is an essential requirement for healthy livestock, with healthy cattle consuming, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer. Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VCE, 2000). In addition, horses drinking from marshy areas or areas where wildlife or cattle carrying Leptospirosis have access tend to have an increased incidence of moonblindness associated with Leptospirosis infections (VCE, 1998a). Some farmers have also noticed decreased leg injuries in livestock from crossing steep or muddy stream banks (Zeckoski *et al.*, 2007). A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills.

In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. Installation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to wet, muddy areas.

Implementing 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, and consequently, improve the profitability of the operation. With feed costs typically responsible for 70 to 80% of the cost of growing or maintaining an animal, and pastures providing feed at a cost of 0.01 to 0.02 cents/lb of total digestible nutrients (TDN) compared to 0.04 to 0.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VCE, 1996). 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. Distributed off-stream waterers and cross-fencing can also improve forage utilization and manure nutrient distribution throughout a pasture (Zeckoski *et al.*, 2007). Another benefit is that, at any given time cattle are in a smaller area, facilitating inspection and handling. The

agricultural BMPs recommended in this document will provide both environmental benefits and economic benefits to the farmer.

The residential pollutant control measures discussed herein will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter potentially carry. An improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20 to 25 years, if properly maintained. 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 in locations where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system. Additionally, if the repair/replacement and pump-out programs become available, they will benefit owners of private sewage (e.g., septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation. Additionally, income from maintenance of these systems should continue long after implementation is complete. A portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which, in turn, will allow for individual landowners to participate in implementation.

6. MEASURABLE GOALS AND MILESTONES

6.1. Implementation Goals

The goals of TMDL implementation are to restore the water quality in the impaired stream segments in the Three Creek, Mill Swamp, and Darden Mill Run watersheds so that they comply with water quality standards and to de-list these segments from the Commonwealth of Virginia's 303(d) List of Impaired Waters. Progress towards these goals can be assessed during the implementation process by tracking the number/type of control measures that are installed and programs or policies developed and executed (implementation actions) and continued water quality monitoring. Improvements in water quality will be measured through monitoring of bacteria concentrations throughout the watersheds.

6.2. Implementation Milestones and Water Quality Goals

The implementation of control measures will be accomplished in stages. In general, the Commonwealth intends that the needed control measures be implemented in a progressive process that first addresses the pollutant sources with the largest impact on water quality. This staged approach is based on meeting water quality goals over a ten-year period.

Once the implementation milestones and stages are established, the water quality improvement that should result from achieving each milestone can be predicted. The bacteria violations that result from each implementation milestone were estimated by using the modeling files that were developed during the TMDL process.

The TMDL report lists an interim set of Stage 1 goals for bacteria load reductions and will serve as a guideline for the first implementation milestone at the 5-year mark. These goals are summarized in Table 3-8. Implementation of Stage 1 control measures are expected to reduce the bacteria loadings from controllable sources so that violations of the single sample maximum *E. coli* criterion (235 cfu/100mL) are less than 10.5% without reductions to wildlife.

Table 6-1 lists the control measures that are scheduled to be implemented in Stage 1. All implementation practices needed in the Darden Mill Run and Mill Swamp watersheds will be applied during Stage 1. For the Three Creek watershed, the focus of Stage 1 will be implementing practices to eliminate human sources of fecal bacteria, installing the livestock exclusion practices, instituting the pet waste education program, and implementing half of the practices needed to reduce kennel wash-off. Local SWCD and NRCS personnel have already started working with producers in the watersheds to install agricultural BMPs. The BMPs

needed in the Three Creek watershed to achieve Stage 2 are summarized in Table 6-2. These 'Stage 2' control measures will be installed during the 5-year period following Stage 1.

Table 6-1. Control Measures to meet Stage 1 Implementation Milestones for Three Creek, Darden Mill Run, and Mill Swamp.

	Three Creek (K26R-03)	Three Creek (K26R-02)	Three Creek (K7R-02)	Mill Swamp	Darden Mill Run	Total
Streams‡ needing Fencing (%)	75	90	-	-	95	
No. of Livestock Exclusion LE-1T systems	2	1	-	-	9	**12**
No. of Livestock Exclusion LE-2T systems	-	-	-	-	1	**1**
No. of Livestock Exclusion CRSL-6 systems	1	1	-	-	4	**6**
Septic Tank Pump-outs	34	60	81	24	24	**223**
Replace Straight Pipes	-	-	-	-	2	**2**
Repair Failing Septic Systems	10	28	20	7	14	**79**
Replace Failing Septic Systems	4	9	7	3	4	**27**
Pet Waste Education Program	1	1	1	-	1	**1****
Kennel Wash-off Diversions	-	7	-	-	7	**14**

‡ Streams with pasture access
** One program throughout the impaired watersheds

Table 6-2. Control Measures to meet Stage 2 Implementation Milestones for Three Creek.

	Units	Three Creek (K26R-03)	Three Creek (K26R-02)	Three Creek (K7R-02)	Total
Improved Pasture Management	acres	2,067	-	-	**2,067**
Reforestation of Erodible Pasture	acres	689	-	-	**689**
Permanent Vegetative Cover on Critical Areas	acres	6	-	-	**6**
Water Control Structures	acres-treated	930	-	-	**930**
Field Borders/Wildlife Option	acres	33	-	-	**33**
Idle Land/Wildlife Option	acres	34	-	-	**34**
Fescue Conversion/Wildlife Option	acres	33	-	-	**33**
Continuous No-till	acres	472	-	-	**472**
Harvestable Cover Crop	acres	378	-	-	**378**
Small Grain Cover Crop	acres	377	-	-	**377**
Grass Buffers	acres	5	-	-	**5**
Kennel Wash-off Diversions		7	-	-	**7**

Table 6-3 shows the costs associated with Stage 1 and Stage 2 implementation efforts. The exceedances of the *E. coli* criteria at Stage 1 and Stage 2 are listed in Table 6-4.

Table 6-3. Staged Implementation Costs for Three Creek, Mill Swamp, and Darden Mill Run.

Type of Control Measure	Implementation Costs		
	Stage 1	Stage 2	Total
Livestock Exclusion Measures			
LE-1T systems	$180,000		$180,000
LE-2T systems	$11,000		$11,000
CRSL-6	$90,000		$90,000
Pasture Control Measures			
improved pasture management		$227,370	$227,370
reforestation of erodible pasture		$65,455	$65,455
permanent vegetative cover on critical areas		$16,800	$16,800
water control structures		$334,800	$334,800
Cropland Control Measures			
wildlife options			
WL-1		$8,580	$8,580
WL-2		$5,100	$5,100
WL-3		$9,900	$9,900
continuous no-till		$44,840	$44,840
cover crops		$26,425	$26,425
grass buffers		$900	$900
Residential Wastewater Control Measures			
septic tank pump-out	$55,750		$55,750
conventional septic systems	$64,000		$64,000
alternative waste treatment systems	$420,000		$420,000
septic system repairs	$276,500		$276,500
pet waste education program	$5,000		$5,000
kennel wash-off diversions	$7,000	$3,500	$10,500
Technical Assistance	$600,000	$300,000	$900,000
Total	**$1,709,250**	**$1,043,670**	**$2,752,920**

Table 6-4. Percent exceedances of the single sample maximum *E. coli* criterion (235 cfu/100mL) and the 30-day geometric mean criterion (126 cfu/100 mL) at Stage 1 and Stage 2 of implementation.

Impaired Segment	Stage 1		Stage 2	
	Single Sample	Geometric Mean	Single Sample	Geometric Mean
Three Creek (K26R-03)	8	40	0	0
Three Creek (K26R-02)	27	38	27	38
Three Creek (K27R-02)	1	0	1	0
Mill Swamp	1	0	1	0
Darden Mill Run	27	65	27	65

Implementation milestones establish the fraction of implementation actions to be taken within certain timeframes. Water quality goals establish the corresponding improvements in water quality that can be expected as the implementation milestones are achieved.

Many implementation activities are already underway in the watersheds. These activities are strongly supported and the recommendation from the Working Group is a continuation of those efforts that are complementary to this plan.

The Working Group also supports prioritizing the placement of implementation practices to critical areas during Stage 1 to achieve the greatest impact in water quality in the shortest amount of time. Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each sub-watershed. An effort should be made to prioritize financial and technical resources for livestock exclusion fencing in sub-watersheds 3, 4, 5, and 6 for Darden Mill Run, and sub-watersheds 21 and 33 for Three Creek (Figure 6-1). The repair and replacement of straight pipes and failing septic systems in Mill Swamp are also a high priority to remove Mill Swamp from the state's impaired waters list. Bacterial loads from sources of human sewage located close to a stream are highest in Darden Mill Run sub-watershed 5; and Three Creek sub-watersheds 6, 20, 24, 28 and 30. Priority analysis for kennel wash-off diversions was based on the sub-watersheds with the highest number of licensed kennels. Darden Mill Run has the highest number of kennels in sub-watersheds 1, 10, and 11. Installation of kennel wash-off diversions should first be prioritized in Three Creek sub-watersheds 20, 22, 24, 27 and 28 to affect the areas with the highest number of kennels in the Three Creek watershed.

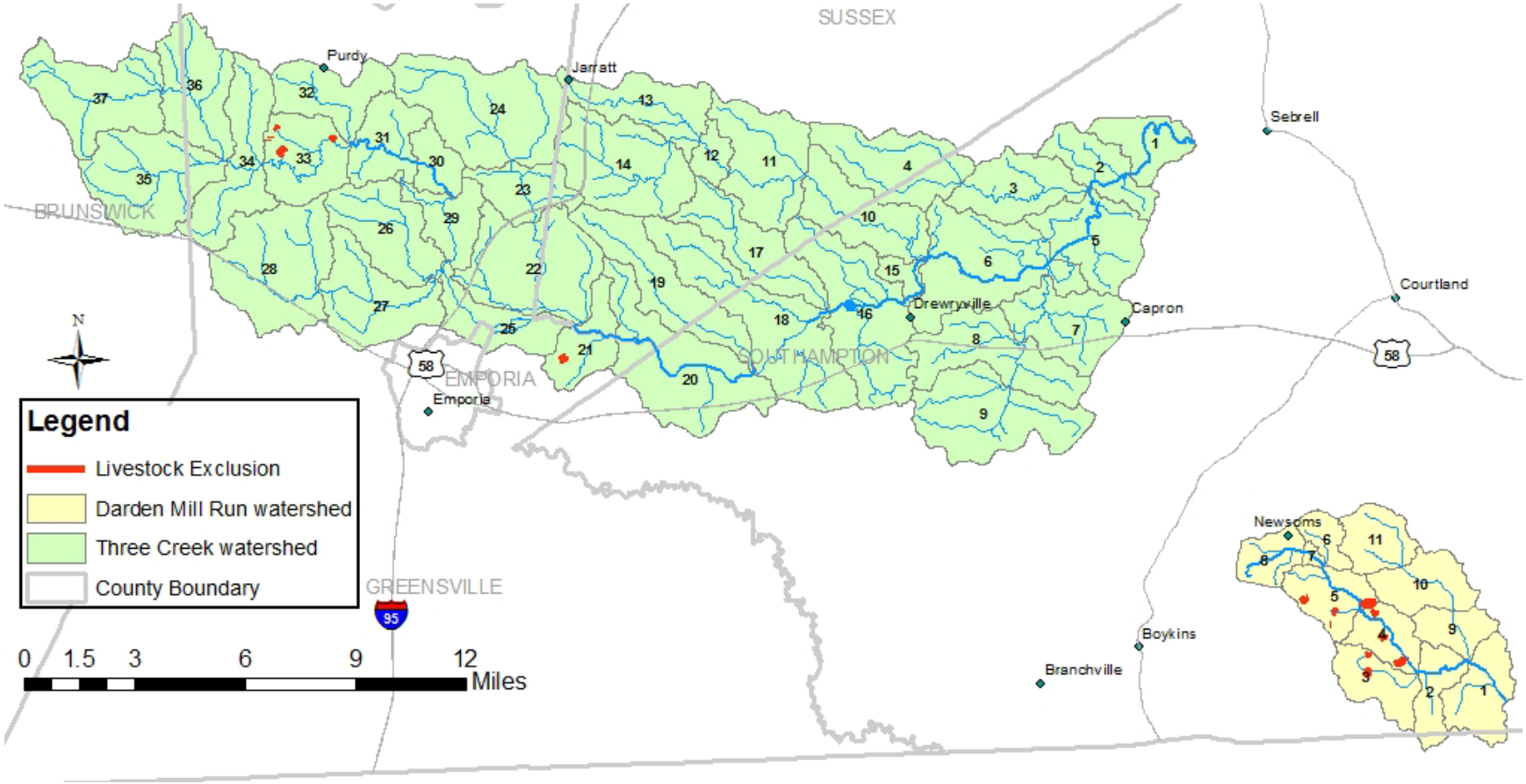

Figure 6-1. Area available for streamside fencing in the Darden Mill Run and Three Creek watersheds.

Monitoring will begin after BMPs have been established and serves to document progress towards goals and to provide a mechanism for evaluating the effectiveness of the implementation actions for achieving intended water quality goals. The benefits of staged implementation are 1) as stream monitoring continues, it allows for water quality improvements to be recorded as they are being achieved; 2) it provides a measure of quality control, given the uncertainties which exist in any implementation plan; 3) it provides a mechanism for developing public support; 4) it helps to ensure that the most cost-effective practices are implemented initially; and 5) it allows for the evaluation of the adequacy of the TMDL in achieving the water quality standard.

6.3. Reasonable Assurance

Public participation is an integral part of the IP development and is critical in gaining support for both the voluntary implementation activities that are being planned. During the public participation process, the major stakeholders in the watershed and a wide variety of local conservation agency personnel were involved in Working Group and public meetings, and provided additional information through email and phone conversations. This participation by the major watershed stakeholders provides a reasonable assurance that the public was contributing to the TMDL process and had input into the selection of management and implementation practices recommended by this IP.

A TMDL IP Steering Committee will be formed as a result of the implementation plan to provide oversight for implementation as needed, with guidance provided by agency members of VADEQ and VADCR, ensuring continuity of leadership and vision. Conservation Technicians are already on staff in the Chowan Basin SWCD to assist agricultural producers in implementing BMPs. The Conservation Technicians have agreed to take responsibility for promoting both agricultural and residential implementation practices within the watersheds.

Implementation to address the bacteria impairments on Three Creek, Mill Swamp, and Darden Mill Run will be carried out primarily through the use of voluntary BMPs and education. Available cost-share programs will be utilized to the extent possible to provide incentives to targeted watershed stakeholders. The Steering Committee is encouraged to seek grant funding to provide additional monies to increase participation from stakeholders that would otherwise be reticent to participate.

Taken together, all of these planning components comprise a reasonable assurance that implementation will progress as planned and will lead to restoration of water quality in Three Creek, Mill Swamp, and Darden Mill Run.

6.4. Implementation Tracking

Tracking of agricultural and residential practices will be done by the Chowan Basin SWCD through the existing BMPCSP tracking maintained by VADCR. Tracking information will include the locations and numbers of practices installed in the watershed. Strategies to facilitate implementation, such as educational programs and other outreach activities will also be tracked. The Steering Committee will provide oversight and direction as needed during implementation.

6.5. Water Quality Monitoring

Virginia's 1997 Water Quality Monitoring, Information and Restoration Act requires that TMDL IPs include measurable goals and milestones for attaining water quality standards. Implicit in those milestones is the requirement of a method to measure progress. Water quality improvement will be evaluated through water quality monitoring conducted by VADEQ. VADEQ will monitor 6 locations in the watersheds (Table 6-5, Figure 6-2). Through the DEQ Ambient Water Quality Monitoring Program, each monitoring station will be visited once per month or every other month depending on the station type. 5ADMR008.42, 5ATRE008.48, and 5ATRE016.02 are trend stations. These stations are long-term stations sited for permanent monitoring for the purpose of detecting water quality trends for various parameters. 5AMSP000.16, 5ATRE022.05, and 5ATRE038.07 are part of a network of watershed stations in which they are sampled every other month for two years. Stations are then rotated within the network for a six year cycle. VADEQ will collect water quality data at each station, including, but not be limited to, the following parameters: *E. coli* bacteria, temperature, dissolved oxygen, and specific conductance.

Table 6-5. VADEQ Monitoring Stations in the Three Creek, Mill Swamp, and Darden Mill Run Watersheds.

VADEQ Station ID	Stream Name	Station Location
5ADMR008.42	Darden Mill Run	Route 673 Bridge
5AMSP000.16	Mill Swamp	Route 731 Bridge
5ATRE008.48	Three Creek	Route 655 Bridge
5ATRE016.02	Three Creek	Route 649 Bridge
5ATRE022.05	Three Creek	Route 615 Bridge
5ATRE038.07	Three Creek	Route 610 Bridge

6.6. Evaluation of Progress

During each periodic evaluation of implementation progress on Three Creek, Mill Swamp, and Darden Mill Run, a reassessment of implementation priorities will be made by the Steering Committee to readjust and fine-tune the targeting approach in concert with the staged implementation approach. Periodic re-evaluation is especially critical during these times of economic uncertainty, where increasing energy prices and fluctuating market prices are bound to affect stakeholders in the agricultural sector and their willingness to commit resources for conservation, especially if they are struggling to maintain their viability as a farming enterprise.

If reasonable progress toward implementing the management practices is not demonstrated, the Steering Committee will consider additional implementation actions. If it is demonstrated that reasonable and feasible management measures have been implemented for a sufficient period of time and TMDL targets are still not being met, the TMDL will be reevaluated and revised accordingly. If after five years the Steering Committee determines that load reductions are being achieved as management measures are implemented, then the recommended appropriate course of action would be to continue management measure implementation and compliance oversight. If it is determined that all proposed control measures have been implemented, yet the TMDL is not achieved, further investigations will be made to determine whether: 1) the control measures are not effective; 2) bacteria loads are due to sources not previously addressed; or 3) the TMDL is unattainable.

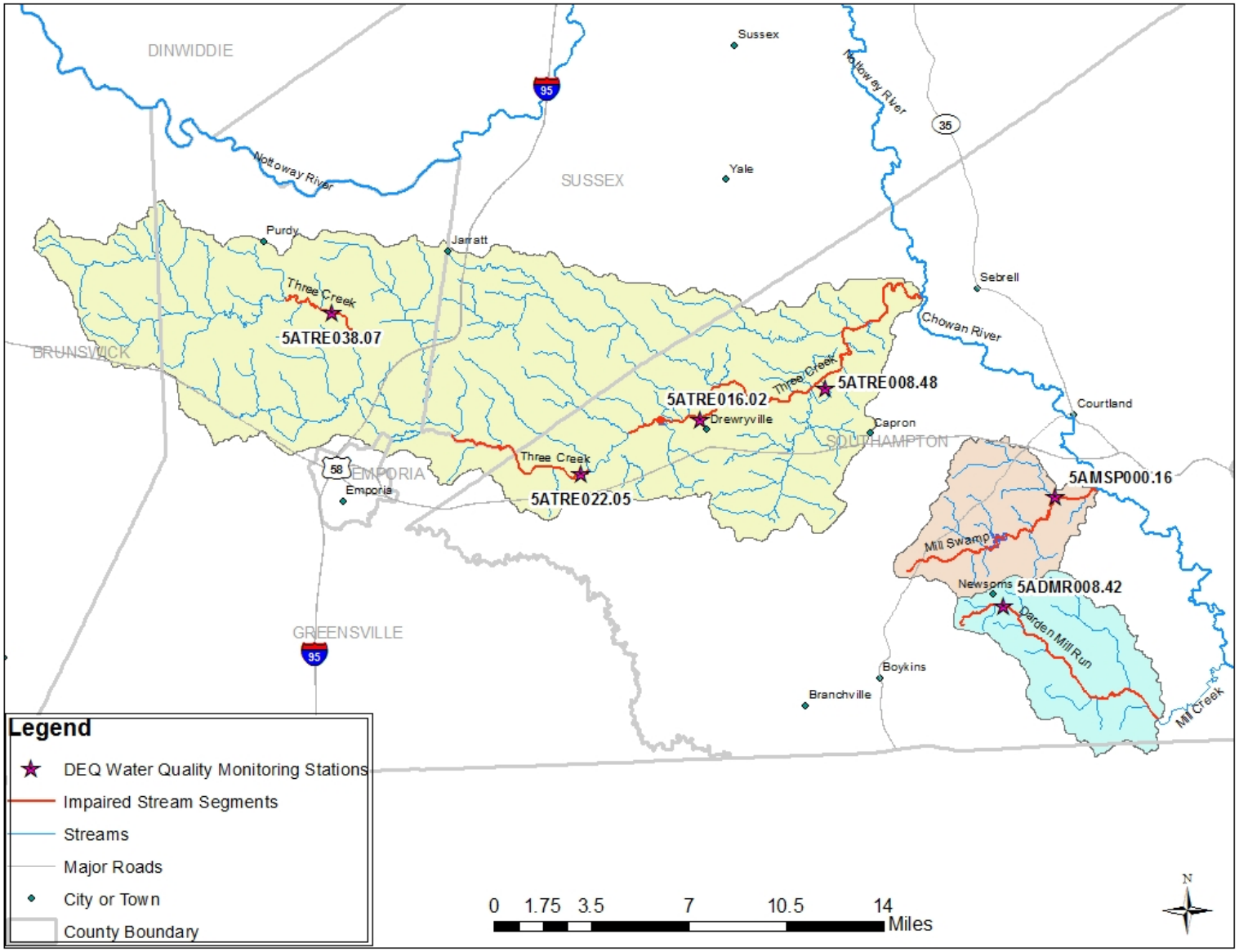

Figure 6-2. Location of Three Creek, Mill Swamp, and Darden Mill Run TMDL Implementation Monitoring Stations.

7. STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (i.e., improving water quality and removing streams from the impaired waters list). The purpose of this chapter is to identify and define the roles of the stakeholders who will work together to put the IP into practice. The roles and responsibilities of some of the major stakeholders are described below.

7.1. Federal Government

United States Environmental Protection Agency (USEPA): USEPA has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states.

Natural Resource Conservation Service (NRCS): The U.S. Department of Agriculture, Natural Resources Conservation Service is the federal agency that works hand-in-hand with US citizens to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies and policymakers also rely on the expertise of NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through CREP and the Environmental Quality Incentive Program (EQIP). For more information on NRCS, visit http://www.nrcs.usda.gov/.

7.2. State Government

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are five state agencies responsible for regulating and/or overseeing statewide activities that impact water quality in the Three Creek, Mill Swamp, and Darden Mill Run watersheds.

Virginia Department of Environmental Quality (VADEQ): The State Water Control Law authorizes the State Water Control Board to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years the focus of VADEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of VADEQ's

pollution reduction efforts from the effluent of wastewater treatment plants to the NPS pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs.

VADEQ is the lead agency in the TMDL process. The Code of Virginia directs VADEQ to maintain a list of impaired waters and develop TMDLs for these waters. VADEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to USEPA and the State Water Control Board for approval. VADEQ is also responsible for implementing point source WLAs, assessing water quality across the state, and conducting water quality standard related actions. The Code also requires the development of IPs for the TMDLs. VADEQ is providing funding for the development of this IP.

Virginia Department of Conservation and Recreation (VADCR): VADCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the CWA. USEPA requires much of the §319 grant monies be used for the development of TMDLs. Because of the magnitude of the NPS component in the TMDL process, VADCR is a major participant in the TMDL process. VADCR has a lead role in the development of IPs to address correction of NPSs contributing to water quality impairments. VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. VADCR staff will also be working with other state agencies, Soil and Water Conservation Districts, and watershed groups to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

Virginia Department of Agriculture and Consumer Services (VDACS): 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. 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 may include civil penalties. 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.

Virginia Department of Game and Inland Fisheries (VDGIF): The VDGIF manages Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; provides opportunity for all to enjoy wildlife, inland fish, boating, and related outdoor recreation; and promotes safety for persons and property in connection with boating, hunting and fishing. The VDGIF has responsibility for administering certain U.S. Fish and Wildlife Service funding programs. Personnel participate, review, and comment on projects processed through state and federal project and permitting review processes to insure the consideration for fish and wildlife populations and associated habitats.

Virginia Department of Health (VDH): The VDH is responsible for maintaining safe drinking water measured by standards set by the USEPA. Like VDACS, VDH is complaint driven. Their duties also include regulation of septic systems, straight pipes, and biosolids land application. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 et seq.). VDH also issues permits for the repair and installation of septic systems and alternative waste treatment systems.

Virginia Department of Forestry (VADOF): The VADOF has prepared a manual to inform and educate forest landowners and the professional forest community on proper BMPs and technical specifications for installation of these practices in forested areas (http://www.dof.virginia.gov/wq/index-BMP-Guide). Forestry BMPs are directed primarily to control erosion. For example, streamside forest buffers provide nutrient uptake and soil stabilization, which can benefit water quality by reducing the amount of nutrients and sediments that enter local streams. VADOF's BMP program is voluntary.

Another state entity with responsibilities for activities that impact water quality in the watersheds is the Virginia Cooperative Extension (VCE). VCE is an educational outreach program of Virginia's land grant universities (Virginia Tech and Virginia State University), and a part of the national Cooperative State Research, Education, and Extension Service, an agency of the United States Department of Agriculture. VCE is a product of cooperation among local, state, and federal governments in partnership with citizens. VCE offers educational programs and technical resources for topics such as crops, grains, livestock, poultry, dairy, natural resources, and environmental management. VCE has published several publications that deal specifically with TMDLs. For more information on these publications and to find the location of county extension offices, visit http://www.ext.vt.edu/.

7.3. Regional and Local Government

Regional and local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their regional and local community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. Some local government groups and their roles in the TMDL process are listed below.

Chowan Basin SWCD: Soil and Water Conservation Districts (SWCDs) are local units of government responsible for the soil and water conservation work within their boundaries. The districts' role is to increase voluntary conservation practices among farmers, ranchers and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices.

Southampton, Sussex, Greensville, and Brunswick Counties: County government staff members work closely with state agencies to develop and implement TMDLs in concert with their comprehensive plans. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of the TMDL process.

7.4. Businesses, Community Groups, and Citizens

While successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. Virginia's approach to correcting non-point source pollution problems continues to be encouragement of participation through education and financial incentives; that is, outside of the regulatory framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

Community Watershed Groups: Local watershed groups (for example, Blackwater Nottoway Riverkeeper Program, Historic Southside Chapter of the Virginia Master Naturalist) offer a meeting place for river groups to share ideas and coordinate preservation efforts and are also a showcase site for citizen action. Watershed groups also have a valuable knowledge of the local watershed and river habitat that is important to the implementation process. Active community watershed groups can be a good resource for procuring and distributing grant funds to assist in financing implementation actions. Depending on their missions, they also present opportunities for educating residents and other stakeholders about the TMDL and implementation plan.

Citizens and Businesses: The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings, assisting with public outreach, providing input about the local watershed history, and/or implementing BMPs to help restore water quality.

Community Civic Groups: Community civic groups take on a wide range of community service including environmental projects. Such groups include the Ruritan, Farm Clubs, Homeowner Associations and youth organizations such as 4-H and Future Farmers of America. These groups offer a resource to assist in the public participation process, educational outreach, and assisting with implementation activities in local watersheds.

Animal Clubs/Associations: Clubs and associations for various animal groups (e.g., beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other land owners, not only in rural areas, but in urban areas as well, where pet waste has been identified as a source of bacteria in water bodies.

8. INTEGRATION WITH OTHER WATERSHED PLANS

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include, but are not limited to, Total Maximum Daily Loads, water quality management plans (WQMPs), sediment and erosion control regulations, stormwater management (SWM), Source Water Assessment Program (SWAP), and local comprehensive plans.

8.1. Continuing Planning Process

According to Perciasepe (1997) the continuing planning process (CPP) established by Section 303(e) of the CWA provides a good framework for implementing TMDLs, especially the NPS load allocations. Under the Section 303(e) process, states develop and update statewide plans that include TMDL development and adequate implementation of new and revised water quality standards, among other components. The water quality management regulations at 40 CFR 130.6 require states to maintain WQMPs that are used to direct implementation of key elements of the continuing planning process, including TMDLs, effluent limitations, and NPS management controls. These state WQMPs are another way for states to describe how they will achieve TMDL load allocations for NPSs. The CPP in Virginia is implemented in various state programs, all aimed toward achieving and maintaining the state water quality standards. Virginia Code Sections 62.1-44.15(10) & (13), 62.1-44.17:3, and 62.1-44.19:7 give the Virginia State Water Control Board (Board) the duty and authority to conduct the CPP in Virginia. Under the authority of Virginia Code Section 10.1-1183, VADEQ serves as the administration arm of the Board. Virginia WQMPs consist of initial plans produced in accordance with Sections 208 and 303(e) of the CWA and approved updates to the plans. Currently, Virginia has a total of 18 WQMPs developed under Sections 208 and 303(e). Many of these plans are outdated, and efforts are underway to update them. The updated plans will serve as repositories for all TMDLs approved by USEPA and adopted by the Board, as well as IPs approved by the Board.

8.2. Watershed and Water Quality Management Planning Programs in Virginia

TMDLs – TMDLs are the maximum amount of pollutant that a water body can assimilate without surpassing state water quality standards. TMDLs are developed for water bodies that are listed on a state's 303(d) list, known as the "Impaired Waters List." The TMDL develops a waste load allocation for point sources and a load allocation for NPSs and incorporates a "margin of safety" in defining the assimilation capacity of the water body. The IP outlines strategies to meet the allocations.

WQMPs – Water Quality Management Plans (WQMPs) are produced and updated by VADEQ in accordance with Sections 208 and 303(e) of the CWA as outlined in the CPP section above. These plans will be the repository for TMDLs and TMDL IPs.

SWM – Stormwater Management (SWM) programs are implemented according to the Virginia Stormwater Management Law and Virginia Stormwater Management Regulations (VSWML&R). These statutes are specifically set forth regarding land development activities to prevent water pollution, stream channel erosion, depletion of ground water resources, and more frequent localized flooding to protect property values and natural resources. SWM programs operated according to the law are designed to address these adverse impacts and comprehensively manage the quality and quantity of stormwater runoff on a watershed-wide basis. VADCR oversees regulated activities undertaken on state and federal property. Revisions to the Virginia SWM Regulations require most Virginia localities to operate their own local SWM program. Only towns without an MS4 program have the option of administering their SWM program or having development regulated by the surrounding county. For more information, visit http://www.dcr.virginia.gov/stormwater_management/stormwat.shtml.

SWAP – Section 1453 of the 1986 Amendments of the Safe Drinking Water Act (SDWA) requires each state to develop a Source Water Assessment Plan (SWAP) that will delineate the boundaries of the assessment areas from which public water systems receive drinking water using hydrogeologic information, water flow, recharge, and discharge and other reliable information. The VDH is the primary agency for drinking water and is therefore responsible for SWAP. In Virginia, all 187 surface water intakes serving 151 public waterworks have completed

surface water assessments. All 4,584 ground water source assessments, serving nearly 4,000 public waterworks, were completed by the end of 2003.

Local Comprehensive Plans – (Southampton, Sussex, Greensville, and Brunswick Counties) Virginia state law requires all local governments have an adopted comprehensive plan. Typical topics addressed in a comprehensive plan include the analysis of population change, land use and trends, natural and environmental features, transportation systems, and community facilities and services. Local comprehensive plans should be referred to in the TMDL development process as well as TMDL implementation, especially for urbanized watersheds.

9. POTENTIAL FUNDING SOURCES

Clean Water State Revolving Fund – USEPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, NPS, and estuary protection projects. Point source projects typically include building wastewater treatment facilities; combined sewer overflow and sanitary sewer overflow correction; urban stormwater control; and water quality aspects of landfill projects. NPS projects include agricultural, silviculture, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc.

Conservation Reserve Enhancement Program – The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. CREP is an offshoot of the country's largest private-lands environmental improvement program -- the Conservation Reserve Program (CRP). Like CRP, CREP is administered by USDA's Farm Service Agency (FSA). CREP addresses high-priority conservation issues of both local and national significance, such as impacts to water supplies, loss of critical habitat for threatened and endangered wildlife species, soil erosion, and reduced habitat for fish populations such as salmon. CREP is a community-based, results-oriented effort centered on local participation and leadership. CREP contracts require a 10- to 15-year commitment to keep lands out of agricultural production. A federal annual rental rate, including an FSA state committee-determined maintenance incentive payment, is offered, plus cost-share of up to 50 percent of the eligible costs to install the practice.

Environmental Quality Incentives Program – The USDA Natural Resources Conservation Service's Environmental Quality Incentives Program (EQIP) was established to provide a voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

EPA Section 319 Grant Incremental Funds – Through Section 319 of the Federal CWA, Virginia is awarded grant funds to implement NPS programs. The VADCR administers the money

annually on a competitive grant basis to fund watershed projects, demonstration and educational programs, NPS pollution control program development, and technical and program staff including TMDL Implementation.

Landowner Incentive Program (Non-Tribal) – The U.S. Fish and Wildlife Service's Landowner Incentive Program (LIP) grant program provides competitive matching grants to states, territories, and the District of Columbia to establish or supplement landowner incentive programs. LIP is a grant-based voluntary cost-share program administered by Virginia Department of Game and Inland Fisheries. These programs provide technical and financial assistance to private landowners for projects that protect and restore habitats of listed species or species determined to be at-risk. LIP projects will likely involve activities such as the restoration of marginal farmlands to wetlands, the removal of exotic plants to restore natural prairies, a change in grazing practices and fencing to enhance important riparian habitats, instream structural improvements to benefit aquatic species, road closures to protect habitats and reduce harassment of wildlife, and acquisition of conservation easements. Although not directly eligible for these grants, third parties such as nonprofit organizations may benefit from these funds by working directly with their states to see if either grants or partnering opportunities are available.

National Fish and Wildlife Foundation – Grant proposals for this funding are accepted throughout the year and processed during fixed sign up periods. There are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, a full proposal evaluation, and a Board of Directors' decision. Grants generally range between $10,000 and $150,000. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special grant programs are listed and described on the NFWF website (http://www.nfwf.org). If the project does not fall into the criteria of any special grant programs, a proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated.

Southeast Rural Community Assistance Project (Southeast RCAP) – The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the Southeast RCAP central office staff across the region. They can provide (at no cost to a community): on-site technical assistance and consultation, operation and

maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Southeast RCAP also has a state-funded Indoor Plumbing and Rehabilitation Program to help with interior plumbing upgrades for low-income rural residents. For more information, visit http://www.southeastrcap.org.

Virginia Aquatic Resources Trust Fund (VARTF) – The Virginia Aquatic Resources Trust Fund is administered in partnership with The Nature Conservancy in Virginia, the VADEQ, and the United States Army Corps of Engineers Norfolk District. The Trust Fund helps make large-scale conservation possible. The program is able to implement large-scale watershed efforts that restore, enhance, and protect water quality through cost-effective, ecologically preferable projects.

Virginia Agricultural Best Management Practices Cost-Share Program – The Virginia Agricultural Best Management Practices (BMPs) Cost-Share Program provides funds to help install conservation practices that protect water and make farms more productive. Funding availability varies by SWCD. The state provides SWCDs with funds to target areas with known water quality needs. Areas with the greatest need receive the greatest funding. The cost-share program supports using various practices in conservation planning to treat animal waste, cropland, pastureland and forested land. Some are paid for at a straight per-acre rate. Others are cost-shared on a percentage basis up to 85 percent. In some cases, USDA also pays a percentage. In fact, the cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner's expense to less than 30 percent of the total cost. Cost-share funds are also available for approved innovative BMP demonstration projects intended to improve water quality.

Virginia Agricultural Best Management Practices Loan Program – The Virginia Agricultural Best Management Practices Loan Program provides a source of low interest financing which will encourage the use of specific best management practices which reduce or eliminate the impact of Agricultural Nonpoint Source (NPS) pollution to Virginia's waters. VADEQ's Virginia Ag BMP loan program is a subset of the parent Virginia Clean Water Revolving Loan Fund (VCWRLF) loan program and is intended to create a continuing source of low interest financing that will be available to Virginia's agricultural producers to assist them in their efforts to reduce agricultural non-point source pollution. Unlike other assistance programs, the Ag BMP loan program is not dependent on legislative appropriations for its fund availability. All repayments of principle and interest from previous Ag BMP loans are returned to the Fund and used to provide additional loans to other Virginia farmers. In addition to the revenue available from repayments, VADEQ

will request that the State Water Control Board (SWCB) consider making additional funding set-asides from the VCWRLF revenue as deemed necessary in order to meet Virginia's agricultural non-point source pollution reduction needs.

Virginia Agricultural Best Management Practices Tax Credit Program - For all taxable years, any individual or corporation, who is engaged in agricultural production for market and who has in place a soil conservation plan approved by the local SWCD, is allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. The amount of the credit cannot exceed $17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed. This program can be used independently or in conjunction with other cost-share programs on the stakeholder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Virginia Environmental Endowment – The Virginia Mini-Grant Program supports community-based efforts to strengthen environmental education and to promote stewardship of Virginia's waterways. Preference is given to modest local projects. Public and private schools (K-12) and nongovernmental, nonprofit community organizations in Virginia are eligible to apply for one-year Mini-Grant awards up to $5,000. Local, state, and federal government agencies and programs are not eligible.

Virginia Open-Space Lands Preservation Trust Fund – Farmland, forest land, and open space land are important to our heritage in Virginia. These lands are under increasing pressure from urban development in parts of the Commonwealth. The 1997 Virginia General Assembly created a new fund (Va. Code Sections 10.1801-2) to assist landowners with the costs of conveying conservation easements and the purchase of all or part of the value of the easements. The fund is operated by the Virginia Outdoors Foundation. Conservation easements preserve farmland, forestland, and natural and recreational areas by restricting intensive uses, such as development and mining, which would alter the conservation values of the land. An easement is a voluntary legal agreement between a landowner and a public body or conservation group in which the parties agree to protect the open-space and natural resource values of the land. Each easement is tailored to reflect the conservation values of the property and is recorded in the local courthouse as a permanent part of the property records. Easements do not grant public access to a landowner's property. Costs that the fund may reimburse include legal costs, appraisal and other costs, and all or part of the easement's value. To be eligible, the

easement must be perpetual in duration. Additional information is available at http://www.virginiaoutdoorsfoundation.org/VOF_land-ptf.php.

Virginia Small Business Environmental Assistance Fund Loan Program – The Fund, administered through VADEQ, is used to make loans or to guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs. The loans are available in amounts up to $50,000 and will carry an interest rate of 3%, with favorable repayment terms based on the borrower's ability to repay and the useful life of the equipment being purchased or the life of the BMP being implemented. To be eligible for assistance, a business must employ 100 or fewer people and be classified as a small business under the federal Small Business Act.

Virginia Water Quality Improvement Fund – The purpose of the Virginia Water Quality Improvement Act of 1997 (WQIA) is to restore and improve the quality of state waters and to protect them from impairment and destruction for the benefit of current and future citizens of the Commonwealth of Virginia (Section 10.1-2118 of the Code of Virginia). The purpose of the fund is to provide water quality improvement grants to local governments, soil and water conservation districts and individuals for point and nonpoint source pollution prevention, reduction and control programs (Section 10.1-2128.B. of the Code of Virginia). Nonpoint source pollution is a significant cause of degradation of state waters. The Virginia Department of Environmental Quality (VADEQ) is responsible for administering point source grants and the Virginia Department of Conservation and Recreation (VADCR) administers nonpoint source grants. WQIF funds are provided, in accordance with the guidelines, to help stimulate nonpoint source pollution reduction through the Virginia Agricultural Best Management Practices Cost-share Program and water quality improvement projects. VADCR staff provides technical assistance, as well as financial assistance. During implementation in the RR watersheds, standards, specifications, cost-share, and tax credits for practices under the Virginia Agricultural BMP Cost-share Program will be followed for funding eligibility.

Wildlife Habitat Incentive Program (WHIP) – WHIP is a voluntary program for landowners who want to develop or improve wildlife habitat on private agricultural lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. Cost-share assistance of up to 75% of the total cost of installation (not to exceed $10,000 per applicant) is

available for establishing habitat. Types of practices include: disking, prescribed burning, mowing, planting habitat, converting fescue to warm season grasses, establishing riparian buffers, creating habitat for waterfowl, and installing filter strips, field borders and hedgerows.

Wetland and Stream Mitigation Banking – Mitigation banks are sites where aquatic resources such as wetlands, streams, and streamside buffers are restored, created, enhanced, or in exceptional circumstances, preserved expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture which provides compensation for aquatic resources in financially and environmentally preferable ways. Not every site or property is suitable for mitigation banking. Wetlands and streams are complex systems, and their restoration, creation, enhancement, or preservation often requires specialized ecological and engineering knowledge. Likewise, the mitigation banking process requires experience to efficiently navigate. Mitigation banks are required to be protected in perpetuity, to provide financial assurances, and long term stewardship. The mitigation banking processes is overseen by the Inter-Agency Review Team (IRT) consisting of several state and federal agencies and chaired by DEQ and Army Corps of Engineers. For more information, contact the Army Corps of Engineers or VADEQ's Virginia Water Protection Program.

Wetland Reserve Program (WRP) – This program is a voluntary program provided through NRCS to restore and protect wetlands on private property. Landowners who choose to participate in WRP may receive payments for a conservation easement or cost-share assistance for a wetland restoration agreement. The landowner will retain ownership but voluntarily limits future use of the land. To be eligible for WRP, land must be suitable for restoration (formerly wetland and drained) or connect to adjacent wetlands. A landowner continues to control access to the land and may lease the land for hunting, fishing, or other undeveloped recreational activities.

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APPENDIX A. GLOSSARY OF BMP AND OTHER CONTROL MEASURE DEFINITIONS

Alternative water system: A structural practice that will provide an alternative water source for livestock to discourage animal access to streams. Cost-sharing and/or tax credits may apply to construction or deepening of wells; development of springs or seeps, including fencing of the area where needed, to protect the development from pollution by livestock; construction or repair of dugouts, dams, pits, or ponds; and the installation of pipelines, storage facilities, cisterns, troughs and artificial watersheds.

Barnyard runoff controls: This practice consists of gutters and downspouts to redirect runoff from heavy use area protection around a facility.

Continuous no-till system: Planting crops every year without disturbing the soil through tillage.

Cover crop: A fall-seeded grass or legume crop planted after the harvest of corn or soybeans to maintain a vegetative cover over the winter.

Critical area stabilization: Establishing permanent vegetation on sites that have or are expected to have high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices. This practice is used in areas with existing or expected high rates of erosion or degraded sites that usually cannot be stabilized by ordinary conservation treatment.

Fencing: A constructed barrier to livestock, wildlife or people. Standard or conventional (barbed or smooth wire), suspension, woven wire, or electric fences shall consist of acceptable fencing designs to control the animal(s) or people of concern and meet the intended life of the practice.

Hardened crossing: A controlled stream crossing for livestock and/or farm machinery in order to prevent streambed erosion and reduce sediment.

Improved pasture management: This practice consists of a series of measures to improve vegetative cover on, and reduce bacteria loading from, pasture areas and may include soil testing, application of lime and fertilizer based on soil testing results, maintenance of a 3-inch minimum grass height through the growing season except for droughts, mowing to control woody vegetation, and chain-harrowing to break-up manure piles after livestock are moved from field.

Livestock exclusion: Excluding livestock from areas where grazing or trampling will cause erosion of stream banks and lowering of water quality by livestock activity in or adjacent to the water. Limitation is generally accomplished by permanent or temporary fencing. In addition, installation of an alternative water source away from the stream has been shown to reduce livestock access.

Livestock exclusion fencing: This practice consists of installing fencing, both temporary and stream exclusion (permanent), for grazing distribution and to restrict stream access in connection with newly developed watering facilities. State and federal cost-sharing requires that the stream exclusion fence be placed a minimum of 35 feet away from the stream, except as designed in areas immediately adjacent to livestock crossings and controlled hardened accesses.

Livestock exclusion buffers: In the implementation plan, this term is used to differentiate the filtering benefits of the buffer, as opposed to the removal of livestock and their directly deposited bacteria loads from the stream. Removal of the livestock has an immediate effect in removing bacteria loads, while the buffer mitigates loading from surface runoff during storm events.

Loafing lot management system: This practice consists of preventing manure and sediment runoff from areas exposed to heavy livestock traffic from entering nearby water corridors and streams.

Reforestation of pasture or cropland: This practice consists of planting trees (hardwoods and/or conifers) on land currently used as cropland or pastureland in order to make a permanent land use conversion to forest, so as to more effectively control the soil and nutrient loss from surface runoff, thus improving water quality. As part of the practice, a permanent vegetative cover is to be established on gullied or eroded areas and shall be maintained until trees provide a protective canopy.

Riparian forest buffer: A protection method used along streams to reduce erosion, sedimentation, and the pollution of water from agricultural nonpoint sources. An area of trees and shrubs 35 – 300 feet wide located up gradient, adjacent, and parallel to the edge of a water feature.

Riparian grass buffer: Grass filter strips are vegetative buffers that are located along the banks of water courses to filter runoff, anchor soil particles, and protect banks against scour and erosion. The strips also improve water quality by filtering out fertilizers, pesticides, and microorganisms that otherwise might reach waterways. In addition, grass filter strips along streams serve as environmental corridors.

Septic system pump out: This preventative control measure consists of periodic maintenance of septic tank systems by having the tank pumped to remove solids and to inspect the septic tank. This practice also allows for the identification of systems which are not functioning properly. The practice also may include inspection of the distribution box to determine if the effluent is being properly distributed to the drainfields and the system is functioning in accordance to design.

Septic system repair: This measure consists of the correction of a malfunctioning on-site sewage disposal system to remove the presence of raw or partially treated sewage on the ground's surface, or in adjacent ditches or waterways, or in ground water.

Septic system, alternative: An alternative on-site waste treatment system is needed to correct a malfunctioning on-site sewage disposal system or to replace an identified straight pipe in situations where the installation/replacement of a septic tank system cannot be permitted. Alternative systems may include the following: aerobic treatment units, low pressure distribution systems, drip distribution systems, sand filters, elevated sand mounds, constructed wetlands, peat filters, vault privies, incinerator toilets, and composting toilets.

Septic system, new: This control measure consists of the installation of a septic tank system to replace an identified straight pipe which delivers sewage directly to a stream, pond, lake, or river or an installation to correct a malfunctioning on-site sewage disposal system. Cost-sharing may include the pump out and removal of solids from the malfunctioning septic tank, the installation of a septic tank and subsurface drainfield components, and the re-stabilization of disturbed areas by planting seed.

Septic system, new with pump: Same as for a new septic system, with the inclusion of a pump as a primary component to move waste to a higher elevation.

Sewer hookup, new: This practice consists of connecting a malfunctioning on-site sewage disposal system to public sewer, or replacing an identified straight pipe by a connection to public sewer. Cost-sharing may be authorized for the connection fee, which is the fee allowing the dwelling to be connected to the public sewer system, for the construction cost associated with connecting the dwelling to a sewer line, for re-stabilization of disturbed areas, and for the pump-out and removal of solids from the septic tank.

Water control structure: This practice consists of constructing detention or retention structures, such as erosion control dams, desilting reservoirs, sediment basins, debris basins, or similar structures that reduce the movement of sediment and other sources of pollutants from the land to the receiving stream.

APPENDIX B. BMP CODES AND PRACTICE NAMES

CRSL-6:	CREP grazing land protection
CRWQ-1:	Grass filter strips
EQIP 512:	Pasture and hayland planting
EQIP 528:	Prescribed grazing
FR-1:	Reforestation of erodible crop and pastureland
LE-1T:	Livestock exclusion with riparian buffers
LE-2T:	Livestock exclusion with reduced setback
RB-1:	Septic tank pump out
RB-2:	Connection of malfunctioning On-site Sewage Disposal System or straight pipe to public sewer
RB-3:	Septic tank system repair
RB-4:	Septic tank system installation/replacement
RB-4P:	Septic tank system installation/replacement with pump
RB-5:	Alternative on-site waste treatment system
SL-6:	Stream exclusion with grazing land management
SL-8B:	Small grain cover crop for nutrient management and residue management
SL-8H:	Harvestable cover crop
SL-10T:	Pasture management
SL-11:	Permanent vegetative cover on critical areas
SL-15A:	Continuous no-till system
WL-1:	Field Borders / Wildlife Option
WL-2:	Idle Land / Wildlife Option
WL-3:	Fescue Conversion / Wildlife Option
WP-1:	Sediment retention, erosion, or water control structures
WP-4B:	Loafing lot management system