Middle Clinch River Watershed Implementation Plan (Bacteria TMDL) Technical Report

Prepared for:
Virginia Department of Environmental Quality

Submitted November 20, 2013

New River-Highlands RC&D

Submitted by:
MapTech, Inc., 3154 State Street, Blacksburg VA 24060

This is a copy of the final report with website links removed. To receive the non-redacted copy, please refer to the VA DEQ website.

Page intentionally blank.

CONTENTS

Page intentionally blank

FIGURES

Page intentionally blank

TABLES

ACKNOWLEDGMENTS

Steering Committee Members

Working Group Members

Virginia Department of Environmental Quality (VADEQ)

VADEQ, Southwest Regional Office

Virginia Department of Conservation and Recreation (VADCR)

Natural Resources Conservation Service

Tazewell Soil & Water Conservation District

Clinch Valley Soil & Water Conservation District

Virginia Department of Health

New River Highlands RC&D

Local citizens and stakeholders in the Middle Clinch River watershed

MapTech, Inc. of Blacksburg, is supported this study
through funding provided by the
Virginia Department of Environmental Quality Contract Number 15029

Page intentionally blank

EXECUTIVE SUMMARY

Twenty (20) segments of the Clinch River and its tributaries are listed for bacteria impairments, including segments of these fourteen (14) streams: Clinch River, Indian Creek, Weaver Creek, Thompson Creek, Lewis Creek, Hess Creek, Swords Creek, Little River, Big Cedar Creek, Burgess Creek, Dumps Creek, Elk Garden Creek, Loop Creek and Maiden Spring Creek.

As a result of the listings, a Total Maximum Daily Load (TMDL) report was developed (TMDL Development Middle Clinch River Watershed, VA) by MapTech, Inc., in August 2012, which established the reduction in loads needed to restore these waters. Virginia law requires that a plan be developed to achieve fully supporting status for impaired waters. In fulfilling the state's requirement for the development of a TMDL Implementation Plan (IP), a framework was established for reducing fecal bacteria to achieve the water quality goals for the impaired streams.

Review of TMDL Development

MapTech, Inc. developed an *E. coli* TMDL report for the Middle Clinch River watershed which was completed in August 2012. Modeling conducted in support of the fecal bacteria TMDL report considered loads in runoff resulting from wildlife (*e.g.,* deer, raccoon, muskrat, beaver, turkey, goose, mallard, and wood duck), livestock (*e.g.,* beef, dairy and horse), and residential (*e.g.,* failing septic systems, straight pipes, dogs and cats) sources. Direct loads to the stream (including direct deposition from cattle and wildlife), uncontrolled discharges (failing septic systems and straight pipes), and permitted sources were also modeled. The *E. coli* standard current at the time of modeling, along with an implicit Margin of Safety (MOS), were used as the water quality endpoints.

The results of the Middle Clinch River watershed TMDLs are percent reductions to various sources of bacteria in the watershed. These percent reductions are detailed in **Table ES. 1**, and are grouped into sets for modeling purposes, called Nested TDML Units (NTUs).

Table ES. 1 Fecal bacteria TMDL reduction scenarios for the Middle Clinch River Watershed.

NTU	Impairment Group Name	Livestock Direct	Agricultural Land Based	Human Direct	Human and Pet Land Based
		% Reduction in Fecal Bacteria Loading From Existing Conditions			
250	**Middle Clinch River**	100	0	100	8
251	**Dumps Creek**	100	0	100	60
252	**Big Cedar/Burgess**	100	86	100	90
253	**Elk Garden/Loop Creek**	100	83	100	89
298	**Lewis Creek**	100	79	100	83
421	**Swords/Hess Creek**	100	0	100	63

Public Participation

The actions and commitments described in this document were drawn together through input from local citizens, local government representatives, Virginia Departments of Conservation and Recreation (VADCR), Environmental Quality (VADEQ), and Health (VDH), Virginia Cooperative Extension (VCE), Natural Resources Conservation Service (NRCS), the local Soil & Water Conservation Districts (SWCDs), MapTech, Inc. and other organizations. Every citizen and interested party in the watershed is encouraged to become involved in implementing the plan to help restore the health of the Middle Clinch River watershed.

Public meetings were conducted to distribute information and gain feedback from the community. Active participation was solicited in smaller forums called working groups. These groups were comprised of stakeholders with similar concerns (*e.g.,* agricultural, residential and urban, and governmental). Representatives from each working group participated in the Steering Committee, where input from the working groups was reviewed and decisions about the IP were made. Throughout the public participation process, a major emphasis was placed on discussing best management practices (BMPs), BMP specifications, locations of control measures, education, technical assistance, and funding.

Opinions were voiced throughout the public participation meetings regarding what should be included in the Implementation Plan. Most members of the working groups agreed that the cornerstone of the Implementation Plan should be cultivating public involvement

and education, and encouraging commitment and partnerships between the citizens in the watershed and government agencies in order to reduce fecal bacteria pollution in the Middle Clinch River watershed.

Assessment of Implementation Action Needs

The quantity or extent of pollution control measures, or BMPs, needed during implementation was determined through spatial analyses of land use, stream-networks, along with regionally appropriate data archived in the VADCR Agricultural BMP Database. Additionally, input from local agency representatives and community members were used to verify the analyses. Overall, the needs to meet the TMDL for the 15-year implementation period were identified and are shown in **Table ES. 2**.

Table ES. 2 Agricultural and residential BMPs needed in the Middle Clinch Watershed by NTU.

Control Measure	Unit	NTU					
Agricultural		**250**	**251**	**252**	**253**	**298**	**421**
LE-1T >100-acres Livestock Exclusion	System	98	4	33	21	7	13
LE-1T <100-acres Livestock Exclusion	System	97	4	33	21	7	13
LE-2T >100-acres Livestock Exclusion	System	97	4	33	21	7	13
LE-2T <100-acres Livestock Exclusion	System	97	4	32	20	7	12
WP-2T Livestock Exclusion	System	4	0	1	1	0	1
SL-6 Livestock Exclusion	System	21	1	7	4	1	3
Livestock Exclusion Maintenance	Feet	71,023	2,862	23,771	15,167	4,621	9,349
Retention Ponds	Acres-Treated	0	0	4,132	2,130	638	0
Loafing Lot Management System	System	1	0	1	1	0	1
Reforestation of Erodible Pasture	Acres	0	0	11	111	203	0
Conservation Tillage	Acres	0	0	151	155	30	0
Improved Pasture Management	Acres	0	0	15,563	9,852	2,023	0
Beef - Waste Storage System	System	2	0	0	0	1	0
Residential							
Septic Systems Pump-out Program (RB-1)	Pump-out	4,531	139	1,640	890	810	1,462
Connection to Public Sewer (RB-2)	System	8	0	3	2	1	2
Septic System Repair (RB-3)	System	72	3	26	14	13	23
Septic System Install/Replacement (RB-4)	System	56	1	2	1	2	8
Alt. Waste Treatment System Install (RB-5)	System	37	2	27	14	15	28
Community Pet Waste Education Program	Program	0	0	1	0	0	0
Residential Pet Waste Composters	System	125	50	250	100	75	125

Cost/Benefit Analysis

The costs of the above control measures were determined based on the cost of control measures previously installed through the Virginia Agricultural Cost-Share Program in the Middle Clinch River watershed, and discussions with local agency representatives and working groups. The cost of technical assistance needed to implement the control measures was determined based upon discussions with working group members and technical assistance costs from both ongoing and previous implementation plans in similar watersheds. The estimated total cost to install agricultural and residential control measures in the Middle Clinch River watershed impairments is $30,979,951 and $6,511,350 respectively, excluding technical assistance. The estimated total cost to provide technical assistance during implementation for Middle Clinch River watershed impairments is expected to be $1,200,000. The total cost estimated for 15 years of implementation in the Middle Clinch River watershed is $38,691,301.

The primary benefit of implementation is the reduction of *E. coli* bacteria in this watershed. With the completion of this Implementation Plan, the risk of illness or infection as a result of direct contact with *E. coli* bacteria through swimming in or drinking water from this stream will decrease significantly. Streambank protection, provided through exclusion of livestock from streams, will also lead to improved aquatic habitat. The practices recommended in this document will provide economic benefits to landowners in addition to the anticipated environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, and improved pasture management will improve profitability of farms, while private sewage system installation and maintenance will ultimately save homeowners money by preventing expensive fees and repairs. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The VCE (1998a) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7 billion to 2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy herd can be reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas.

Measurable Goals and Milestones for Attaining Water Quality Standards

Potential funding sources available during implementation were identified during plan development. Sources may include, but are not limited to:

- Federal Clean Water Act Section 319 Incremental Funds
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- USDA Environmental Quality Incentives Program (EQIP)
- Virginia Revolving Loan Programs (Agricultural BMPs and onsite sewage disposal systems)
- USDA Wildlife Habitat Incentive Program (WHIP)
- Virginia Water Quality Improvement Fund

Implementation is divided into two stages. Stage I concentrates on implementing the most cost-effective BMPs, those with the largest impact on water quality. Following Stage I implementation, the steering committee will evaluate water quality improvements and determine how to proceed to complete implementation of Stage II. Stage II continues towards achieving the TMDL allocations by implementing the remaining BMPs needed to meet the TMDL allocations for those stream segments which remain impaired following Stage I implementation.

Implementation progress success will be determined by water quality monitoring conducted by VADEQ through the agency's monitoring program.

Stakeholders and Their Role in Implementation

The Tazewell and Clinch Valley Soil & Water Conservation Districts (SWCDs) will be in charge of initiating contact with farmers and homeowners in the impaired watersheds to encourage the installation of agricultural, residential and industrial BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The local SWCD staff will conduct outreach activities in the watersheds to garner the participation and community support necessary to reach implementation milestones, and to make the community aware of the water quality impairments present in the Middle Clinch River watershed and how they may affect local residents. Such activities will include information exchange through newsletters,

mailings, field days, organizational meetings, etc. The local SWCD staff will work with appropriate organizations (such as VCE) to educate the public.

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. The agencies regulating activities that impact water quality in Virginia include: VADEQ, VADCR, Virginia Department of Agriculture and Consumer Services (VDACS), Virginia Department of Mines, Minerals, and Energy (DMME), and the Virginia Department of Health (VDH).

Achieving the goals of this IP (*i.e.*, improving water quality and removing these waters from the Section 303(d) list) is dependent on stakeholder participation – not only the local citizens needing agricultural control measures or residential waste treatment facilities, but also all citizens living in the watershed. It must be acknowledged first that there is a water quality problem, and changes must be made as needed in operations, programs, and legislation to address these pollutants. Local citizens can become involved by picking up after their pets, properly maintaining their septic systems, becoming water quality monitoring volunteers and volunteering to distribute information and educate others at public events.

Discussion at the Government Working Group suggested that there is potential for successful citizen monitoring in the watershed. Citizen monitoring could potentially be coordinated in cooperation with the citizen lab at Lonesome Pine SWCD. The focus of citizen monitoring in the Middle Clinch watershed would be to identify places for VADEQ to conduct follow-up monitoring.

1. INTRODUCTION

1.1 Background

The detrimental effects of bacteria in food and water supplies have been documented repeatedly. On August 8, 1994, the Virginia Department of Health (VDH) was notified that campers and counselors at a Shenandoah Valley summer camp developed severe gastrointestinal illness. It was confirmed that *E. coli* 0157:H7, a type of fecal coliform bacteria commonly found in the intestines of humans and animals, was the causative agent (CDC, 1995).

In Franklin County, Virginia, a 1997 outbreak of illnesses involving three children was attributed to *E. coli* (0157:H7) in Smith Mountain Lake. The children came in contact with the bacteria while swimming in the lake, and a two-year-old child almost died as a result of the exposure (Roanoke Times, 1997a, 1997b, 1998b).

In August 1998, seven children and two adults at a day-care center in rural Floyd County were infected with *E. coli* (0157:H7). Upon investigation, two of the property's wells tested positive for total coliform (Roanoke Times, 1998a, 1998c). On June 6, 2000, Crystal Spring (Roanoke, Virginia's second largest water source) was shut down by the VDH for *E. coli* contamination (Roanoke Times, 2000).

These are not isolated cases. Throughout the United States, the Centers for Disease Control estimates that at least 73,000 cases of illnesses and 61 deaths per year are caused by *E. coli* 0157:H7 bacteria (CDC, 2001). Other fecal coliform (FC) pathogens (*e.g., E. coli* 0111) are responsible for similar illnesses. In addition, the presence of other bacterial and viral pathogens is indicated by the presence of FC. Whether the source of contamination is human or livestock waste, the threat of these pathogens appears more prevalent as both populations increase. As stakeholders, we must assess the risk we are willing to accept and then implement measures to safeguard the public from these risks.

The Clean Water Act (CWA) that became law in 1972 requires that all U.S. streams, rivers, and lakes meet their state's water quality standards. The CWA also requires that

states conduct monitoring to identify polluted waters or those that do not meet standards. Through this required program, the state of Virginia has found that many stream segments do not meet state water quality standards for protection of the six beneficial uses: recreation/swimming, aquatic life, wildlife, fish consumption, shellfish consumption, and public water supply (drinking).

When streams fail to meet standards, Section 303(d) of the CWA and the U.S. Environmental Protection Agency's (EPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a stream can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. A TMDL accounts for seasonal variations and must include a margin of safety (MOS). Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed and approved by the State Water Control Board (SWCB) and EPA, measures must be taken to reduce pollution levels in the stream. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) 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". The TMDL Implementation Plan (IP) describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process."

There are twenty (20) different impaired stream segments in this study area. The impaired segments are on the following streams: Clinch River, Indian Creek, Weaver Creek, Thompson Creek, Lewis Creek, Hess Creek, Swords Creek, Little River, Big Cedar Creek, Burgess Creek, Dumps Creek, Elk Garden Creek, Loop Creek and Maiden Spring Creek. **Table 1.1** shows descriptive information for each impaired segment.

Figure 1.1 shows the location of the impaired segments in the Middle Clinch River Watershed.

Table 1.1 Descriptive information for fecal bacteria impairments in the Middle Clinch River Watershed.

Stream Name Impairment ID	**Impairment Location Description**	**2010 River Miles**
Indian Creek VAS-P05R_IDN01A04	From the highway 19 crossing to the Little River confluence at Wardell.	3.98
Clinch River VAS-P07R_CLN01A00	From its confluence with Big Cedar Creek near Pinnacles downstream to its confluence with Dumps Creek at Carbo.	13.95
Big Cedar Creek VAS-P06R_BCD01A98	From the vicinity of Daughertys Cave downstream to confluence with Clinch River.	4.11
Big Cedar Creek VAS-P06R_BCD02A02	From the confluence with Little Cedar Creek downstream to the vicinity of Daughertys Cave.	1.12
Big Cedar Creek VAS-P06R_BCD02A00	From the Lebanon raw water intake downstream to the confluence with Little Cedar Creek.	2.75
Big Cedar Creek VAS-P06R_BCD03A00	From its headwaters downstream to the Lebanon raw water intake.	3.23
Loop Creek VAS-P06R_LOO01A06	From route 80 downstream to the Elk Garden Creek confluence.	2.87
Burgess Creek VAS-P06R_BUG01A06	From its confluence with Campbell Branch to its confluence with Big Cedar Creek.	1.50
Elk Garden Creek VAS-P06R_EKG01A06	From Elk Garden to its confluence with Big Cedar Creek.	3.28
Weaver Creek VAS-P07R_WEA01A06	From it's confluence with Hart Creek to its confluence with the Clinch River near Artrip	9.14
Thompson Creek VAS-P07R_TMP01A06	From Coulwood to its confluence with the Clinch River.	4.26
Lewis Creek VAS-P04R_LWS01A98	From it's confluence with Stone Branch at Flat Rock downstream to the Clinch River confluence.	4.83

Table 1.1 Descriptive information for fecal bacteria impairments in the Middle Clinch River Watershed (cont.).

Stream Name Impairment ID	Impairment Location Description	2010 River Miles
Lewis Creek VAS-P04R_LWS01A10	From it's confluence with Grassy Creek downstream to the Stone Branch confluence at Flat Rock.	3.43
Hess Creek VAS-P04R_HES01A10	From groundhog hollow downstream to just south of Dye.	1.04
Swords Creek VAS-P04R_SWD01A10	Sulfur Spring Branch at Dye confluence downstream to the Clinch River confluence.	2.88
Little River VAS-P05R_LTR02A00	From the Claypool Hill STP downstream to Laurel Creek confluence near Wardell.	5.18
Little River VAS-P05R_LTR02A02	From the Laurel Creek confluence near Wardell downstream to Grays Branch confluence at Russell/Tazewell County line.	4.11
Dumps Creek VAS-P08R_DUM01A94	From the Hurricane Creek confluence downstream to Clinch River confluence at Carbo.	3.41
Maiden Spring Creek VAS-P05R_MSC01A02	From the Little River confluence upstream to foot of Morris Knob north of Robbins Gap.	6.51
Maiden Spring Creek VAS-P05R_MSC01C04	From an unnamed tributary with Buchanan Cemetery downstream through Thompson Valley to Morris Knob.	8.57

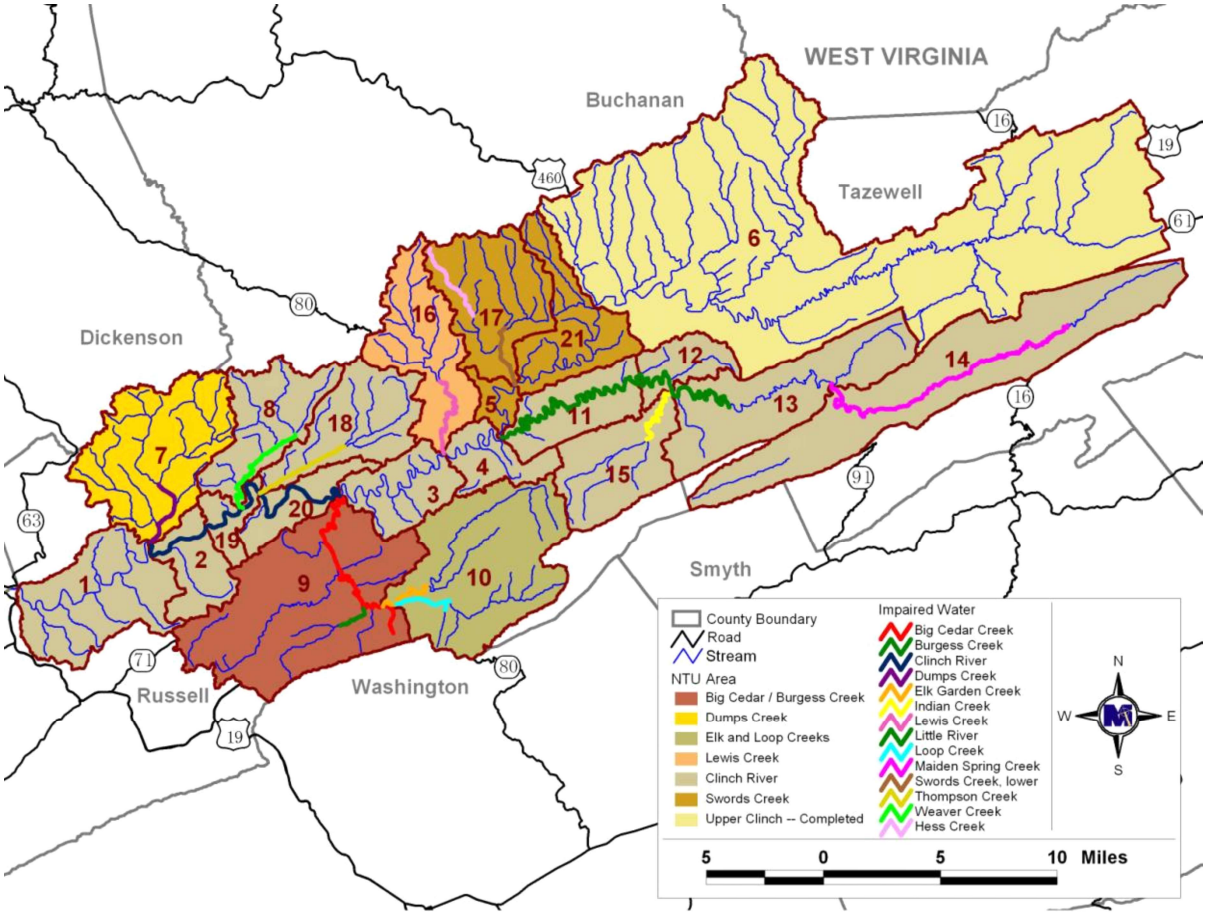

Figure 1.1 Location of impaired segments in the Middle Clinch River Watershed.

Land use information for the Middle Clinch River watershed is shown in **Table 1.2** and **Figure 1.2**.

Table 1.2 Spatial distribution of land use for the Middle Clinch River Watershed.

Land Use	Acres
Re-claimed Mine Land	4,944
Barren[1]	1,648
Commercial	4,491
Crop	1,257
Forest	234,752
Gas Wells	410
LAX[2]	1,119
Pasture	107,721
Residential	24,704
Water	3,126
Total	**384,172**

[1] Barren - Areas of bedrock, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
[2] LAX - Livestock pasture access near flowing streams.
Does not include the Upper Clinch River subwatershed because an implementation plan has already been completed for it.

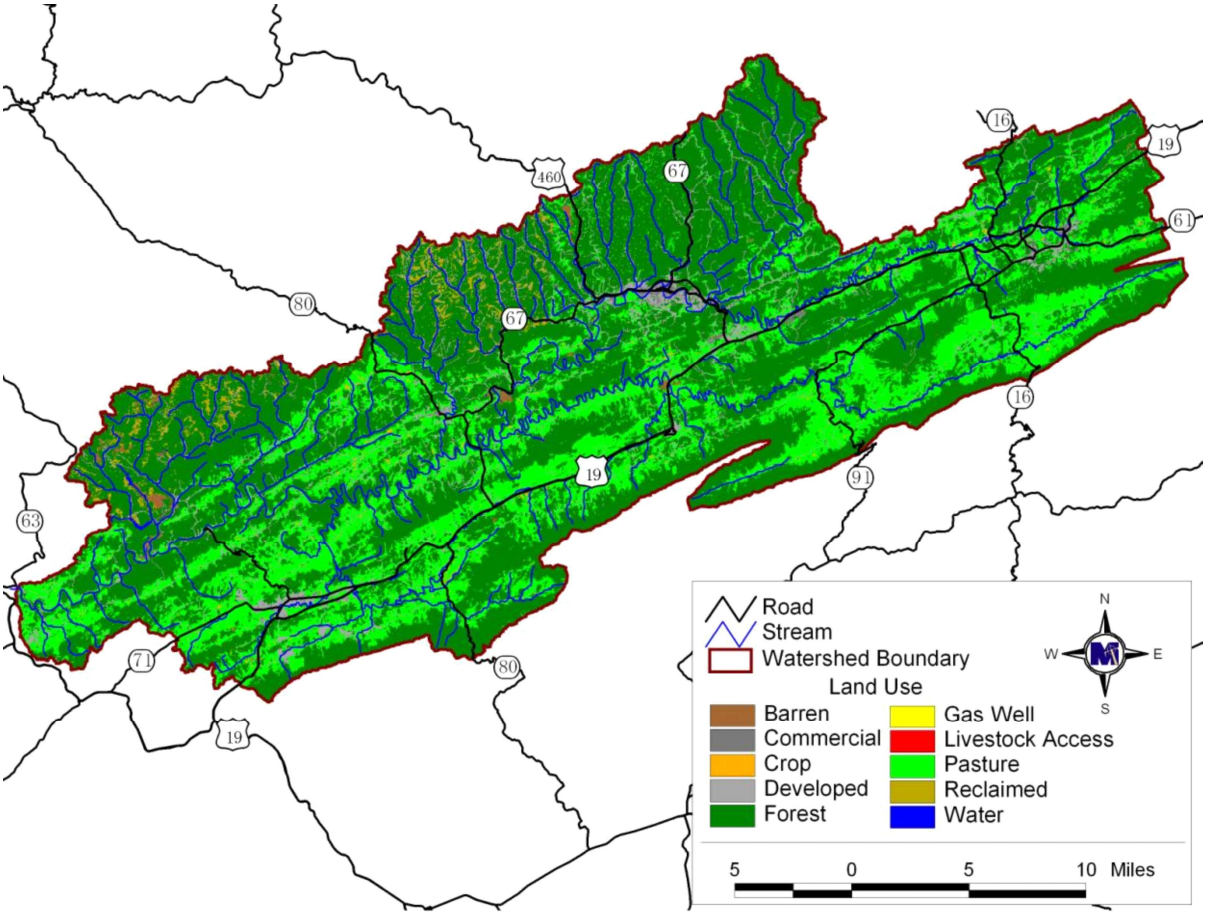

Figure 1.2 Land uses in the Middle Clinch River Watershed.

In developing this IP, elements from both state and federal guidance were incorporated and the recommended guidelines from Virginia's *Guidance Manual for Total Maximum Daily Load Implementation Plans* were followed. Specific state and federal requirements of an IP are described in Chapter 2 of this document.

Once developed, the Virginia Department of Environmental Quality (VADEQ) will take TMDL implementation plans to the SWCB for approval as the plan for implementing the pollutant allocations and reductions contained in the TMDLs. Also, VADEQ will request SWCB authorization to incorporate the TMDL Implementation Plan into the appropriate Water Quality Management Plan (WQMP) in accordance with the CWA's Section 303(e). In

response to a Memorandum of Understanding (MOU) between EPA and VADEQ, VADEQ also submitted a draft Continuous Planning Process to EPA in which VADEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL Implementation Plans developed within a river basin.

1.2 Designated Uses

All waters in the Commonwealth have been designated as "primary contact" for the swimming use regardless of size, depth, location, water quality or actual use. The *E. coli* bacteria standard is described in 9 VAC 25-260-170 and in Section 1.3 of this report. This standard is to be met during all stream flow levels and was established to protect bathers from ingestion of potentially harmful bacteria. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

Recognizing that all waters in the Commonwealth are not used extensively for swimming, Virginia has approved a process for re-designation of the recreational use for secondary contact in cases of: 1) natural contamination by wildlife, 2) small stream size, and 3) lack of accessibility to children, in combination with widespread socio-economic impacts resulting from the cost of improving a stream to a “swimmable” status.

The re-designation of the current recreational use in a stream, if deemed necessary, will require the completion of a Use Attainability Analysis (UAA). A UAA is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in the Federal Regulations. The stakeholders in the watershed, Virginia, and EPA will have an opportunity to comment on these special studies.

1.3 Applicable Water Quality Standards

According to Virginia Water Quality Standard 9 VAC 25-260-5, 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 (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

Virginia Water Quality Standard 9 VAC 25-260-10 (Designation of uses.) states:

A. 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.

◆

D. At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under §§301(b) and 306 of the Clean Water Act and cost-effective and reasonable best management practices for nonpoint source control.

◆

G. The [State Water Quality Control] board may remove a designated use which is not an existing use, or establish subcategories of a use, if the board can demonstrate that attaining the designated use is not feasible because:

1. *Naturally occurring pollutant concentrations prevent the attainment of the use;*

2. *Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating state water conservation requirements to enable uses to be met;*

3. *Controls more stringent than those required by §§301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.*

At the time stream segments in the Middle Clinch River watershed were first designated as impaired, TMDLs were developed for *E. coli* bacteria based on the *E. coli* State water quality standard. For a non-shellfish supporting waterbody to be in compliance with Virginia *E. coli* standard for contact recreational use, VADEQ specified the following criteria (Virginia Water Quality Standard 9 VAC 25-260-170):

> *A. In surface waters, except shellfish waters and certain waters identified in subsection B of this section, the following criteria shall apply to protect primary contact recreational uses:*
>
> *1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water. This criterion shall not apply for a sampling station after the bacterial indicators described in subdivision 2 of this subsection have a minimum of 12 data points or after June 30, 2008, whichever comes first.*
>
> *2. E. coli and enterococci bacteria per 100 ml of water shall not exceed the following:*

	Geometric Mean[1]	*Single Sample Maximum*[2]
Freshwater[3]		
E. coli	*126*	*235*
Saltwater and Transition Zone[3]		
enterococci	*35*	*104*

[1] For two or more samples taken during any calendar month.
[2] No single sample maximum for *enterococci* and *E. coli* shall exceed a 75% upper one-sided confidence limit based on a site-specific log standard deviation. If site data are insufficient to establish a site-specific log standard deviation, then 0.4 shall be used as the log standard deviation in freshwater and 0.7 shall be as the log standard deviation in saltwater and transition zone. Values shown are based on a log standard deviation of 0.4 in freshwater and 0.7 in saltwater.
[3] See 9 VAC 25-260-140 C for freshwater and transition zone delineation.

If the waterbody exceeded either criterion more than 10.5% of the time, the waterbody was classified as impaired and a TMDL was developed and implemented to bring the waterbody into compliance with the water quality criterion. Based on the sampling frequency, only one criterion was applied to a particular datum or data set (Virginia Water Quality Standard 9 VAC 25-260-170). If the sampling frequency was one sample or less per 30 days, the

instantaneous criterion was applied; for a higher sampling frequency, the geometric criterion was applied.

Most of the VADEQ's ambient water quality monitoring is done on a monthly or bi-monthly 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. Prior to the 2006 305(b)/303(d) integrated reports, the fecal coliform bacteria standard was used to determine compliance with the recreational use. A five-year time span was used for the 2002 - 2006 assessment periods. The 2008 and 2010 305(b)/303(d) integrated reports were based on a six-year assessment time span and the *E. coli* bacteria standard was used to determine compliance with the recreational use.

1.4 Indicator Species Change

A regulatory action pertaining to the indicator species for the bacteria water quality standard in Virginia has been implemented in recent history and is worth noting. The EPA recommended that all states adopt an *E. coli* or *enterococci* standard for fresh water and *enterococci* criteria for marine waters by 2003. The EPA pursued the states' adoption of these standards because there is a stronger correlation between the concentration of these organisms (*E. coli* and *enterococci*) and the incidence of gastrointestinal illness than with fecal coliform. *E. coli* and *enterococci* are both bacteriological organisms that can be found in the intestinal tract of warm-blooded animals. Like fecal coliform bacteria, these organisms indicate the presence of fecal contamination. The transition to the *E. coli* and *enterococci* standard began in 2003 and was completed in June 2008. For the 2006, 2008 and 2010 305(b)/303(d) Water Quality Assessment Integrated Reports the new standard was used to assess the bacteria data. The *E. coli* water quality standard has an instantaneous level of 235 colony-forming units (cfu) per 100 ml and geometric mean of 126 colony-forming units (cfu) per 100 ml for two or more samples over a 30-day period.

1.5 Project Methodology

The overall goal of this project was to begin the process of restoring water quality in the Middle Clinch River watershed impaired stream segments.

The key components of the staged Implementation Plan are discussed in detail in the following sections: State and Federal Requirements for Implementation Plans, Review of TMDL Development, Process for Public Participation, Assessment of Needs, Measurable Goals and Milestones, and Implementation.

In fulfilling the state's requirement for the development of a TMDL IP, a framework has been established for reducing *E. coli* levels and achieving the water quality goals for the Middle Clinch River watershed impaired segments for which TMDL allocations were developed. With successful completion of the IP, Virginia will be well on the way to restoring the impaired waters and enhancing the value of this important resource. Additionally, development of an approved IP will improve the localities' chances for obtaining monetary assistance during implementation

.

2. STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

There are a number of state and federal requirements and recommendations for TMDL IPs. The goal of this chapter is to clearly define what they are and explicitly state if the "elements" are a required component of an approvable IP or are merely a recommended topic that should be covered in a thorough IP. This chapter has three sections that discuss a) the requirements outlined by the WQMIRA that must be met in order to produce an IP that is acceptable and approvable by the Commonwealth, b) the EPA recommended elements of IPs, and c) the required components of an IP in accordance with Section 319 guidance.

2.1 State Requirements

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

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

2.2 Federal Recommendations

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

The listed elements include:

- a description of the implementation actions and management measures,
- a time line for implementing these measures,
- legal or regulatory controls,
- the time required to attain water quality standards, and
- a monitoring plan and milestones for attaining water quality standards.

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

2.3 Requirements for Section 319 Fund Eligibility

The EPA develops guidelines that describe the process and criteria used to award CWA Section 319 nonpoint source 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 to achieve water quality standards;
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 loading reductions are being achieved and if progress is being made towards attaining water quality standards; if not, identify 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.

3. REVIEW OF TMDL DEVELOPMENT

MapTech, Inc. was contracted to conduct a bacteria TMDL study for the Middle Clinch River watershed. The TMDL study report completed in August 2012. The *E. coli* load reductions called for in the TMDL study were reviewed to determine the water quality goals and associated pollutant reductions that would need to be addressed through the development of the implementation plan.

3.1 Water Quality Modeling

In order to understand the implications of the load allocations determined during TMDL development, it is important to understand the modeling methods used in the analysis.

3.1.1 Fecal Bacteria Modeling

USGS Hydrologic Simulation Program - Fortran (HSPF) water quality model was used as the modeling framework to simulate hydrology and fecal coliform fate and transport for the bacteria TMDL allocations. The water quality endpoint used for determining the necessary reduction to *E. coli* loads was the 30-day geometric mean standard (126 cfu/100 mL), with an implicit margin of safety.

Potential sources of *E. coli* considered in the TMDL development included both point source and nonpoint source contributions. Permitted point sources that discharge fecal bacteria are shown in **Table 3.1**.

Table 3.1 Permitted point sources in Middle Clinch River Watershed.

Permit	Facility Name	Design Flow (MGD)	Permitted for *E. coli* Control
VA0020672	DOC - Appalachian Detention Center 29	0.021	Y
VA0020745	Lebanon WWTP	0.999	Y
VA0026387	Honaker STP	0.40	Y
VA0064271	Claypool Hill STP	0.35	Y
VA0001015	American Electric Power – Clinch River Plant (Outfall 008)	0.036	Y
VA0021016	Cleveland STP	0.040	Y
62 Domestic Discharges	Domestic	0.001	Y

[1]MGD – million gallons per day

At the time that the TMDL was created, permitted point discharges that may contain pathogens associated with fecal matter were required to maintain an *E. coli* concentrations below 126 cfu/100 mL. One method for achieving this goal is chlorination. Chlorine is added to the discharge stream at levels intended to kill off any pathogens. The monitoring method for ensuring the goal is to measure the concentration of total residual chlorine (TRC) in the effluent. If the concentration is high enough, pathogen concentrations, including *E. coli* concentrations, are considered reduced to acceptable levels. Typically, if minimum TRC levels are met, *E. coli* concentrations are reduced to levels well below the 126 cfu/100 mL limit.

Both urban and rural nonpoint sources of *E. coli* bacteria were considered in water quality modeling. Sources included residential sewage treatment systems, land application of waste, livestock, wildlife, and domestic pets. Loads were represented either as land-based loads (where they were deposited on land and available for wash off during a rainfall event) or as direct loads (where they were directly deposited to the stream). Land-based nonpoint sources are represented as an accumulation of pollutants on land, where some portion is available for transport in runoff. The amount of accumulation and availability for transport vary with land use type and season. The model allows a maximum accumulation to be specified. The maximum accumulation was adjusted seasonally to account for changes in die-off rates, which are dependent on temperature and moisture conditions. Some nonpoint sources, rather than being land-based, are represented as being deposited directly to the stream (*e.g.,* animal defecation in the stream, straight pipes). These sources are modeled similarly to point sources, as they do not require a runoff event for delivery to the stream.

3.1.2 *E. coli* Model Allocations

Several model runs were made investigating scenarios that would meet the 30-day geometric mean TMDL goal of 126 cfu/100mL (includes an implicit margin of safety). The final load allocations are shown in **Table 3.2**.

Table 3.2 Load reductions allocated during fecal bacteria TMDL development for the Middle Clinch River Watershed.

NTU	Impairment Group Name	Livestock Direct	Agricultural Land Based	Human Direct	Human and Pet Land Based
		% Reduction in Fecal Bacteria Loading From Existing Conditions			
250	**Middle Clinch River**	100	0	100	8
251	**Dumps Creek**	100	0	100	60
252	**Big Cedar/Burgess Creek**	100	86	100	90
253	**Elk Garden/Loop Creek**	100	83	100	89
298	**Lewis Creek**	100	79	100	83
421	**Swords/Hess Creek**	100	0	100	63

3.2 Implications of TMDL and Modeling Procedure on Implementation Plan Development

The major implication in the development of this TMDL is that large reductions are required to achieve the water quality standard. All uncontrolled discharges, failing septic systems, leaking sewer lines, and overflows must be identified and corrected; livestock must be excluded from streams and many agricultural nonpoint sources must be reduced. Additionally, residential and rural nonpoint sources of fecal bacteria must be reduced.

However, there are subtler implications as well. Implicit in the requirement for 100% correction of uncontrolled discharges is the need to maintain all functional septic systems.

These TMDLs included straight pipes and failing septic systems in the total bacteria load to the streams. Using the 1990, 2000 and 2010 U.S. Census the number of straight pipes (43) and failing septic systems (317) were estimated. In instances where currently available data was different than data in the TMDL report, the best available data was used to quantify corrective actions and develop cost estimates.

Page intentionally blank

4. PUBLIC PARTICIPATION

Public participation was an integral part of the TMDL Implementation Plan development, and is critical to promote reasonable assurances that the implementation activities will occur. Attendance was encouraged through email, phone calls and notices sent to the Bristol Herald Courier

4.1 Public Meetings for the Middle Clinch River Watershed

Two public meetings were held for the project. The first public meeting was held at the Town Hall in Lebanon, Virginia on May 24, 2012. The meeting was publicized in the Bristol Herald Courier and was attended by five (5) people, including, citizens, government agency representatives, and a consultant. Information delivered to the public at the meeting included a general description of the TMDL process, a more detailed description of TMDL development and IP development, and a solicitation for participation in working groups.

The Steering Committee meeting for Middle Clinch River watershed was held on November 5, 2013 at the USDA Service Center in Lebanon, Virginia. The primary purpose of this meeting was to present the final TMDL Implementation Plan. A presentation was given describing the Implementation Plan using major components as an outline: Review of TMDL development, public participation, assessment of needs, cost/benefit analysis, and implementation. The final public meeting was held at the Town Hall in Lebanon, Virginia on November 5, 2013.

In addition to the public meetings, a steering committee and three specialized working groups (agricultural/residential and government) were assembled from communities of people with common concerns regarding the TMDL process. The working groups served as the primary arena for seeking public input on implementation actions to be included in the plan, associated costs and outreach methods. The steering committee reviewed reports from each of the working groups and helped to guide the overall development of the Implementation Plan. A representative of the Virginia Department of Environmental Quality (VADEQ) attended each working group and Steering Committee meeting in order to facilitate the

process and integrate information collected from the various communities. The minutes from each of the working groups and the Steering Committee are included in Appendix A.

The role of the Agricultural Working Group (AWG) was to review implementation from an agricultural perspective; identify any obstacles (and solutions) related to BMP implementation; review conservation practices and outreach strategies; and provide estimates on the type, number, and costs of BMPs. The primary role of the Residential Working Group (RWG) was to discuss methods needed to reduce human and pet sources of bacteria in the watershed, recommend methods to identify and correct or replace failing septic systems and straight pipes, and provide input on the BMPs to include in the plan. The goals of the Government Working Group (GWG) were to identify regulatory controls currently in place in the watersheds that may help to improve water quality (*e.g.,* livestock stream access and sewer line connections), to identify existing programs and technical resources that may enhance implementation efforts, and to propose additional programs that would support implementation.

All meetings conducted during the course of the TMDL IP development are listed in **Table 4.1** Individuals on local and state levels representing agricultural, industrial and residential/governmental interests devoted many work-hours to attending meetings.

Table 4.1 Meetings held pertaining to the Middle Clinch River Watershed TMDL Implementation Plan development.

Date	Meeting Type	Location	Attendance
May 24, 2012	IP Kickoff Meeting (following the Final TMDL Meeting)	Lebanon Town Hall Lebanon, VA	5
May 24, 2012	1st set of Ag/Res Working Group Meetings (following the IP Kickoff Meeting)	Lebanon Town Hall Lebanon, VA	5
October 17, 2012	Government Working Group Meeting	USDA Service Center, Lebanon, VA	5
January 8, 2013	2nd set of Ag/Res Working Group Meetings	USDA Service Center, Lebanon, VA	12
November 5, 2013	Steering Committee Meeting	USDA Service Center, Lebanon, VA	7
November 5, 2013	Final Public Meeting	Lebanon Town Hall Lebanon, VA	5

4.1.1 Agricultural/Residential Working Group for the Middle Clinch River Watershed

The first Agricultural/Residential Working Group meeting occurred on May 24th, 2012 at Lebanon Town Hall in Lebanon, Virginia. The five (5) members consist of citizens from the watershed, representatives from the local Soil and Water Conservation District, VADEQ, VDH, and VADCR. Discussion focused on the current status of agriculture in the watershed, stream fencing and riparian buffer practices (e.g. LE-1T and WP-2T) for which financial assistance (cost share) is available through the State Cost Share Program, and the maintenance issues involved with these practices.

The second Agricultural/Residential Working Group meeting took place on January 8, 2013 at the USDA Service Center in Lebanon VA. Twelve (12) members were in attendance. The group discussed the fencing estimates that had been prepared for Middle Clinch River and land based BMP practices. It was suggested that sinkhole protection be included in the potential BMP list, as this is an area with a large amount of karst topography and potential for pollutants to reach springs and wells.

4.1.2 Government Working Group for the Middle Clinch River Watershed

The Government Working Group (GWG) meeting took place on October 17th, 2012 at the USDA Service Center in Lebanon, VA. It was attended by 5 people representing the following local governments: Clinch Valley SWCD, VADCR, VDH, and VADEQ. Discussion focused on the timeline, and adjustments to BMP assumptions and costs. Valuable feedback was gathered regarding adjusting residential and agricultural BMPs. It was mentioned that technical assistance costs have increased to an estimated $80,000 including salary, training, and travel expenses. It was mentioned that based on how rural the watershed is, the potential for future sewer connections is low, and should be adjusted to around 5%. Also an increase in the number of alternate septic systems is needed to account for local soil limitations. It was noted that pet waste education should focus on Town of Lebanon. Clinch Valley SWCD noted they had obtained a small grant to do a septic pump-out program which was extremely successful and they are interested in providing another similar program should they find grant funds to support it. Discussion suggested that there is potential for successful citizen monitoring in the watershed. Citizen monitoring could potentially be coordinated in cooperation with the citizen lab at Lonesome Pine SWCD. The

focus of citizen monitoring in the Middle Clinch watershed would be to identify places for VADEQ to conduct follow-up monitoring

4.2 Steering Committee

The purpose of the Steering Committee was to provide guidance on the content and presentation of the final IP and ensure that the working group recommendations were appropriately incorporated into the plan. The Steering Committee met on November 5, 2013 at the USDA Service Center in Lebanon, VA. The minutes from the working group and Steering Committee meetings and the reports can found in **Appendix A**.

Following the discussion of these reports, the final public meeting presentation was reviewed for input and comment from the committee.

4.3 Summary

Varied opinions were voiced throughout the public participation meetings regarding the IP process. Most members of the working groups agreed that the cornerstone of the IP is cultivating public involvement and education and encouraging commitment and partnerships among the citizens and government agencies in the watershed in order to reduce fecal bacteria pollution. A sense of individual responsibility provides a foundation for building partnerships among citizens, businesses, interest groups, and government agencies. It can also cultivate voluntary implementation and long-term support for reducing bacteria levels and restoring water quality in the Middle Clinch River watershed.

5. ASSESSMENT OF IMPLEMENTATION ACTION NEEDS

An important part of the Implementation Plan is the identification of specific best management practices and associated technical assistance needed to improve water quality in the watersheds. Since this plan is designed to be implemented by landowners on a voluntary basis, it is necessary to identify management practices that are both financially and technically realistic and suitable for this particular community. As part of this process, the costs and benefits of these practices must be examined and weighed. Once the best practices have been identified for implementation, the BMPs needed in order to meet the water quality goals established during the TMDL study were quantified.

5.1 Identification of Control Measures

Potential control measures or best management practices (BMPs), their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from Working Groups, and literature review. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts. Some control measures were indicated or implied by the TMDL allocations, while others were selected through a process of stakeholder review and analysis of effectiveness in these watersheds. These measures are discussed in sections 5.1.1 and 5.1.2, respectively.

5.1.1 Control Measures Implied by the TMDL

The reductions in fecal bacteria identified by the TMDL study dictated some of the control measures that must be employed during implementation. In order to meet the reductions in direct bacteria deposition from livestock, some form of stream exclusion is necessary. Fencing is the most obvious choice; however, the type of fencing, distance from the stream bank, and most appropriate management strategy for the fenced pasture are less obvious. The 100% reduction in loads from straight pipes, failing septic systems, sewer leaks/overflows (if any) is a pre-existing legal requirement as well as a result of this TMDL. This reduction indicates that all illicit discharges (*i.e.*, straight pipes and cross-connections)

in the watersheds should be corrected. Additionally all onsite sewage treatment systems (OSTS) (*e.g.,* septic systems and alternative waste treatment systems) and sewer infrastructure should be maintained in proper working condition.

While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, any fencing installed through the use of cost-share programs should follow established NRCS specifications including set-back distances from the stream bank, at a minimum, as is specified in existing Virginia cost-share programs.

An alternative water source will typically be required where pasture is fenced off from streams. The main criterion is that the system be dependable. Water systems alone (*i.e.,* with no streamside fencing) have been shown to reduce the amount of time cattle spend in the stream by as much as 50 to 80%. This is not a large enough reduction to meet all of the TMDLs. It should be restated here that it is recommended that all fencing, even that which is installed solely at the landowner's expense, be placed at least 35-ft from the stream. The inclusion of a buffer helps to reduce bacteria, as well as sediment loads in runoff. The incorporation of effective buffers could reduce the need for more costly control measures.

From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production is contrary to that goal. However, a clean water source has been shown to improve milk production and weight gain. Clean water will also improve the health of animals (*e.g.,* cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. Additionally, intensive pasture management, which becomes possible with an alternative water source, has been shown to improve overall farm profitability and environmental impact. From a part-time farmer's perspective, the best management scenario is one that

requires minimal input of time. This would seem to preclude intensive pasture management; however, those farmers who have adopted an intensive pasture-management system typically report that the additional management of the established system amounts to "opening a gate and getting out of the way" every couple of days. Additionally, the efficient use of the pasture often means that fewer supplemental feedings are necessary. Among both part-time and full-time farmers there are individuals who are hesitant to allow streamside vegetation to grow unrestricted because of aesthetic preferences or because they have spent a lifetime preventing this growth. However, given the reductions needed in pollutant (*i.e.*, fecal bacteria) delivery to the stream, a vegetated buffer will be needed. For planning purposes, it was assumed that a vegetated buffer would be established in conjunction with stream fencing.

Correction of sewer overflows and leaks is an ongoing effort of the entities charged with the maintenance and operation of these systems. This was not identified as a significant source by the TMDL study at this time. The options identified for correcting illicit discharges and failing septic systems included: repair of an existing septic system, installation of a septic system, connection to a sewer system and installation of an alternative waste treatment system.

5.1.2 Control Measures Selected through Stakeholder Review

In addition to the control measures that were directly indicated by the TMDL, a number of measures were needed to control fecal bacteria from land-based bacteria sources. Various scenarios were developed and presented to Working Groups. All scenarios began with implementation of the measures indicated by the TMDL. Next, specific sources of fecal bacteria were addressed where highly economic practices were identified. For instance, a residential pet waste program was specified in each watershed to educate citizens on proper disposal of pet wastes. Additionally, a pet waste composter program will be encouraged.

Beyond this level of control for the pollutants of interest, practices that require the control or treatment of runoff are the primary tools available. One additional BMP was improved pasture management. The improved pasture management BMP is considered an

enhancement of a grazing land management system. Along with the infrastructure provided by a grazing land management system, improved pasture management includes:

- Maintenance of an adequate forage height (suggested 3-inch minimum grass height) during growing season.
- Application of lime and fertilizer according to soil test results.
- Mowing of pastures to control woody vegetation.
- Distribution of manure through managed rotational grazing.
- Reseeding due to severe drought if necessary.

Currently, improved pasture management (SL-10T) is available as a pilot practice funded with TMDL implementation funds in selected watersheds. NRCS also offers cost-share for prescribed grazing (EQIP practice 528). Employing the pasture management practices listed above can produce significant economic gains to producers at a very low investment cost. The final set of control measures identified and the efficiencies used in this study to estimate needs are listed in **Table 5.1**. "Direct Reductions" are those that reduce the load of pollutant from a specific source to the stream itself or to the land. "Buffer" practices control pollutants through both a land conversion and treatment of runoff from an upstream area. "Runoff Treatment" measures are those that either treat runoff from a given land area (*e.g.*, retention ponds) or treat runoff based on changing the runoff-producing characteristics of the land (*e.g.*, improved pasture management).

Table 5.1 Potential control measure costs and efficiencies in removing *E. coli*.

BMP Type	Control Measure	Bacteria Removal Efficiency	Reference
	Direct Reduction Efficiency		
Ag	Livestock Exclusion System (>100-acres)	100%	1
Ag	Livestock Exclusion System (<100-acres)	100%	1
Ag	Livestock Exclusion System (WP-2T)	100%	1
Ag	Agricultural Sinkhole Protection (WQ-11)	100%	1
Ag	Beef/Dairy Waste Storage Facilities (WP-4)	85%	5
	Runoff Treatment Efficiency		
Ag	Improved Pasture Management	50%	2
Ag	Loafing Lot Management (WP-4B)	60%	4
Ag	Reforestation of Erodible Pasture (FR-1)	99%	1
Ag	Retention Ponds	70%	3
Ag	Conservation Tillage (SL-15)	61%	2,6
	Preventative Maintenance		
Res	Septic Tank Pump-out	*	
	Direct Reduction Efficiency		
Res	Corrected Straight-pipe / Septic System Install	100%	1
Res	Repaired Septic System	100%	1
Res	Sewer Hook-Up	100%	1
Res	Alternative Waste Treatment System	100%	1
Res	Pet Waste Education Program	75%	7
Res	Pet Waste Composters	99%	1

1 Removal efficiency is defined by the practice.

2 Commonwealth of Virginia. 2005. Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the James River, Lynnhaven, and Poquoson Coastal Basins.

3 Center for Watershed Protection. 2007. National Pollutant Removal Performance Database Version 3.

4 Barnett, J. R., R. C. Warner, and C. T. Agouridis. "The effectiveness of a combination weep berm-grass filter riparian control system for reducing fecal bacteria and nutrients from grazed pastures." Web.

5 Based on measurements of bacteria density as excreted and after storage.

6 Bacteria removal efficiency estimated based on sediment and nutrient removal efficiency.

7 Swann, C. 1999. A survey of residential nutrient behaviors in the Chesapeake Bay. Widener Burrows, Inc. Chesapeake Bay Research Consortium. Center for Watershed Protection. Ellicott City, MD. 112pp.

* There is no explicit bacteria removal efficiency associated Septic Tank Pump-outs, as they are a preventative maintenance practice to prolong the life of septic systems and prevent failures.

5.2 Quantification of Control Measures

The quantity of control measures recommended during implementation was determined through spatial analyses, modeling alternative implementation scenarios, as well as requests from Working Group members. Spatial analyses included the processing of data that included land use, census data, stream networks, and elevation, along with data archived in the VADCR Agricultural BMP Database and TMDL development documents. The map layers and archived data were combined to establish the number of control measures recommended overall, in each watershed, and in each subwatershed, where appropriate. Estimates of the amount of on-site treatment systems, sewer connections, streamside fencing and number of full livestock exclusion systems were made through these analyses. The quantities of additional control measures were determined through modeling alternative scenarios and applying the related reduction efficiencies to their associated loads.

Implicit in the TMDL is the need to avoid increased delivery of pollutants from sources that have not been identified as needing a reduction, and from sources that may develop over time, as implementation proceeds. One potential for additional sources of the pollutants identified is future residential development. Care should be taken to monitor development and its impacts on water quality. Where residential development occurs, there is potential for additional pollutant loads from pet waste, failing septic systems, sewer line overflows and leaks.

5.2.1 Agricultural Control Measures

5.2.1.1 Livestock Exclusion BMPs

To estimate fencing requirements, the stream network was overlaid with land use. Stream segments that flowed through or adjacent to land use areas that had a potential for supporting cattle (*e.g.,* improved pasture) were identified. If the stream segment flowed through the land-use area, it was assumed that fencing was required on both sides of the stream, while if a stream segment flowed adjacent to the land-use area, it was assumed that fencing was required on only one side of the stream. These assumptions were further refined to examine size of resultant pasture and existing BMPs. Not every land-use area identified as pasture has

livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access. A map of potential streamside fencing required for the Middle Clinch River watershed is shown in **Figure 5.1**.

According to data retrievals from the Virginia DCR Agricultural BMP and CREP databases, 818,157 feet of livestock exclusion BMPs have already been installed within the watershed. To completely exclude cattle from the streams in the watershed, and taking into consideration the fencing already installed, an estimated 1,690,573 feet of streamside fence would need to be implemented in order to meet the allocated bacteria load reductions.

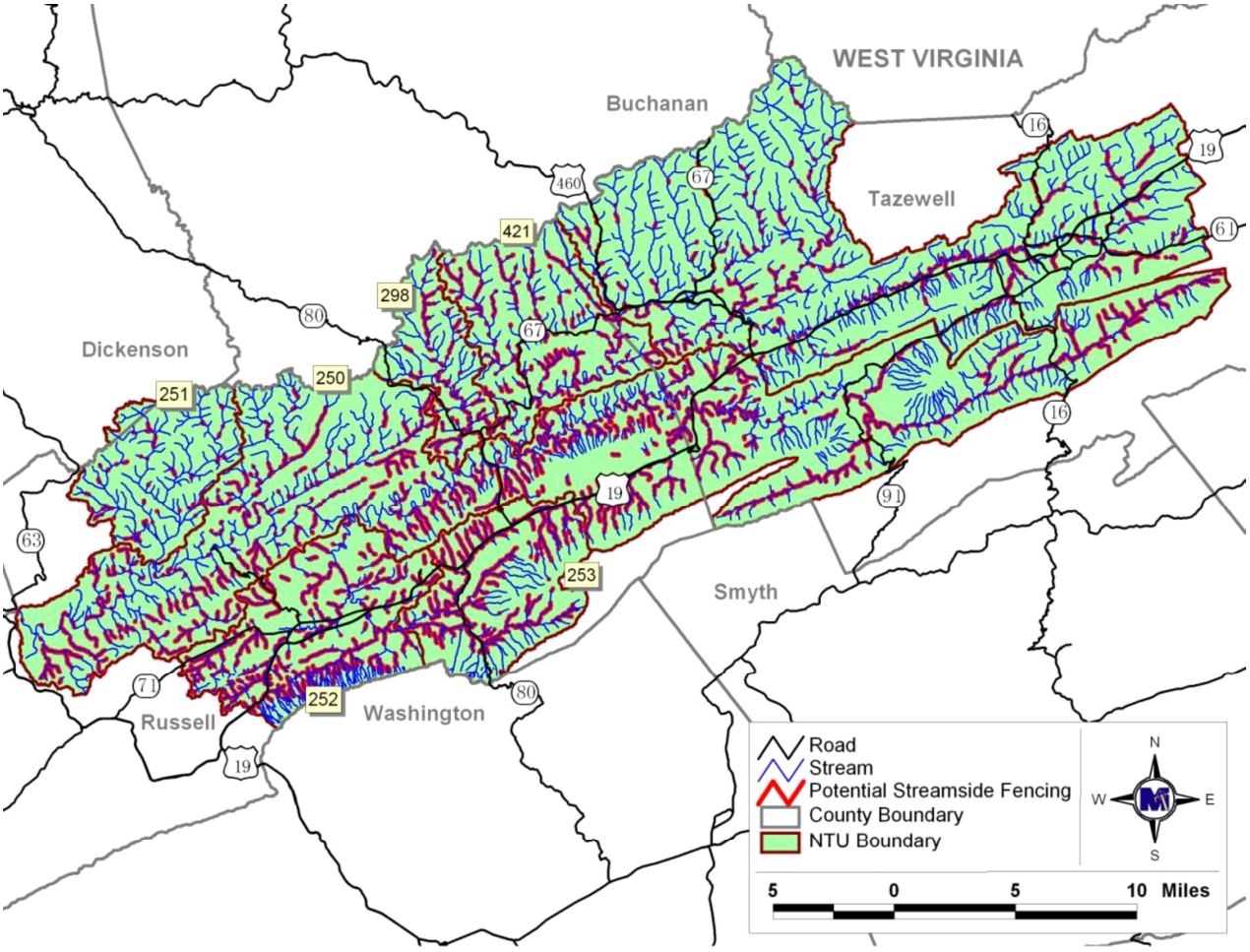

Figure 5.1 Potential streamside fencing for perennial streams in the Middle Clinch River watershed.

The VADCR Agricultural BMP Database was utilized to determine typical characteristics (e.g., streamside fencing length per practice) of full livestock exclusion systems so that the number of different systems needed could be accurately estimated. The database was queried for information on Grazing Land Protection Systems (LE-1T and LE-2T) and Stream Protection Systems (WP-2T) installed in Russell and Tazewell Counties. The LE-1T system includes streamside fencing, cross fencing, an alternative watering system, and a 35-ft buffer from the stream (the LE-2T system includes the same items as the LE-1T but only requires a 10-ft buffer). It was estimated that 50% of livestock exclusion systems would be accomplished through the installation of LE-1T systems. The (LE-1T) offers 85% cost share and is only available in targeted TMDL watersheds with Implementation Plans. The LE-2T offers a 50% cost share in TMDL watersheds with Implementation Plans. The WP-2T systems include streamside fencing, hardened crossings, and a 35-ft buffer from the stream. The WP-2T practice is only available in TMDL targeted implementation areas. This practice includes an up-front cost share payment of 50 cents per linear foot of fence installed to assist in covering anticipated fencing maintenance costs. In cases where a watering system already exists, a WP-2T system is a more appropriate choice. Despite the additional payment for maintenance costs, members of the agricultural working group explained that this practice is seldom used because it does not provide cost share for the installation of a well; this was reflected in the number of WP-2 systems noted in the Ag BMP Database. Consequently, it was estimated that only 5% of fencing would be accomplished using the WP-2T practice. Fencing through the Conservation Reserve Enhancement Program (CREP) is an option in the watershed provided a 35-ft setback is used. The Conservation Reserve Program (CRP) is an alternative for landowners who do not want to install a 35-ft buffer but this program does require a 20-ft buffer. The SL-6 practice is another alternative.

To establish the total number of full livestock exclusion systems necessary to achieve full implementation, systems were calculated by dividing the potential pasture streamside fencing required by the average streamside fencing length per system. The breakdown of number of exclusions systems that are expected to be LE-1T, LE-2T or WP-2T is based on historical use

of these practices in the Middle Clinch River watershed and input from the agricultural working group. This IP focuses on fencing along perennial streams. **Table 5.2** shows the livestock exclusion requirements for the Middle Clinch River watershed.

It was estimated that 7.5 % (126,793 feet) of all fencing length installed would need to be replaced during the length of the project.

Table 5.2 Livestock exclusion systems required in the Middle Clinch River Watershed by NTU.

NTU #	250	251	252	253	298	421
>100-acres LE-1T	98	4	33	21	7	13
< 100-acres LE-1T	97	4	33	21	7	13
>100-acres LE-2T	97	4	33	21	7	13
< 100-acres LE-2T	97	4	32	20	7	12
# WP-2 systems	4	0	1	1	0	1
# of SL-6 systems	21	1	7	4	1	3
Fence Maintenance*	71,023	2,862	23,771	15,167	4,621	9,349

*Fencing already installed was not included in this calculation.
Values rounded to nearest integer.

5.2.1.2 Land-Based BMPs

The Middle Clinch River watershed TMDLs recommend reductions to land-based bacteria loads. In order to meet these recommendations, the BMPs shown in **Table 5.3** must be implemented. Animal waste control facilities (WP-4) and loafing lot management systems (WP-4B) are additional options for achieving land based bacteria reductions should a need for these BMPs be identified throughout implementation. There was discussion among the stakeholders at the Ag/Res working group meetings that this is an area with a lot of karst topography with potential for pollutants to reach springs and wells, so agricultural sinkhole protection (WQ-11) should be considered when applicable throughout implementation.

One practice that is expected to have a substantial impact on water quality is improved pasture management. It is anticipated that this improved management will take the form of both rotational grazing systems and rotational loafing lot systems. Vegetated buffers were

also included in the implementation strategy to treat runoff from pasture and cropland. These buffers will act as filters, trapping bacteria and sediment before it runs into the stream. When considering the effectiveness of a vegetated buffer in trapping pollutants, it is important to consider the area that will be draining to the buffer. For modeling purposes, it was assumed that a typical buffer would be capable of receiving and treating runoff from an area four times its width. For example, a buffer that was 35 feet wide and 1,000 feet long would treat runoff from an area that was 140 feet wide and 1,000 feet long. Once you move beyond four times the buffer width, it was assumed that the runoff would be in the form of channelized flow rather than the sheet flow that a buffer can filter.

Table 5.3 Agricultural land-based BMPs for the Middle Clinch River Watershed by NTU.

Control Measure	Unit	NTU 250	NTU 251	NTU 252	NTU 253	NTU 298	NTU 421
Retention Ponds	Acres-Treated	0	0	4,132	2,130	638	0
Loafing Lot Management System	System	1	0	1	1	0	1
Reforestation of Erodible Pasture	Acres	0	0	11	111	203	0
Conservation Tillage	Acres	0	0	151	155	30	0
Improved Pasture Management	Acres	0	0	15,563	9,852	2,023	0
Waste Storage System	System	2	0	0	0	1	0

5.2.2 Residential Control Measures

5.2.2.1 BMPs to Correct Failing Septic Systems and Straight Pipes

All straight pipes and failing septic systems must be identified and corrected during implementation since a 100% load reduction from these sources was deemed necessary to meet the TMDL goal. **Table 5.4** shows the number of failing septic systems and straight pipes for each impairment group.

The following BMPs have been identified to correct failing septic systems and straight pipes: septic system repairs, new septic system installation, connect to public sewer system and alternative waste treatment systems. It is estimated that 50% of the failing septic systems can be corrected with repairs, and the other 50% will need to be replaced. Of those to be replaced, it is estimated that 60% can be typical septic systems, 35% would require

alternative waste treatment systems, and 5% may be sewered. It is estimated that 60% of straight pipes can be corrected with the installation of a septic system, and the remaining 40% would require alternative waste treatment systems.

Clinch Valley SWCD has had a successful pump-out program in 2008 and discussion at the Government Working Group was that the SWCDs in the watershed are interested in providing a pump-out program should there be available grant funds.

Table 5.4 Estimates of septic systems, failing septic systems, and straight pipes in the Middle Clinch River watershed NUTs.

NTU	Impairment Group Name	Houses with Standard Septic Systems	Potential Failing Septic Systems	Potential Straight Pipes
250	Middle Clinch River	4,531	151	22
251	Dumps Creek	139	5	1
252	Big Cedar/Burgess Creek	1,640	55	3
253	Elk Garden/Loop Creek	890	30	1
298	Lewis Creek	810	27	4
421	Swords/Hess Creek	1,462	49	12
	Total	9,472	317	43

Values rounded to nearest integer

5.2.2.2 Land-Based BMPs

The Middle Clinch River watershed TMDLs recommend reductions to residential land-based sources, or nonpoint sources (NPS). In order to meet these recommendations, all the BMPs in **Table 5.5** should be implemented; however, a staged approach to implementation is described in Chapter 6 of this document. In addition to these control measures, it was recognized that educational efforts would be vital to the successful implementation of these TMDLs. The residential education program includes a program addressing the benefits of cleaning up after pets and maintaining septic systems. The residential education program may also include a combination of educational materials distributed to pet owners, signage describing water quality concerns related to pet waste, and disposal bags and receptacles in areas of high pet traffic. Input gathered from the Government Working Group suggested that pet waste education should be focused on the Town of Lebanon since it is the main urban

area in the watershed and has parks with pet traffic. Signage, receptacles, and disposal bags could be located within these parks. An additional Pet Waste Composter program is also proposed to help eliminate pet waste in homeowner's yards and kennels, instead of just in public places. The program includes the distribution of pet waste composters to households in this watershed with pets. This could be accomplished through partnerships with local stores selling pet food, County Animal Shelters, and the Society for the Prevention of Cruelty to Animals (SPCA).

Table 5.5 Residential BMPs recommended to meet the Middle Clinch River Watershed TMDLs.

Residential Control Measure	Unit	NTU 250	NTU 251	NTU 252	NTU 253	NTU 298	NTU 421
Septic Systems Pump-out Program (RB-1)	Pump-out	4,531	139	1,640	890	810	1,462
Connection to Public Sewer (RB-2)	System	8	0	3	2	1	2
Septic System Repair (RB-3)	System	72	3	26	14	13	23
Septic System Installation/Replacement (RB-4)	System	56	1	2	1	2	8
Alt. Waste Treatment System Install (RB-5)	System	37	2	27	14	15	28
Community Pet Waste Education Program	Program	0	0	1	0	0	0
Residential Pet Waste Composters	System	125	50	250	100	75	125

5.3 Technical Assistance and Education

Stakeholders agree that technical assistance and education is key to getting people involved in implementation. There must be a proactive approach to contact farmers and residents to articulate exactly what the TMDL means to them and what practices will help meet the goal of improved water quality. The working groups recommended several education/outreach techniques, which will be utilized during implementation. Outreach at County Fairs has been successful in other watersheds in the past. There are also opportunities for joint events with the Virginia Cooperative Extension Service. It may also be possible to involve the local Ruritan and Rotary clubs. A program should be established to educate septic and alternative waste system installers on the maintenance requirements expected of the homeowner. Many waste system installers are not aware of the maintenance required. In addition a Pet Waste Education program will be developed.

The following tasks associated with agricultural, residential and industrial programs were identified:

Agricultural Programs

1. Make contact with landowners in the watershed to make them aware of implementation goals, cost-share assistance, and voluntary options that are beneficial.
2. Provide technical assistance for agricultural programs (*e.g.,* survey, design, layout, and approval of installation).
3. Develop educational materials & programs.
4. Organize educational programs (*e.g.,* County Fair, presentations at joint VCE events or club events).
5. Distribute educational materials (*e.g.,* informational articles in Farm Service Agency (FSA) or Farm Bureau newsletters, local media).
6. Handle and track cost-share.
7. Assess and track progress toward BMP implementation goals.
8. Coordinate use of existing agricultural programs and suggest modifications where necessary.

Residential Programs

1. Identify straight-pipes and failing septic systems (*e.g.*, contact landowners in older homes, septic pump-out program).
2. Handle and track cost-share.
3. Develop educational materials & programs.
4. Organize educational programs (*e.g.*, demonstration septic pump-outs, nutrient management, pet waste control).
5. Distribute educational materials (*e.g.*, informational pamphlets on TMDL IP and on-site sewage disposal systems).
6. Assess progress toward implementation goals.

The staff needed to implement the agricultural and residential components of the plan were estimated based on discussions with stakeholders and the staffing levels used in similar projects. It was determined that one combined residential/agricultural staff person would be needed to provide technical assistance in the watersheds throughout implementation.

5.4 Cost Analysis

5.4.1 Agricultural Control Measures

Streamside fencing through or adjacent to pasture with potential livestock access was translated and quantified into full livestock exclusion systems as described in Section 5.2.1.1. The costs for the LE-1T, LE-2T and WP-2T systems were estimated based on the cost of systems already in place in the North Fork Holston River watershed. The cost of an LE-1T and LE-2T systems were estimated at $53,000 for farms larger than 100 acres, the cost for smaller farms was estimated to be $11,500. Through VADCR input it was assumed that the costs for hardened crossings and improved pasture management (cross fencing) would be included in the LE-1T and LE-2T systems.

The total cost of livestock exclusion systems includes not only the costs associated with fence installation, repair, and maintenance; but also the cost of taking land (*e.g.,* 35-ft buffer area) out of production. The cost of fence maintenance was identified as a deterrent to participation. Financial assistance possibilities for maintaining fences include an annual 25% tax credit for fence maintenance and conservation easements where the landowner is paid a percentage of the land value to leave it undisturbed. Additionally, the Streambank Protection (WP-2T) cost-share practice will be available as part of the implementation project and provides an upfront incentive payment to maintain stream fencing. The cost per foot for streamside fence maintenance is estimated at $3.50/ft.

The remaining costs outlined in **Table 5.6** were determined through literature review, analysis of the Virginia Agricultural BMP Database, and discussion with stakeholders. The number and type of practices that have been installed in each watershed were determined through discussions with local personnel and data from the Virginia Agricultural BMP Database.

Table 5.6 Agricultural control measure costs and needs in the Middle Clinch River watershed.

Agricultural Control Measure	Unit	Cost[2]	NTU 250	NTU 251	NTU 252	NTU 253	NTU 298	NTU 421
LE-1T >100-acres Livestock Exclusion	System[1]	$53,000	98	4	33	21	7	13
LE-1T <100-acres Livestock Exclusion	System[1]	$11,500	97	4	33	21	7	13
LE-2T >100-acres Livestock Exclusion	System[1]	$53,000	97	4	33	21	7	13
LE-2T <100-acres Livestock Exclusion	System[1]	$11,500	97	4	32	20	7	12
WP-2T Livestock Exclusion	System[1]	$3,400	4	0	1	1	0	1
SL-6 Livestock Exclusion	System[1]	$53,000	21	1	7	4	1	3
Livestock Exclusion Maintenance	Feet	$3.50	71,023	2,862	23,771	15,167	4,621	9,349
Retention Ponds	Acres-Treated	$150	0	0	4,132	2,130	638	0
Loafing Lot Management System	System	$35,000	1	0	1	1	0	1
Reforestation of Erodible Pasture	Acres	$845	0	0	11	111	203	0
Conservation Tillage	Acres	$135	0	0	150	155	30	0
Improved Pasture Management	Acres	$155	0	0	15,563	9,852	2,023	0
Beef/Dairy - Waste Storage System	System	$70,000	2	0	0	0	1	0

Numbers are rounded to the nearest whole number.
1 .. Average system length in watershed is 2,285 ft
2 .. Costs based on working group input

5.4.2 Residential Control Measures

It is estimated that 50% of the failing septic systems can be corrected with repairs ($3,500), and 50% will need to be replaced. Of those to be replaced, it is estimated that 60% can be typical septic systems ($8,000), 35% would require alternative waste treatment systems ($20,000), and 5% would be sewered ($5,000). It is estimated that 60% of straight pipes can be corrected with the installation of a septic system, and the remaining 40% would require alternative waste treatment systems.

Input gathered from the Government Working Group suggested that local alternative waste treatment system costs depend on the type and complexity of the system. The GWG suggested a cost range of $15,000 to $25,000 for non-discharging systems, and $9,000 for discharging systems. Since the type and complexity of each system is case-specific based on site constraints, a cost of $20,000 per alternative waste treatment system was assumed for the purposes calculating total implementation cost.

The Government Working Group suggested that septic pump-out costs are approximately $300 per 1,000 gallons. Since the capacity of individual systems is case-specific and unknown, an assumption was made that the average tank capacity is 1,000 gallons for the purpose of calculating total implementation costs, yielding an average cost of $300 to pump out each system.

The remaining costs outlined in **Table 5.7** were determined through literature review and discussion with stakeholders.

Table 5.7 Residential control measure costs and needs in the Middle Clinch River Watershed by NTU.

Residential Control Measure	Unit	Cost	NTU 250	NTU 251	NTU 252	NTU 253	NTU 298	NTU 421
Septic Systems Pump-out Program (RB-1)	Pump-out	$ 300	4,531	139	1,640	890	810	1,462
Connection to Public Sewer (RB-2)	System	$ 5,000	8	0	3	2	1	2
Septic System Repair (RB-3)	System	$ 3,500	72	3	26	14	13	23
Septic System Inst/Replacement (RB-4)	System	$ 8,000	56	1	2	1	2	8
Alt. Waste Treatment System Install (RB-5)	System	$ 20,000	37	2	27	14	15	28
Community Pet Waste Education Program	Program	$ 5,000	0	0	1	0	0	0
Residential Pet Waste Composters	System	$ 50	125	50	250	100	75	125

5.4.3 Technical Assistance

It was determined by the working group members that it would require $80,000 to support the salary, benefits, travel, training, and incidentals for education of one technical staff member. One technical staff member is expected to be needed for the whole watershed, throughout implementation.

5.4.4 Total Estimated Costs

The total estimated costs for the implementation of BMPs in the Middle Clinch River watershed is shown in **Table 5.8**. The technical assistance cost assumes that one technical assistance personnel will be required for the watershed for 15 years.

Table 5.8 Total estimated costs to meet the Middle Clinch River Watershed *E. coli* bacteria TMDLs.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total Cost ($)
NTU 250	$14,116,181	$2,845,550		$18,161,731
NTU 251	$579,017	$102,700		$681,717
NTU 252	$7,799,844	$1,171,500	$1,200,000	$8,971,344
NTU 253	$4,962,265	$619,000		$5,581,265
NTU 298	$1,627,024	$613,250		$2,240,274
NTU 421	$1,895,622	$1,159,350		$3,054,972
Total	**$30,979,951**	**$6,511,350**	**$1,200,000**	**$38,691,301**

5.5 Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia. Specifically, *E. coli* contamination in Middle Clinch River Watershed will be reduced to meet water quality standards. **Table 5.9** indicates the cost efficiencies of the various practices being proposed in this IP. It is hard to gage the impact that reducing *E. coli* 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 *E. coli* sources through contact with surface waters should be reduced considerably.

Table 5.9 Relative Cost efficiencies of control measures in bacteria-colony-forming-units removed per $1,000 in the Middle Clinch River watershed.

Control Measure	Bacteria Colonies Removed Per $1,000 spent
Community Pet Waste Education Program	2.61E+13
Conservation Tillage	1.65E+13
Beef - Waste Storage System	4.06E+12
Loafing Lot Management System (WP-4B)	3.82E+12
Reforestation of Erodible Crop & Pasture	2.68E+12
Retention Ponds	2.20E+12
Residential Pet Waste Composters	2.08E+12
Improved Pasture Management	1.32E+12
Connection to Public Sewer (RB-2)	2.87E+11
Livestock Exclusion	1.92E+11
Septic System Repair (RB-3)	3.95E+10
Septic System Installation/Replacement (RB-4)	1.73E+10
Alternative Waste Treatment System (RB-5)	6.92E+09

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural, residential and industrial practices recommended in this document will provide economic benefits to the community, as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, improved pasture management, private sewage system maintenance and stream bank stabilization will each provide economic benefits to land owners. Additionally, money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

5.5.1 Agricultural Practices

A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is the primary nutrient for 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 moon blindness associated with *Leptospirosis* infections (VCE, 1998b). 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. The VCE (1998a) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7 billion to 2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy herd can be reduced through proper sanitation of milking equipment, mastitis-causing bacteria can be harbored and spread in the environment where cattle have access to wet and dirty areas. Installation of streamside fencing and well managed loafing areas will reduce the amount of time that cattle have access to these areas. Taking the opportunity to implement an improved pasture management system in conjunction with installing clean water supplies will also provide economic benefits for the producer. Improved pasture management can allow a producer to feed less hay in winter months, increase stocking rates by 30 to 40% 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. In addition to reducing costs to producers, intensive pasture management can boost profits by allowing higher stocking rates and increasing the amount of gain per acre. Another benefit is that cattle are closely confined allowing for quicker examination and handling. In general,

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

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.

5.5.2 Residential Practices

The residential programs 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 can potentially carry. In terms of economic benefits to homeowners, an improved understanding of on-site sewage treatment systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. 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 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 ($300) in comparison to repairing or replacing an entire system ($3,500 to $25,000).

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. As will be discussed in greater detail in Chapter 8, 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 not only yield environmental benefits to the community, but economic benefits as well, which, in turn, will allow for individual landowners to participate in implementation.

Page intentionally blank

6. MEASURABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

Given the scope of work involved with implementing these TMDLs, full implementation and de-listing from the Virginia Section 305(b)/303(d) list is expected within 15 years. Described in this section are funding sources, identification of milestones, timeline for implementation of control measures.

6.1 Milestones Identification

The end goals of implementation are restored water quality of the impaired waters and subsequent de-listing of these impairments from the Commonwealth of Virginia's Section 305(b)/303(d) list within 15 years. Progress toward end goals will be assessed during implementation through tracking of control measure installations and continued water quality monitoring. Agricultural, residential and industrial control measures will be tracked through the Virginia Agricultural Cost-Share Program.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of control measures installed within certain timeframes, while water quality milestones establish the corresponding improvements in water quality that can be expected as the implementation milestones are met. The milestones described here are intended to achieve full implementation within 15 years.

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures first. For example, concentrating on eliminating straight pipes and correcting failing septic systems within the first years may provide the highest return on water quality improvement with less cost to landowners. The Stage I goals for implementation will focus on correcting straight pipes and failing septic systems, implementing a pet waste control program, fencing cattle out of the stream, and improving pasture management. Stage II will allow additional time to implement the BMPs that may be needed for de-listing and to obtain the bacteria source load reductions in the TMDL.

Table 6.1 shows the key estimated parameters for three implementation milestones, for each NTU modeling group: the existing condition, after Stage I implementation, and after Stage II implementation. The parameters in **Table 6.1** include the cumulative progress toward reaching the bacteria load reductions specified in each TMDL as BMPs are installed. The bacteria violations are based on the percentage of the modeled monthly geometric mean bacteria that exceeds the 126 cfu/100mL standard. The cost is the percentage of the total implementation cost expended up to that point.

Table 6.1 Cumulative progress toward bacteria load goal for each impairment in the Middle Clinch Watershed

NTU 250	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	79%	100
Bacteria Violations (126 cfu/100ml)	31%	9%	0
Cost (% of Total)	0	72%	100

NTU 251	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	76%	100
Bacteria Violations (126 cfu/100ml)	17%	12%	0
Cost (% of Total)	0	74%	100

NTU 252	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	59%	100
Bacteria Violations (126 cfu/100ml)	66%	56%	0
Cost (% of Total)	0	69%	100

NTU 253	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	61%	100
Bacteria Violations (126 cfu/100ml)	49%	44%	0
Cost (% of Total)	0	70%	100

NTU 298	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	56%	100
Bacteria Violations (126 cfu/100ml)	49%	44%	0
Cost (% of Total)	0	67%	100

NTU 421	**Existing**	**Stage I**	**Stage II**
Cumulative Progress Toward Bacteria Load Goal	0	56%	100
Bacteria Violations (126 cfu/100ml)	31%	21%	0
Cost (% of Total)	0	72%	100

Two milestones will be sought over 15 years. The first milestone will be 10 years after implementation begins, whereby the more cost-efficient control measures will be installed, with significant reductions in bacteria anticipated (**Table 6.2**).

Table 6.3 presents a breakdown of the costs for Stage I. Following Stage I implementation, the steering committee should evaluate water quality improvements and determine how to proceed to complete implementation (Stage II). Costs for Stage II are presented in the same table**.** Based on completing both implementation stages, the final milestone would be achieving the bacteria reductions required by the TMDLs.

For detail planning, the practices and costs by stage for each NTU are presented in **Table 6.4** through **Table 6.13**.

Table 6.2 Stage I and Stage II implementation goals for the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System[1]	132	44	176
LE-1T <100-acres Livestock Exclusion	System[1]	131	44	175
LE-2T >100-acres Livestock Exclusion	System[1]	131	44	175
LE-2T <100-acres Livestock Exclusion	System[1]	129	43	172
WP-2T Livestock Exclusion	System[1]	5	2	7
SL-6 Livestock Exclusion	System[1]	28	9	37
Livestock Exclusion Maintenance	Feet	83,683	43,110	126,793
Retention Ponds	Acres-Treated	0	6,900	6,900
Loafing Lot Management System	System	4	0	4
Reforestation of Erodible Pasture	Acres	243	82	325
Conservation Tillage	Acres	252	84	336
Improved Pasture Management	Acres	20,578	6,860	27,438
Beef - Waste Storage System	System	0	3	3
Septic Systems Pump-out Program (RB-1)	Pump-out	6,252	1,704	9,472
Connection to Public Sewer (RB-2)	System	11	27	16
Septic System Repair (RB-3)	System	100	51	151
Septic System Install/Replacement (RB-4)	System	46	29	70
Alt. Waste Treatment System Install (RB-5)	System	81	30	123
Community Pet Waste Education Program	Program	1	5	1
Residential Pet Waste Composters	System	479	247	725

[1]system size is 2,285 ft.

Table 6.3 Stage I and Stage II implementation costs for the Middle Clinch River Watershed.

Implementation Practice	Unit	Cost	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	$53,000	$ 6,982,750	$ 2,345,250	$ 9,328,000
LE-1T <100-acres Livestock Exclusion	System	$11,500	$ 1,506,500	$ 506,000	$ 2,012,500
LE-2T >100-acres Livestock Exclusion	System	$53,000	$ 6,943,000	$ 2,332,000	$ 9,275,000
LE-2T <100-acres Livestock Exclusion	System	$11,500	$ 1,480,625	$ 497,375	$ 1,978,000
WP-2T Livestock Exclusion	System	$ 3,400	$ 17,850	$ 5,950	$ 23,800
SL-6 Livestock Exclusion	System	$53,000	$ 1,484,000	$ 477,000	$ 1,961,000
Livestock Exclusion Maintenance	Feet	$ 3.5	$ 292,892	$ 150,884	$ 443,776
Retention Ponds	Acres-Treated	$ 150	-	$ 1,035,000	$ 1,035,000
Loafing Lot Management System	System	$35,000	$ 140,000	-	$ 140,000
Reforestation of Erodible Pasture	Acres	$ 845	$ 205,546	$ 69,079	$ 274,625
Conservation Tillage	Acres	$ 135	$ 33,986	$ 11,374	$ 45,360
Improved Pasture Management	Acres	$ 155	$ 3,189,629	$ 1,063,261	$ 4,252,890
Beef - Waste Storage System	System	$70,000	-	$ 210,000	$ 210,000
Agricultural Total			**$22,276,778**	**$8,703,172**	**$30,979,951**
Septic Systems Pump-out Program (RB-1)	Pump-out	$ 300	$1,875,456	$ 966,144	$2,841,600
Connection to Public Sewer (RB-2)	System	$ 5,000	$ 52,800	$ 27,200	$80,000
Septic System Repair (RB-3)	System	$ 3,500	$ 348,810	$ 179,690	$528,500
Septic System Install/Replacement (RB-4)	System	$ 8,000	$ 369,600	$ 190,400	$560,000
Alt. Waste Treatment System Install (RB-5)	System	$ 20,000	$1,623,600	$ 836,400	$2,460,000
Community Pet Waste Education Program	Program	$ 5,000	$ 5,000	-	$5,000
Residential Pet Waste Composters	System	$ 50	$ 23,925	$ 12,325	$36,250
Residential Total			**$ 4,299,191**	**$ 2,212,159**	**$ 6,511,350**
Technical Assistance			**$ 800,000**	**$ 400,000**	**$ 1,200,000**
Grand Total			**$27,375,969**	**$11,315,331**	**$38,691,301**

Table 6.4 Stage I and Stage II implementation BMPs for NTU 250 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	74	25	98
LE-1T <100-acres Livestock Exclusion	System	73	24	97
LE-2T >100-acres Livestock Exclusion	System	73	24	97
LE-2T <100-acres Livestock Exclusion	System	73	24	97
WP-2T Livestock Exclusion	System	3	1	4
SL-6 Livestock Exclusion	System	16	5	21
Livestock Exclusion Maintenance	Feet	46,875	24,148	71,023
Retention Ponds	Acres-Treated	0	0	0
Loafing Lot Management System	System	1	0	1
Reforestation of Erodible Pasture	Acres	0	0	0
Conservation Tillage	Acres	0	0	0
Improved Pasture Management	Acres	0	0	0
Beef - Waste Storage System	System	0	2	2
Septic Systems Pump-out Program (RB-1)	Pump-out	2,990	1,541	4,531
Connection to Public Sewer (RB-2)	System	5	3	8
Septic System Repair (RB-3)	System	48	24	72
Septic System Install/Replacement (RB-4)	System	37	19	56
Alt. Waste Treatment System Install (RB-5)	System	24	13	37
Community Pet Waste Education Program	Program	0	0	0
Residential Pet Waste Composters	System	83	43	125

Table 6.5 Stage I and Stage II implementation costs for NTU 250.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 3,895,500	$ 1,298,500	$5,194,000
LE-1T <100-acres Livestock Exclusion	$ 836,625	$ 278,875	$1,115,500
LE-2T >100-acres Livestock Exclusion	$ 3,855,750	$ 1,285,250	$5,141,000
LE-2T <100-acres Livestock Exclusion	$ 836,625	$ 278,875	$1,115,500
WP-2T Livestock Exclusion	$ 10,200	$ 3,400	$13,600
SL-6 Livestock Exclusion	$ 834,750	$ 278,250	$1,113,000
Livestock Exclusion Maintenance	$ 164,063	$ 84,517	$248,581
Retention Ponds	-	-	-
Loafing Lot Management System	$ 35,000	-	$35,000
Reforestation of Erodible Pasture	-	-	-
Conservation Tillage	-	-	-
Improved Pasture Management	-	-	-
Beef - Waste Storage System	-	$ 140,000	$140,000
Agriculture Total:	$10,468,513	$3,647,667	$14,116,181
Septic Systems Pump-out Program (RB-1)	$ 897,138	$ 462,162	$ 1,359,300
Connection to Public Sewer (RB-2)	$ 26,400	$ 13,600	$ 40,000
Septic System Repair (RB-3)	$ 166,320	$ 85,680	$ 252,000
Septic System Install/Replacement (RB-4)	$ 295,680	$ 152,320	$ 448,000
Alt. Waste Treatment System Install (RB-5)	$ 488,400	$ 251,600	$ 740,000
Community Pet Waste Education Program	-	-	-
Residential Pet Waste Composters	$ 4,150	$ 2,150	$ 6,250
Residential Total:	**$ 1,878,063**	**$ 967,487**	**$ 2,845,550**
Grand Total	**$ 13,146,576**	**$ 5,015,154**	**$ 18,161,731**

Table 6.6 Stage I and Stage II implementation BMPs for NTU 251 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	3	1	4
LE-1T <100-acres Livestock Exclusion	System	3	1	4
LE-2T >100-acres Livestock Exclusion	System	3	1	4
LE-2T <100-acres Livestock Exclusion	System	3	1	4
WP-2T Livestock Exclusion	System	0	0	0
SL-6 Livestock Exclusion	System	1	0	1
Livestock Exclusion Maintenance	Feet	1,889	973	2,862
Retention Ponds	Acres-Treated	0	0	0
Loafing Lot Management System	System	0	0	0
Reforestation of Erodible Pasture	Acres	0	0	0
Conservation Tillage	Acres	0	0	0
Improved Pasture Management	Acres	0	0	0
Beef - Waste Storage System	System	0	0	0
Septic Systems Pump-out Program (RB-1)	Pump-out	92	47	139
Connection to Public Sewer (RB-2)	System	0	0	0
Septic System Repair (RB-3)	System	2	1	3
Septic System Install/Replacement (RB-4)	System	1	0	1
Alt. Waste Treatment System Install (RB-5)	System	1	1	2
Community Pet Waste Education Program	Program	0	0	0
Residential Pet Waste Composters	System	33	17	50

Table 6.7 Stage I and Stage II implementation costs for NTU 251 of the Middle Clinch River Watershed.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 159,000	$ 53,000	$ 212,000
LE-1T <100-acres Livestock Exclusion	$ 34,500	$ 11,500	$ 46,000
LE-2T >100-acres Livestock Exclusion	$ 159,000	$ 53,000	$ 212,000
LE-2T <100-acres Livestock Exclusion	$ 34,500	$ 11,500	$ 46,000
WP-2T Livestock Exclusion	-	-	-
SL-6 Livestock Exclusion	$ 39,750	$ 13,250	$ 53,000
Livestock Exclusion Maintenance	$ 6,611	$ 3,406	$ 10,017
Retention Ponds	-	-	-
Loafing Lot Management System	-	-	-
Reforestation of Erodible Pasture	-	-	-
Conservation Tillage	-	-	-
Improved Pasture Management	-	-	-
Beef - Waste Storage System	-	-	-
Agriculture Total:	**$ 433,361**	**$ 145,656**	**$ 579,017**
Septic Systems Pump-out Program (RB-1)	$ 27,522	$ 14,178	$ 41,700
Connection to Public Sewer (RB-2)	-	-	-
Septic System Repair (RB-3)	$ 6,930	$ 3,570	$ 10,500
Septic System Install/Replacement (RB-4)	$ 5,280	$ 2,720	$ 8,000
Alt. Waste Treatment System Install (RB-5)	$ 26,400	$ 13,600	$ 40,000
Community Pet Waste Education Program	-	-	-
Residential Pet Waste Composters	$ 1,650	$ 850	$ 2,500
Residential Total:	**$ 67,782**	**$ 34,918**	**$ 102,700**
Grand Total	**$ 501,143**	**$ 180,574**	**$ 681,717**

Table 6.8 Stage I and Stage II implementation BMPs for NTU 252 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	25	8	33
LE-1T <100-acres Livestock Exclusion	System	25	8	33
LE-2T >100-acres Livestock Exclusion	System	25	8	33
LE-2T <100-acres Livestock Exclusion	System	24	8	32
WP-2T Livestock Exclusion	System	1	0	1
SL-6 Livestock Exclusion	System	5	2	7
Livestock Exclusion Maintenance	Feet	15,689	8,082	23,771
Retention Ponds	Acres-Treated	0	4,132	4,132
Loafing Lot Management System	System	1	0	1
Reforestation of Erodible Pasture	Acres	8	3	11
Conservation Tillage	Acres	113	38	150
Improved Pasture Management	Acres	11,672	3,891	15,563
Beef - Waste Storage System	System	0	0	0
Septic Systems Pump-out Program (RB-1)	Pump-out	1,082	558	1,640
Connection to Public Sewer (RB-2)	System	2	1	3
Septic System Repair (RB-3)	System	17	9	26
Septic System Install/Replacement (RB-4)	System	1	1	2
Alt. Waste Treatment System Install (RB-5)	System	18	9	27
Community Pet Waste Education Program	Program	1	0	1
Residential Pet Waste Composters	System	165	85	250

Table 6.9 Stage I and Stage II implementation costs for NTU 252 of the Middle Clinch River Watershed.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 1,311,750	$ 437,250	$1,749,000
LE-1T <100-acres Livestock Exclusion	$ 284,625	$ 94,875	$379,500
LE-2T >100-acres Livestock Exclusion	$ 1,311,750	$ 437,250	$1,749,000
LE-2T <100-acres Livestock Exclusion	$ 276,000	$ 92,000	$368,000
WP-2T Livestock Exclusion	$ 2,550	$ 850	$3,400
SL-6 Livestock Exclusion	$ 278,250	$ 92,750	$371,000
Livestock Exclusion Maintenance	$ 54,911	$ 28,287	$83,199
Retention Ponds	-	$ 619,800	$619,800
Loafing Lot Management System	$35,000	-	$35,000
Reforestation of Erodible Pasture	$6,760	$ 2,535	$9,295
Conservation Tillage	$15,255	$ 5,130	$20,385
Improved Pasture Management	$1,809,160	$ 603,105	$2,412,265
Beef - Waste Storage System	-	-	-
Agriculture Total:	**$ 5,386,011**	**$ 2,413,832**	**$ 7,799,844**
Septic Systems Pump-out Program (RB-1)	$ 324,720	$ 167,280	$492,000
Connection to Public Sewer (RB-2)	$ 9,900	$ 5,100	$15,000
Septic System Repair (RB-3)	$ 60,060	$ 30,940	$91,000
Septic System Install/Replacement (RB-4)	$ 10,560	$ 5,440	$16,000
Alt. Waste Treatment System Install (RB-5)	$ 356,400	$ 183,600	$540,000
Community Pet Waste Education Program	$ 5,000	-	$5,000
Residential Pet Waste Composters	$ 8,250	$ 4,250	$12,500
Residential Total:	**$ 774,890**	**$ 396,610**	**$ 1,171,500**
Grand Total	**$ 6,160,901**	**$ 2,810,442**	**$ 8,971,344**

Table 6.10 Stage I and Stage II implementation BMPs for NTU 253 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	16	5	21
LE-1T <100-acres Livestock Exclusion	System	16	5	21
LE-2T >100-acres Livestock Exclusion	System	16	5	21
LE-2T <100-acres Livestock Exclusion	System	15	5	20
WP-2T Livestock Exclusion	System	1	0	1
SL-6 Livestock Exclusion	System	3	1	4
Livestock Exclusion Maintenance	Feet	10,010	5,157	15,167
Retention Ponds	Acres-Treated	0	2,130	2,130
Loafing Lot Management System	System	1	0	1
Reforestation of Erodible Pasture	Acres	83	28	111
Conservation Tillage	Acres	116	39	155
Improved Pasture Management	Acres	7,389	2,463	9,852
Beef - Waste Storage System	System	0	0	0
Septic Systems Pump-out Program (RB-1)	Pump-out	587	303	890
Connection to Public Sewer (RB-2)	System	1	1	2
Septic System Repair (RB-3)	System	9	5	14
Septic System Install/Replacement (RB-4)	System	1	0	1
Alt. Waste Treatment System Install (RB-5)	System	9	5	14
Community Pet Waste Education Program	Program	0	0	0
Residential Pet Waste Composters	System	66	34	100

Table 6.11 Stage I and Stage II implementation costs for NTU 253 of the Middle Clinch River Watershed.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 834,750	$ 278,250	$1,113,000
LE-1T <100-acres Livestock Exclusion	$ 181,125	$ 60,375	$241,500
LE-2T >100-acres Livestock Exclusion	$ 834,750	$ 278,250	$1,113,000
LE-2T <100-acres Livestock Exclusion	$ 172,500	$ 57,500	$230,000
WP-2T Livestock Exclusion	$ 2,550	$ 850	$3,400
SL-6 Livestock Exclusion	$ 159,000	$ 53,000	$212,000
Livestock Exclusion Maintenance	$ 35,036	$ 18,049	$53,085
Retention Ponds	-	$ 319,500	$319,500
Loafing Lot Management System	$ 35,000	-	$35,000
Reforestation of Erodible Pasture	$ 70,135	$ 23,660	$93,795
Conservation Tillage	$ 15,694	$ 5,231	$20,925
Improved Pasture Management	$ 1,145,295	$ 381,765	$1,527,060
Beef - Waste Storage System	-	-	-
Agriculture Total:	**$ 3,485,835**	**$ 1,476,430**	**$ 4,962,265**
Septic Systems Pump-out Program (RB-1)	$ 176,220	$ 90,780	$ 267,000
Connection to Public Sewer (RB-2)	$ 6,600	$ 3,400	$ 10,000
Septic System Repair (RB-3)	$ 32,340	$ 16,660	$ 49,000
Septic System Install/Replacement (RB-4)	$ 5,280	$ 2,720	$ 8,000
Alt. Waste Treatment System Install (RB-5)	$ 184,800	$ 95,200	$ 280,000
Community Pet Waste Education Program	-	-	-
Residential Pet Waste Composters	$ 3,300	$ 1,700	$ 5,000
Residential Total:	**$408,540**	**$ 210,460**	**$ 619,000**
Grand Total	**$ 3,894,375**	**$ 1,686,890**	**$5,581,265**

Table 6.12 Stage I and Stage II implementation BMPs for NTU 298 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	5	2	7
LE-1T <100-acres Livestock Exclusion	System	5	2	7
LE-2T >100-acres Livestock Exclusion	System	5	2	7
LE-2T <100-acres Livestock Exclusion	System	5	2	7
WP-2T Livestock Exclusion	System	0	0	0
SL-6 Livestock Exclusion	System	1	0	1
Livestock Exclusion Maintenance	Feet	3,050	1,571	4,621
Retention Ponds	Acres-Treated	0	638	683
Loafing Lot Management System	System	0	0	0
Reforestation of Erodible Pasture	Acres	152	51	203
Conservation Tillage	Acres	23	8	30
Improved Pasture Management	Acres	1,517	506	2,023
Beef - Waste Storage System	System	0	1	1
Septic Systems Pump-out Program (RB-1)	Pump-out	535	275	810
Connection to Public Sewer (RB-2)	System	1	0	1
Septic System Repair (RB-3)	System	9	4	13
Septic System Install/Replacement (RB-4)	System	1	1	2
Alt. Waste Treatment System Install (RB-5)	System	10	5	15
Community Pet Waste Education Program	Program	0	0	0
Residential Pet Waste Composters	System	50	26	75

Table 6.13 Stage I and Stage II implementation costs for NTU 298 of the Middle Clinch River Watershed.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 265,000	$ 106,000	$ 371,000
LE-1T <100-acres Livestock Exclusion	$ 57,500	$ 23,000	$ 80,500
LE-2T >100-acres Livestock Exclusion	$ 265,000	$ 106,000	$ 371,000
LE-2T <100-acres Livestock Exclusion	$ 57,500	$ 23,000	$ 80,500
WP-2T Livestock Exclusion	-	-	-
SL-6 Livestock Exclusion	$ 53,000	-	$ 53,000
Livestock Exclusion Maintenance	$ 10,675	$ 5,499	$ 16,174
Retention Ponds	-	$ 95,700	$ 95,700
Loafing Lot Management System	-	-	-
Reforestation of Erodible Pasture	$ 128,651	$ 42,884	$ 171,535
Conservation Tillage	$ 3,038	$ 1,013	$ 4,050
Improved Pasture Management	$ 235,174	$ 78,391	$ 313,565
Beef - Waste Storage System	-	$ 70,000	$ 70,000
Agriculture Total:	**$ 1,075,537**	**$ 551,486**	**$ 1,627,024**
Septic Systems Pump-out Program (RB-1)	$ 160,380	$ 82,620	$ 243,000
Connection to Public Sewer (RB-2)	$ 3,300	$ 1,700	$ 5,000
Septic System Repair (RB-3)	$ 30,030	$ 15,470	$ 45,500
Septic System Install/Replacement (RB-4)	$ 10,560	$ 5,440	$ 16,000
Alt. Waste Treatment System Install (RB-5)	$ 198,000	$ 102,000	$ 300,000
Community Pet Waste Education Program	-	-	-
Residential Pet Waste Composters	$ 2,475	$ 1,275	$ 3,750
Residential Total:	**$ 404,745**	**$ 208,505**	**$ 613,250**
Grand Total	**$ 1,480,282**	**$ 759,991**	**$ 2,240,274**

Table 6.14 Stage I and Stage II implementation g BMPs for NTU 421 of the Middle Clinch River Watershed.

Implementation Practice	Unit	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	System	10	3	13
LE-1T <100-acres Livestock Exclusion	System	10	3	13
LE-2T >100-acres Livestock Exclusion	System	10	3	13
LE-2T <100-acres Livestock Exclusion	System	9	3	12
WP-2T Livestock Exclusion	System	1	0	1
SL-6 Livestock Exclusion	System	2	1	3
Livestock Exclusion Maintenance	Feet	6,170	3,179	9,349
Retention Ponds	Acres-Treated	0	0	0
Loafing Lot Management System	System	1	0	1
Reforestation of Erodible Pasture	Acres	0	0	0
Conservation Tillage	Acres	0	0	0
Improved Pasture Management	Acres	0	0	0
Beef - Waste Storage System	System	0	0	0
Septic Systems Pump-out Program (RB-1)	Pump-out	965	497	1,462
Connection to Public Sewer (RB-2)	System	1	1	2
Septic System Repair (RB-3)	System	15	8	23
Septic System Install/Replacement (RB-4)	System	5	3	8
Alt. Waste Treatment System Install (RB-5)	System	18	10	28
Community Pet Waste Education Program	Program	0	0	0
Residential Pet Waste Composters	System	83	43	125

Table 6.15 Stage I and Stage II implementation costs for NTU 421 of the Middle Clinch River Watershed.

Implementation Practice	Stage I 1st 10 years	Stage II Final 5 years	Total
LE-1T >100-acres Livestock Exclusion	$ 516,750	$ 172,250	$ 689,000
LE-1T <100-acres Livestock Exclusion	$ 112,125	$ 37,375	$ 149,500
LE-2T >100-acres Livestock Exclusion	$ 516,750	$ 172,250	$ 689,000
LE-2T <100-acres Livestock Exclusion	$ 103,500	$ 34,500	$ 138,000
WP-2T Livestock Exclusion	$ 2,550	$ 850	$ 3,400
SL-6 Livestock Exclusion	$ 119,250	$ 39,750	$ 159,000
Livestock Exclusion Maintenance	$ 21,596	$ 11,125	$ 32,722
Retention Ponds	-	-	-
Loafing Lot Management System	$ 35,000	-	$ 35,00
Reforestation of Erodible Pasture	-	-	-
Conservation Tillage	-	-	-
Improved Pasture Management	-	-	-
Beef - Waste Storage System	-	-	-
Agriculture Total:	**$ 1,427,521**	**$ 468,100**	**$ 1,895,622**
Septic Systems Pump-out Program (RB-1)	$ 289,476	$ 149,124	$ 438,600
Connection to Public Sewer (RB-2)	$ 6,600	$ 3,400	$ 10,000
Septic System Repair (RB-3)	$ 53,130	$ 27,370	$ 80,500
Septic System Install/Replacement (RB-4)	$ 42,240	$ 21,760	$ 64,000
Alt. Waste Treatment System Install (RB-5)	$ 369,600	$ 190,400	$ 560,000
Community Pet Waste Education Program	-	-	-
Residential Pet Waste Composters	$ 4,125	$ 2,125	$ 6,250
Residential Total:	**$ 765,171**	**$ 394,179**	**$ 1,159,350**
Grand Total	**$ 2,192,692**	**$ 862,279**	**$ 3,054,972**

Table 6.16 Costs to implement Stage I (1st 10 years) for the Middle Clinch River Watershed.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total Cost ($)
NTU 250	$10,468,513	$1,878,063	$800,000	$13,146,576
NTU 251	$433,361	$67,782		$501,143
NTU 252	$5,386,011	$774,890		$6,160,901
NTU 253	$3,485,835	$408,540		$3,894,375
NTU 298	$1,075,537	$404,745		$1,480,282
NTU 421	$1,427,521	$765,171		$2,192,692
Total	**$22,276,778**	**$4,299,191**	**$800,000**	**$27,375,969**

Table 6.17 Costs to implement Stage II (Final 5 years) for Middle Clinch River Watershed.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Technical Assistance ($)	Total Cost ($)
NTU 250	$3,647,667	$455,850	$400,000	$4,503,517
NTU 251	$145,656	$34,918		$180,574
NTU 252	$2,413,832	$396,610		$2,810,442
NTU 253	$1,476,430	$210,460		$1,686,890
NTU 298	$551,486	$208,505		$759,991
NTU 421	$468,100	$394,179		$862,279
Total	**$8,703,172**	**$1,700,522**	**$400,000**	**$10,803,694**

6.2 Timeline

Based on meeting the above milestones, 15-year implementation plan timelines were formulated for the Middle Clinch River watershed (**Figure 6.1** to **Figure 6.6**). The timelines describe the needs for implementation in terms of completion of the agricultural, residential and industrial control measures. **Table 6.18** shows the projected staged implementation costs for agricultural and residential control measures, including technical assistance.

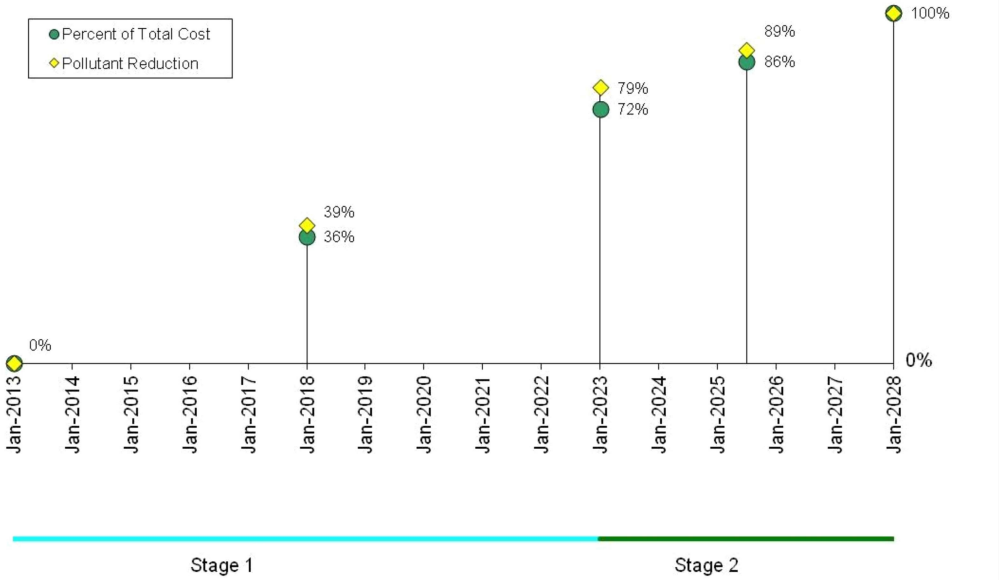

Figure 6.1 Timeline for implementation in the Clinch River (NTU 250).

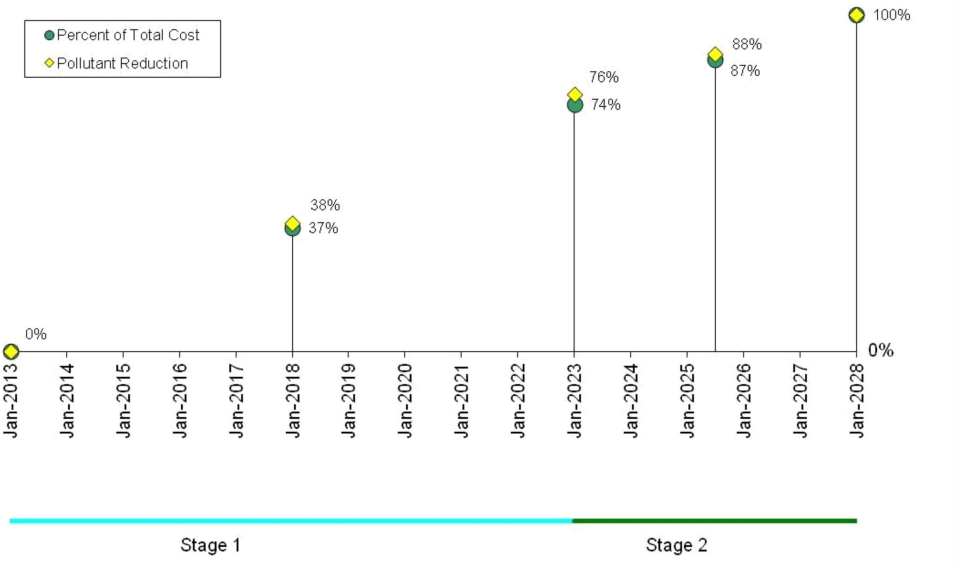

Figure 6.2 Timeline for implementation in Dumps Creek (NTU 251).

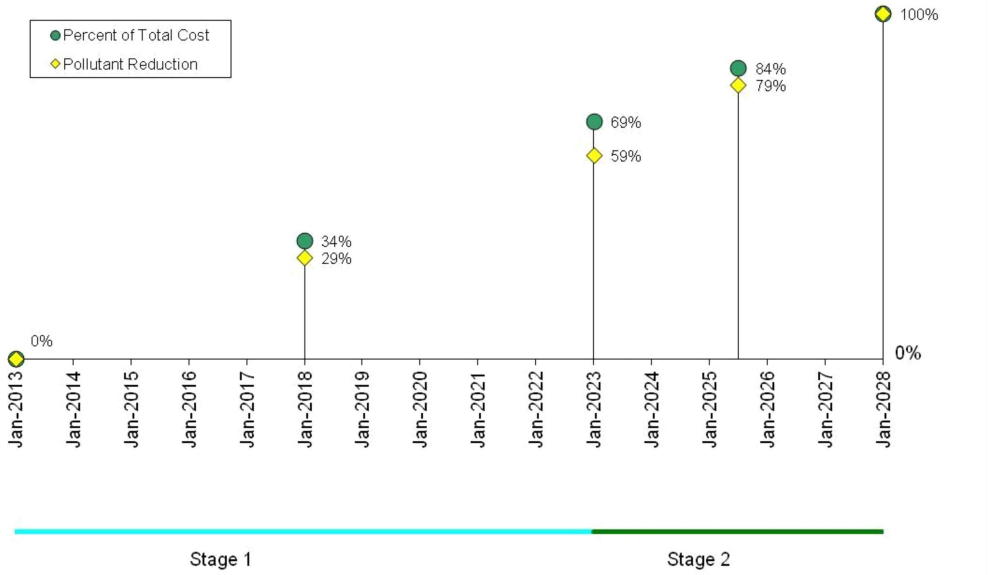

Figure 6.3 Timeline for implementation in Big Cedar/Burgess Creeks (NTU 252).

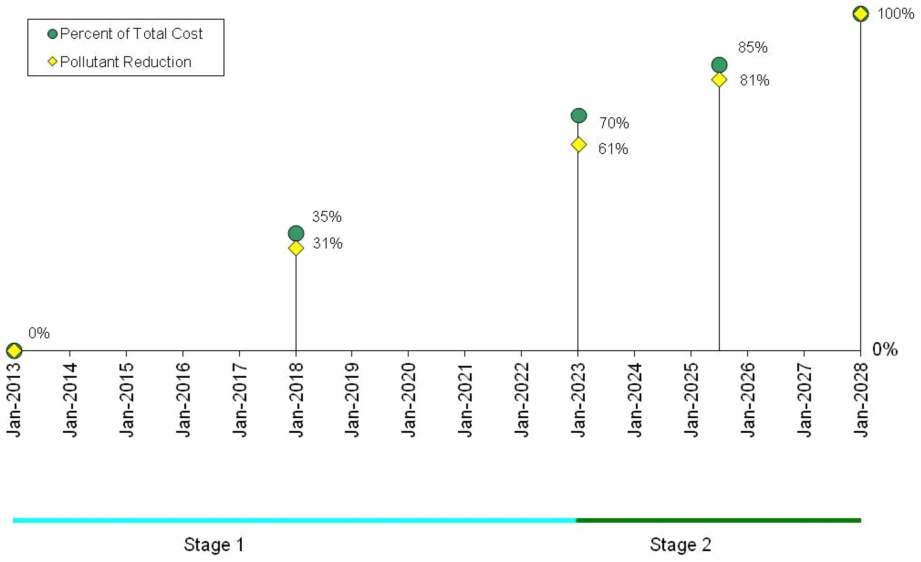

Figure 6.4 Timeline for implementation in Elk Garden/Loop Creeks (NTU 253).

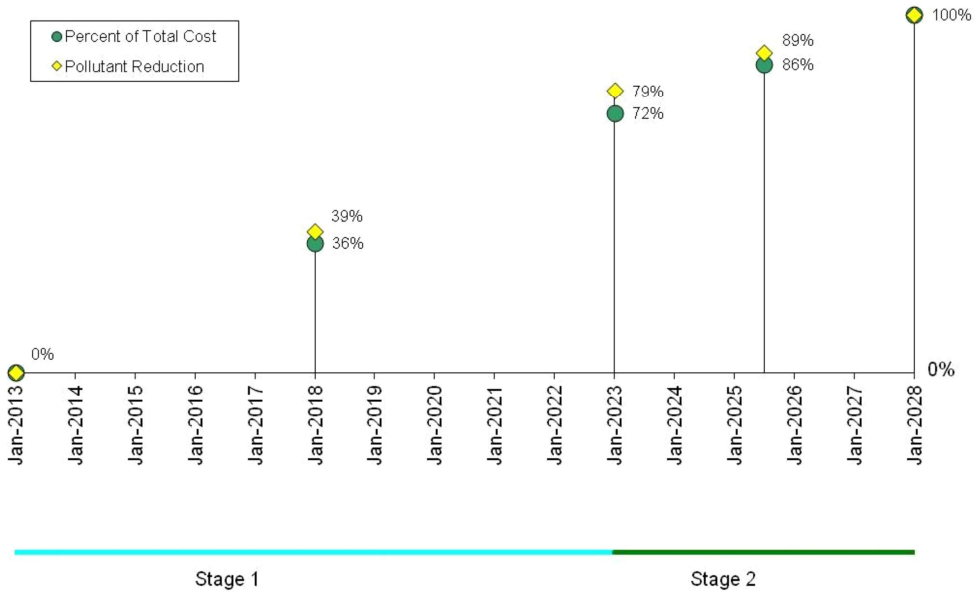

Figure 6.5 Timeline for implementation in Lewis Creek (NTU 298).

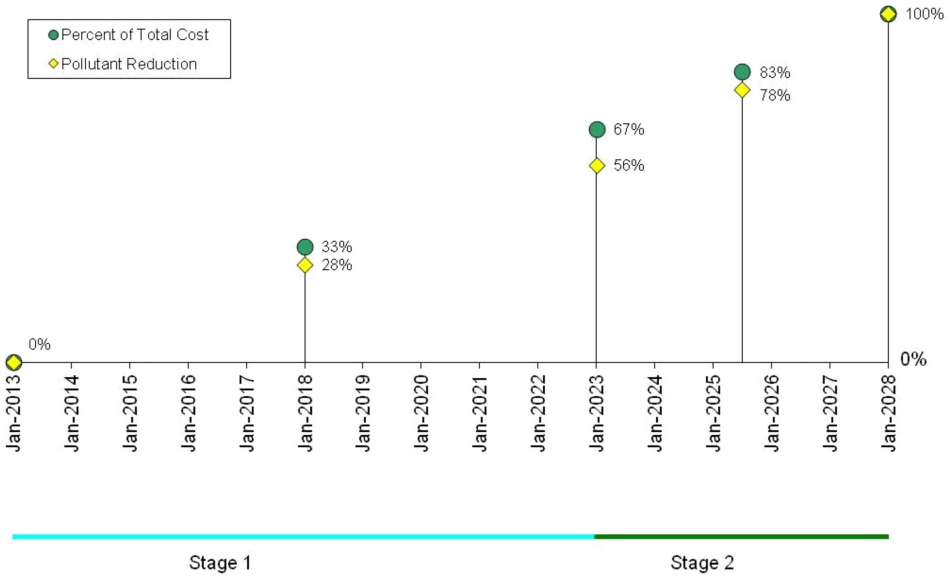

Figure 6.6 Timeline for implementation in Swords/Hess Creeks (NTU 421).

Table 6.18 Break-down of implementation by stage in the Clinch River watershed.

Implementation Milestones	Unit	Stage I	Stage II
Agricultural		**1st 10 years**	**Final 5 years**
LE-1T >100-acres Livestock Exclusion	System	**75%**	**25%**
LE-1T <100-acres Livestock Exclusion	System	**75%**	**25%**
LE-2T >100-acres Livestock Exclusion	System	**75%**	**25%**
LE-2T <100-acres Livestock Exclusion	System	**75%**	**25%**
WP-2T Livestock Exclusion	System	**75%**	**25%**
SL-6 Livestock Exclusion	System	**75%**	**25%**
Livestock Exclusion Maintenance	Feet	**66%**	**34%**
Retention Ponds	Acres-Treated	**0%**	**100%**
Loafing Lot Management System	System	**100%**	**0%**
Reforestation of Erodible Pasture	Acres	**75%**	**25%**
Conservation Tillage	Acres	**75%**	**25%**
Improved Pasture Management	Acres	**75%**	**25%**
Beef - Waste Storage System	System	**0%**	**100%**
Residential			
Septic Systems Pump-out Program (RB-1)	Pump-out	**66%**	**34%**
Connection to Public Sewer (RB-2)	System	**66%**	**34%**
Septic System Repair (RB-3)	System	**66%**	**34%**
Septic System Installation/Replacement (RB-4)	System	**66%**	**34%**
Alternative Waste Treatment System Installation (RB-5)	System	**66%**	**34%**
Community Pet Waste Education Program	Program	**100%**	**0%**
Residential Pet Waste Composters	System	**66%**	**34%**

6.3 Targeting

Implicit in the process of a staged implementation is targeting of control measures. Targeting ensures optimum utilization of resources. The Middle Clinch watershed was divided into 21 subwatersheds (Figure 1.1). Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each subwatershed (Figure 6.7). If feasible, effort should be made to prioritize resources in higher priority subwatersheds. For example, the local SWCDs should initiate participation from farmers in subwatersheds 5 and 8. The targeting priority should be used to focus outreach,

promoting the cost-share programs available. Any interested parties should not be turned away if their farm is in a low ranking subwatershed.

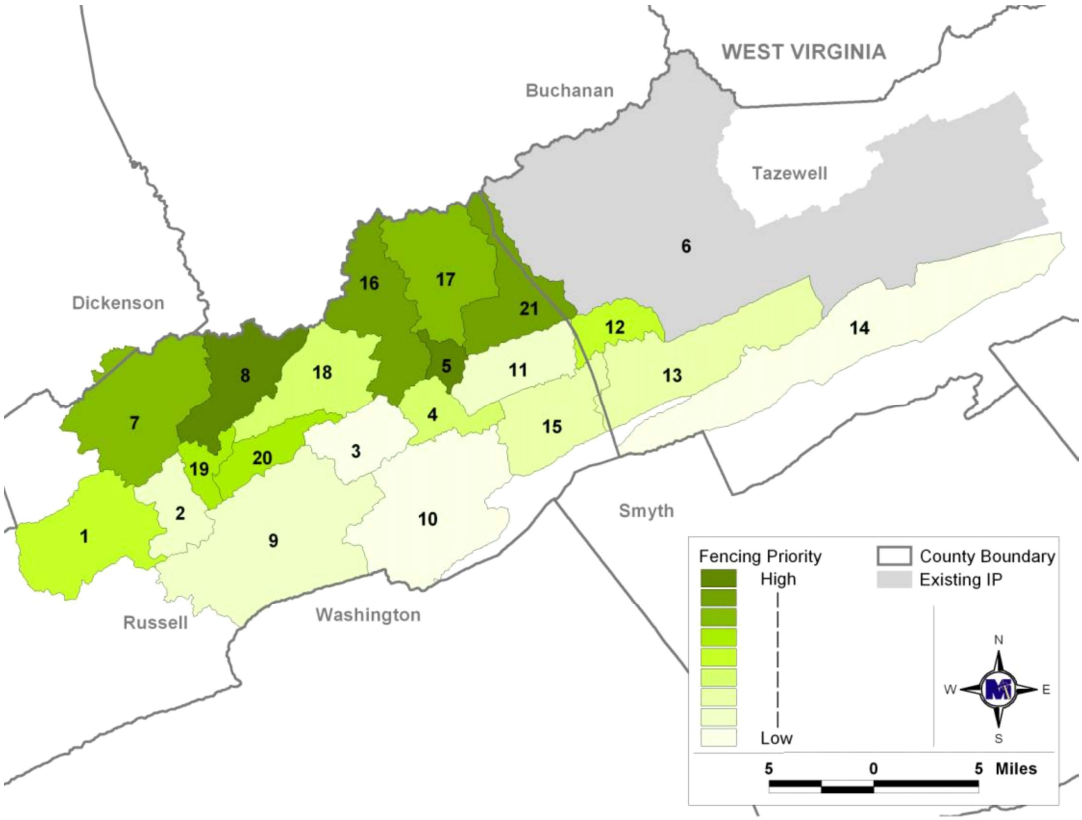

Figure 6.7 Targeting of stream fencing, by subwatershed, based on amount of fencing and cattle population.

Targeting of failing septic systems and straight pipes should be initiated based on the priority shown in Figure 6.8 and Figure 6.9, respectively. These priorities were derived from ranking the number of failing septic systems and straight pipes in each subwatershed.

One method of targeting in agricultural and residential areas involves considering the cost-efficiency of specific practices. Table 5.9 indicates the cost-efficiencies of the practices proposed in this IP. Practices with high cost-efficiencies, relative to other practices, will provide the greatest benefit per dollar invested.

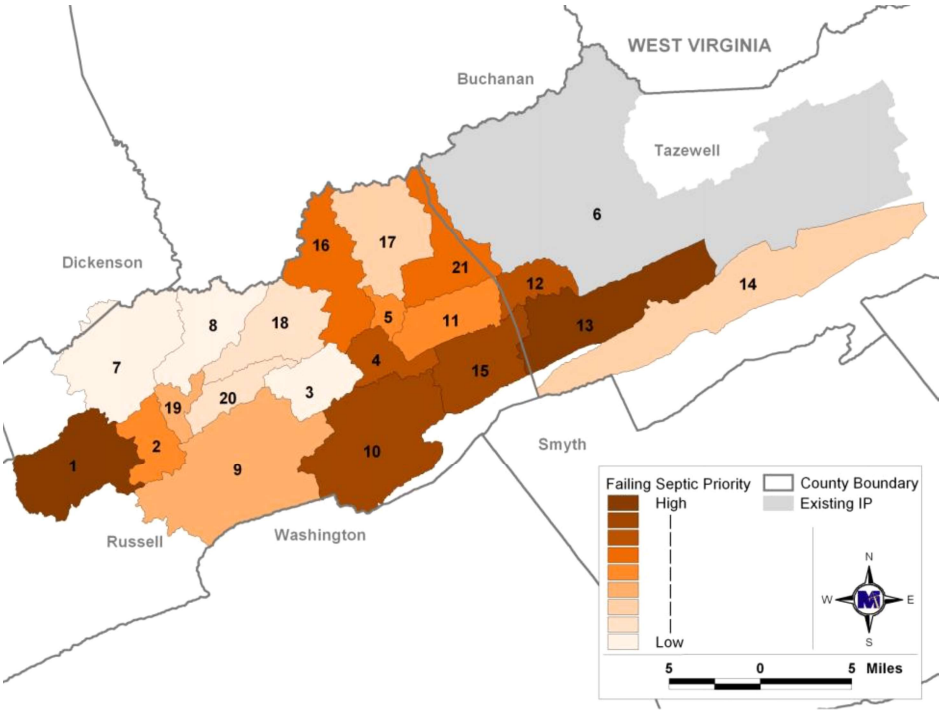

Figure 6.8 Targeting the replacement of failing septic systems, by subwatershed, based on the number of failing septic systems.

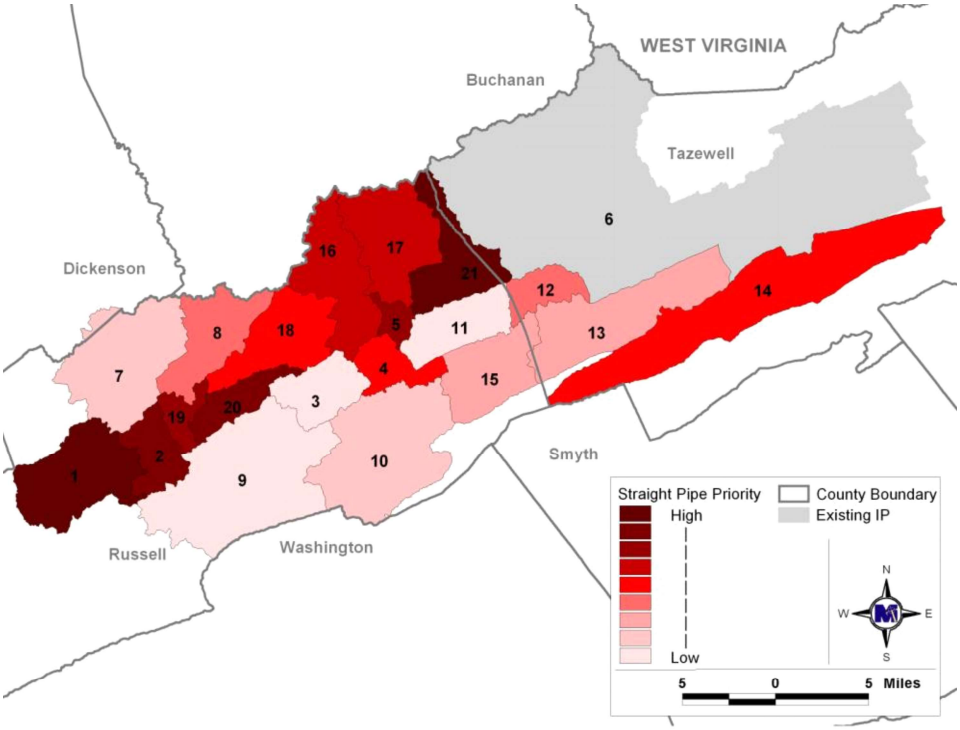

Figure 6.9 Targeting of straight pipe repair, by subwatershed, based on the number of straight pipes.

7. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this effort (*i.e.,* improving water quality and removing these waters from the impaired waters list) is dependent upon stakeholder participation. Local stakeholders who implement control measures are key to the successful implementation of this plan. The first step is to acknowledge that a water quality problem exists and realize that needed changes must be made in operations, programs, and legislation to address these pollutants. The local SWCDs have agreed to take responsibility for initiating contact to encourage landowners to install the agricultural BMPs and to correct residential onsite wastewater treatment systems in need. VADCR and VADEQ staff will take the responsibility of working with the local SWCDs and other partners in tracking implementation efforts as well as organizing the steering committee for evaluations of implementation progress. The following sections in this chapter describe the responsibilities and expectations for the various components of implementation.

7.1 Integration with Other Watershed Plans

Each watershed in the state is under the jurisdiction of a multitude of individual, yet related, water quality programs and activities, many of which have specific geographic boundaries and goals. These include, but are not limited to, TMDLs, Roundtables, Water Quality Management Plans, erosion and sediment control regulations, stormwater management, Source Water Protection Program, and local comprehensive plans. A previous TMDL within this same watershed was "*E. coli Total Maximum Daily Loads in the Upper Clinch River Watershed of Tazewell County, Virginia*". Coordination of the implementation project with these existing programs could result in additional resources and increased participation.

7.2 Monitoring

Improvements in water quality will be determined in the Middle Clinch River watershed through monitoring conducted by the VADEQ's ambient monitoring program. The monitoring data include bacteria, physical parameters (dissolved oxygen, temperature, pH, and conductivity), nutrients and organic and inorganic solids. The VADEQ uses the data to determine overall water quality status. The water quality status will help gauge the success

of implementation aimed at reducing the amount of bacteria in the streams of the Middle Clinch River watershed.

The VADEQ monitoring stations in the Middle Clinch River watershed are shown in **Figure 7.1** and described in **Table 7.1**. Stations are monitored as shown in **Table 7.1.** Most of the monitoring stations in the Middle Clinch watershed are ambient stations that will fall into the regular ambient monitoring cycle. The one station on the mainstem of the Clinch River is a trend station and will be visited every other month.

Up-to-date monitoring results are available to residents by requesting the information from the VADEQ.

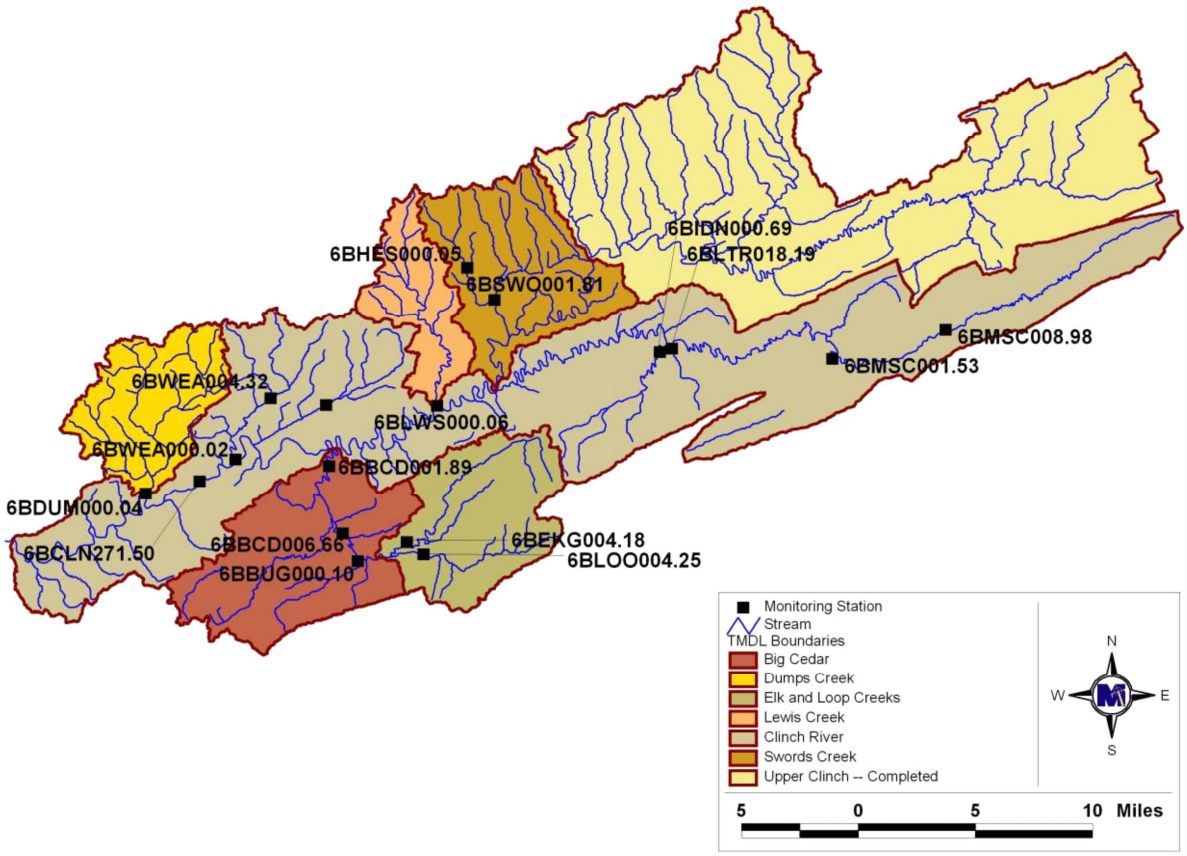

Figure 7.1 Location of monitoring stations in the Middle Clinch River watershed.

Table 7.1 Monitoring station IDs, station locations, and monitoring schedules for the Middle Clinch River watershed VADEQ stations.

Station ID	Stream Name	Station Type	County	Schedule
6BCLN271.50	Clinch River	Trend	Russell	Every other month
6BIDN000.69	Indian Creek	Ambient	Tazewell	Every other month for two years, off for four years
6BWEA000.02	Weaver Creek	Ambient	Russell	
6BWEA004.32	Weaver Creek	Ambient	Russell	
6BTMP003.58	Thompson Creek	Ambient	Russell	
6BLWS000.06	Lewis Creek	Ambient	Russell	
6BHES000.05	Hess Creek	Ambient	Russell	
6BSWO001.81	Swords Creek	Ambient	Russell	
6BLTR018.19	Little River	Ambient	Tazewell	
6BBCD001.89	Big Cedar Creek	Ambient	Russell	
6BBCD006.66	Big Cedar Creek	Ambient	Russell	
6BMSC001.53	Maiden Spring Creek	Ambient	Tazewell	
6BMSC009.89	Maiden Spring Creek	Ambient	Tazewell	
6BLOO004.25	Loop Creek	Ambient	Russell	
6BBUG000.10	Burgess Creek	Ambient	Russell	
6BEKG004.18	Elk Garden Creek	Ambient	Russell	
6BDUM000.04	Dumps Creek	Ambient	Russell	

7.3 Agricultural, Residential and Industrial Education Programs

Education and outreach is a significant component of any TMDL implementation project. The Tazewell and Clinch Valley SWCD will be in charge of initiating contact with residents and farmers to encourage the installation of BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The district staff will conduct a number of outreach activities in the watershed to promote participation and community support to attain the IP milestones and to make the community aware of the TMDL requirements. Such activities will include information exchange through newsletters, mailings, field days, demonstrations, organizational meetings, etc. The staff will work with appropriate organizations such as VCE to educate the public. Grazing land/forage workshops possibly with the Virginia Forage and Grassland Council are venues to distribute agricultural education materials. Specific agricultural and residential outreach ideas are outlined in section 5.3.

A residential education program consisting of educational materials about pet waste and a pet waste composter program will be cost-effective options. Education materials could be handed out through the Master Gardener program if they were to become involved. The

Cooperative Extension and the local SWCDs could also help distribute information on how citizens need to clean up after their pets.

7.3.1 Soil & Water Conservation Districts (SWCDs)

Soil & Water Conservation Districts are local government entities providing soil and water conservation assistance to farmers and residents in this watershed. The Middle Clinch River and tributaries watershed spans two (2) counties and is represented by two Districts. While these SWCDs may have similar functions and interests, each SWCD serves a specific geographic area, which usually corresponds to a county boundary. **Table 7.2** outlines the SWCDs in this watershed, and can serve as a starting point for seeking out assistance from the experienced personnel at the local SWCD.

Table 7.2 Counties and their corresponding Soil & Water Conservation District

Virginia County	Soil and Water Conservation District
Russell County	Clinch Valley SWCD
Tazewell County	Tazewell SWCD

During the implementation project, the local SWCDs will provide outreach, technical and financial assistance to farmers and homeowners in the Middle Clinch River and tributaries watershed through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural and residential BMPs. Education and outreach activities are a significant portion of their responsibilities. Specific education and outreach methods recommended by the working groups are described in section 5.3 of this document. These SWCDs may be eligible for technical assistance funding to support their duties.

7.4 Legal Authority

The EPA 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. 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 activities that impact water quality in Virginia. These

agencies are VADEQ, VADCR, VDH, VADMME and Virginia Department of Agriculture and Consumer Services (VDACS).

VADEQ has responsibility for monitoring waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. It has the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities that hold in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent surface and groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, the Virginia General Assembly passed legislation in 1999 requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999). On January 1, 2008 VADEQ assumed regulatory oversight of all land application of treated sewage sludge, commonly referred to as biosolids as a directed by the Virginia General Assembly in 2007. VADEQ's Office of Land Application Programs within the Water Quality Division manages the biosolids program. The biosolids program includes having and following nutrient management plans for all fields receiving biosolids, unannounced inspections of the land application sites, certification of persons land applying biosolids, and payment of a $7.50 fee per dry ton of biosolids land applied. VADEQ is responsible for addressing nonpoint source pollution and administers the state stormwater program including the MS4 stormwater permit program.

VADCR holds the responsibility for addressing agricultural nonpoint sources (NPS) of pollution. Historically, agricultural NPS pollution has been addressed through education and voluntary incentive programs. Cost-share programs were originally developed to meet the needs of voluntary partial participation and not the level of participation required by TMDLs (near 100%). To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs are continually reevaluated to account for this level of participation.

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

The *Emergency Regulations for Alternative Onsite Sewage Systems*, adopted in April, 2010, require that all alternative onsite sewage treatment systems in Virginia be visited at least annually by a licensed operator. However, the Virginia Department of Health (VDH) does not currently have the authority, the mandate or the resources to require or conduct similar surveillance of all conventional onsite sewage treatment (septic) systems in the Commonwealth. (Note that, as resources allow, VDH may conduct or assist with such surveys that target localized areas of specific concern.)

Given the above limitations, VDH generally learns of failed septic systems directly or indirectly from the owners of those systems or through complaints from neighbors or other government agencies. Reports of straight pipes are less-frequently received from either source, since they are generally located in less-populated areas and are typically sited/intended to avoid detection.

When VDH receives a report of a non-compliant system, it performs a site inspection, if necessary, to verify the report. VDH then works with the homeowner to address the issue in an effective, timely and regulatory-compliant manner, generally through installation of a septic or alternative onsite system, repair or replacement of an existing system and/or failed components of that system, connection to a central collection/treatment system, or other

appropriate measure(s). In the case of non-cooperative homeowners, VDH initially attempts to achieve compliance through internal enforcement actions and, ultimately, through the court system.

An impasse may be reached when a homeowner is willing, but financially unable to correct the non-compliance. In such situations, VDH assists in attempting to locate funding for the needed corrections.

VADMME seeks to enhance the conservation and development of energy and mineral resources in Virginia. They are responsible for eliminating off-site environmental damages and ensuring the proper restoration of lands used for coal and mineral mining, and gas and oil operations.

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

The local governments can play a very active role in the implementation process. For example they could promote a septic system maintenance program. This could be done by handing out literature when individuals apply for a building permit. It is recommended that the counties within the Middle Clinch River watershed adopt a reserve area for land parcels using on-site wastewater treatment of equal size to the approved on-site disposal system for use in the event the on-site disposal system fails. Further, the reserve area shown must be of equal capacity to the primary drainfield using the same technology as the primary system. Nothing shall be constructed within the reserve area. The counties could also play an active role in the proper disposal of pet waste. When licenses for dog kennels are issued the owners should be required to produce a plan for the proper disposal of waste from the facility. Future subdivisions should be developed with sustainable growth practices that minimize of

eliminate storm water runoff. Future subdivisions should be developed with sustainable growth practices that minimize or eliminate storm water runoff.

7.5 Legal Action

The Clean Water Act Section 303(d) calls for the identification of impaired waters. It also requires that the streams be ranked by the severity of the impairment and that a Total Maximum Daily Load be calculated for each impaired stream that would attain the set water quality standard. Currently, TMDL Implementation Plans are not required in the Federal Code; however, Virginia State Code does incorporate the development of Implementation Plans for impaired streams. EPA largely ignored the nonpoint source section of the Clean Water Act until citizens began to realize that regulating only point sources was no longer maintaining water quality standards. Lawsuits from citizens and environmental groups citing EPA for not carrying out the statutes of the CWA began as far back as the 1970s and have continued until the present. In Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303d. The suit was settled by Consent Decree, which contained a TMDL development schedule through 2010. It is becoming more common for concerned citizens and environmental groups to turn to the courts for the enforcement of water quality issues.

In 1989, concerned residents of Castile in Wyoming County, New York filed suit against Southview Farm. Southview had around 1,400 head of milking cows and 2,000 total head of cattle. Tests on private wells determined that the water was contaminated with nitrates traced to irresponsible handling of animal wastes by Southview. In 1990, Southview was given a notice of violations under the Clean Water Act. Rather than change their farming practices or address the contaminated wells, they ignored the warning. In 1995, after court hearings and an appeal, the case was finally settled. Southview had to donate $15,000 to the Dairy Farms Sustainability Project at Cornell University, pay $210,000 in attorney fees for the plaintiff, and employ best management practices (Knauf, 2001).

On the Eastern Shore of Virginia, an aquaculture operation raising clams and oysters, brought suit against its neighbor, a tomato grower. The aquaculture operation owner claimed that the agricultural runoff created from the plasticulture operation carried pollutants which

were destroying his shellfish beds. The suit was settled out of court in favor of the aquaculture operation owner.

Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role, of course, falls on the landowner. However, local, state and federal agencies also have a stake in ensuring that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there is a problem and that the health of citizens is at stake. Virginia's approach to correcting NPS pollution problems has been, and continues to be, encouragement of participation through education and financial incentives.

Page intentionally blank

8. FUNDING

The following practices are identified as vital to attaining the goals of the Middle Clinch River watershed IP: LE-1T and LE-2T (Grazing Land Protection), WP-2T (Streambank Protection in TMDL areas), RB-1 (Septic Tank Pump-Out), RB-3 (Septic System Repair), RB-4 (Septic Tank System Installation/Replacement), RB-5 (Alternative On-site Waste Treatment System), FR-1 (Reforestation of Erodible Crop and Pastureland), Residential Education Program. Potential funding sources available during implementation were identified during IP development. A brief description of the programs and their requirements is provided in this chapter. Detailed descriptions can be obtained from the SWCDs, VADCR, NRCS, and VCE. It is recommended that participants discuss funding options with experienced personnel at their local SWCD in order to choose the best option. Information on program description and requirements was provided from fact sheets prepared by Virginia State Technical Advisory Committee, VADEQ, VADCR, and Southeast Rural Community Assistance Project, Inc.

Federal Clean Water Act 319 Incremental Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement the nonpoint source programs. VADEQ administers the funds for watershed projects, demonstration and educational programs, nonpoint source pollution control program development, and technical and program staff. VADEQ reports annually to the EPA on the progress made in nonpoint source pollution prevention and control.

Virginia Agricultural Best Management Practices Cost-Share Program

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on their land to better control sediment, nutrient loss, and transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a greater impact on water quality. Cost-share is typically 75% of the actual cost, not to exceed the local maximum. The Virginia Natural Resources Commitment Fund (WNRCF) provides funding for this program, which is dependent upon a percentage of state surpluses.

Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, shall be 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. "Agricultural best management practices" are approved measures that will provide a significant improvement to water quality in the state's streams and rivers, and are consistent with other state and federal programs that address agricultural nonpoint source pollution management. Any practice approved by the local SWCD Board shall be completed within the taxable year in which the credit is claimed. The credit shall be allowed only for expenditures made by the taxpayer from funds of his/her own sources. The amount of such credit shall not exceed $17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed, as certified by the Board. If the amount of the credit exceeds the taxpayer's liability for such taxable year, the excess may be carried over for credit against income taxes in the next five taxable years until the total amount of the tax credit has been taken. 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 Agricultural Best Management Practices Loan Program

Loan requests are accepted through VADEQ. The interest rate is 3% per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan, the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is $5,000; there is no maximum limit. Eligible BMPs include 23 structural practices such as animal waste control facilities, loafing lot management systems, and grazing land protection systems. The loans are administered through certain participating lending institutions.

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 equipment either must be needed by the small business to comply with the federal Clean Air Act, or allow the small business to implement voluntary pollution prevention measures. 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. There is a $30 non-refundable application processing fee. The Fund will not be used to make loans to small businesses for the purchase and installation of equipment needed to comply with an enforcement action. 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

This is a permanent, non-reverting fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint nutrient loads to surface waters. Eligible recipients include local governments, SWCDs, and individuals. Grants for point and nonpoint sources are administered through VADEQ. Most WQIF grants provide matching funds on a 50/50 cost-share basis. Successful applications are listed as draft/public-noticed agreements, and are subject to a public review period of at least 30 days. This fund was identified as a potential funding source for the urban stream buffers and pet waste composter program to be included in the implementation plan.

Community Development Block Grant Program

The Department of Housing and Urban Development sponsors this program, intended to develop viable communities by providing decent housing and a suitable living environment and by expanding economic opportunities primarily for persons of low and moderate income. Recipients may initiate activities directed toward neighborhood revitalization, economic development, and provision of improved community facilities and services. Specific activities may include public services, acquisition of real property, relocation and demolition, rehabilitation of structures, and provision of public facilities and improvements, such as new or improved water and sewer facilities.

Conservation Reserve Program (CRP)

Offers are accepted and processed during fixed signup periods that are announced by FSA. All eligible (cropland) offers are ranked using a national ranking process. If accepted, contracts are developed for a minimum of 10 and not more than 15 years. Payments are based on a per-acre soil rental rate. Cost-share assistance is available to establish the conservation cover of tree or herbaceous vegetation. The per-acre rental rate may not exceed the Commodity Credit Corporation's maximum payment amount, but producers may elect to receive an amount less than the maximum payment rate, which can increase the ranking score. To be eligible for consideration, the following criteria must be met: 1) cropland was planted or considered planted in an agricultural commodity for two of the five most recent crop years, and 2) cropland is classified as "highly-erodible" by NRCS. Eligible practices include planting these areas to trees and/or herbaceous vegetation. Application evaluation points can be increased if certain tree species, spacing, and seeding mixtures that maximize wildlife habitats are selected. Land must have been owned or operated by the applicant for at least 12 months prior to the close of the signup period. The payment to the participant is up to 50% of the cost for establishing ground cover. Incentive payments for wetlands hydrology restoration equal 25% of the cost of restoration.

Conservation Reserve Enhancement Program (CREP)

This program is an "enhancement" of the existing USDA CRP Continuous Sign-up. It has been "enhanced" by increasing the cost-share rates from 50% to 75% and 100%, increasing the rental rates, and offering a flat rate incentive payment to place a permanent "riparian easement" on the enrolled area. Pasture and cropland (as defined by USDA) adjacent to streams, intermittent streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, to mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Cost-sharing (75% - 100%) is available to help pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. In addition, a 40% incentive payment upon completion is offered and an average rental rate of $70/acre on stream buffer area for 10-15 years. The State of Virginia will make an additional

incentive payment to place a perpetual conservation easement on the enrolled area. The statewide goal is 8,000 acres.

The landowner can obtain and complete CREP application forms at the FSA center. The forms are forwarded to local NRCS and SWCD offices while FSA determines land eligibility. If the land is deemed eligible, NRCS and the local SWCD determine and design appropriate conservation practices. A conservation plan is written, and fieldwork is begun, which completes the conservation practice design phase.

FSA then measures CREP acreage, conservation practice contracts are written, and practices are installed. The landowner submits bills for cost-share reimbursement to FSA. Once the landowner completes BMP installation and the practice is approved, FSA and the SWCD make the cost-share payments. The SWCD also pays out the state's one-time, lump sum rental payment. FSA conducts random spot checks throughout the life of the contract, and the agency continues to pay annual rent throughout the contract period.

Environmental Quality Incentives Program (EQIP)

This program was established in the 1996 Farm Bill to provide a single voluntary conservation program for farmers and landowners to address significant natural resource needs and objectives. This program replaces the Agricultural Conservation Program (ACP) and the Water Quality Incentive Program (WQIP). Approximately 65% of the EQIP funding for the state of Virginia is directed toward "Priority Areas." These areas are selected from proposals submitted by a locally led conservation work group. Proposals describe serious and critical environmental needs and concerns of an area or watershed, and the corrective actions they desire to take to address these needs and concerns. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers 5 to 10-year contracts to landowners and farmers to provide 75% cost-share assistance, 25% tax credit, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in livestock or agricultural production. Eligible land includes cropland, pasture, and other agricultural land in priority areas, or land that has an environmental need that matches one of the statewide concerns.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners and land users who want to develop or improve wildlife habitat on private agriculture-related 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. In Virginia, these plans will be prepared to address one or more of the following high priority habitat needs: early grassland habitats that are home to game species such as quail and rabbit as well as other non-game species like meadowlark and sparrows; riparian zones along streams and rivers that provide benefits to aquatic life and terrestrial species; migration corridors which provide nesting and cover habitats for migrating songbirds, waterfowl and shorebird species; and decreasing natural habitat systems which are environmentally sensitive and have been impacted and reduced through human activities. 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. Applicants will be competitively ranked within the state and certain areas and practices will receive higher ranking based on their value to wildlife. 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. For cost-share assistance, USDA pays up to 75% of the cost of installing wildlife practices.

Wetland Reserve Program (WRP)

This program is a voluntary program to restore and protect wetlands on private property. The program benefits include providing fish and wildlife habitat, improving water quality, reducing flooding, recharging groundwater, protecting and improving biological diversity, and furnishing recreational and esthetic benefits. Sign-up is on a continuous basis. 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. The program offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of a minimum 10-year duration. Under the permanent easement option,

landowners may receive the agricultural value of the land up to a maximum cap and 100% of the cost of restoring the land. For the 30-year option, a landowner will receive 75% of the easement value and 75% cost-share on the restoration. A ten-year agreement is also available that pays 75% of the restoration cost. 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. At any time, a landowner may request that additional activities be added as compatible uses. Land eligibility is dependent on length of ownership, whether the site has been degraded as a result of agriculture, and the land's ability to be restored. Restoration agreement participants must show proof of ownership. Easement participants must have owned the land for at least one year and be able to provide clear title.

Southeast Rural Community Assistance Project (SE/R-CAP)

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 SE/R-CAP 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. Financial assistance includes $1,500 toward repair/replacement/installation of a septic system and $2,000 toward repair/replacement/installation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level. The federal poverty threshold for a family of four is $25,813.

National Fish and Wildlife Foundation

Offers are accepted throughout the year and processed during fixed signup periods. The signup periods are on a year-round, revolving basis, and 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. An approved pre-proposal is a pre-requisite to the submittal of the full proposal. Grants generally range between $10,000 and $150,000. Payments are based on need. Projects are funded in the U.S. and any international areas that host

migratory wildlife from the U.S. 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. If the project does not fall into the criteria of any special grant programs, the 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. A pre-proposal that is not accepted by a special grant program may be deferred to the general grant program.

Clean Water State Revolving Fund

EPA 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, nonpoint source 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. Nonpoint source projects include agricultural, silvicultural, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc. Estuary protection projects include all of the above point and nonpoint source projects, as well as habitat restoration and other unique estuary projects.

EPA Environmental Education Grant Funding Opportunity

EPA has recently announced an exciting environmental education grant funding opportunity. These grants are intended to promote environmental stewardship and help develop knowledgeable and responsible students, teachers and citizens.

The project start date in proposals should be no earlier than September 1, 2011. There is a requirement to specify an environmental issue, based on EPA's current priorities that the proposed project will focus on. There is more emphasis on expanding the conversation on

environmentalism by including a variety of audiences in proposed projects. There is a strong emphasis on partner letters this year. Letters will be scored for their clarity and completeness. Incomplete applications will not be reviewed. If applying through grants.gov, make sure to register at least one week ahead of time.

Page intentionally blank

REFERENCES

Barnett, J. R., R. C. Warner, and C. T. Agouridis. "The effectiveness of a combination weep berm-grass filter riparian control system for reducing fecal bacteria and nutrients from grazed pastures." Self-Sustaining Solutions for Streams, Wetlands, and Watersheds: proceedings of the 12-15 September 2004 conference, Radisson Riverfront Hotel, St. Paul, Minnesota USA. Amer Society of Agricultural, 2004.

CDC. 1995. Escherichia coli 0157:H7 outbreak at a summer camp – Virginia, 1994. CDC MMWR Weekly. June 9, 1995. 44(22);419-421.

CDC. 2001. Outbreaks of *Escherichia coli* 0157:H7 infections among children associated with farm visits --- Pennsylvania and Washington, 2000. CDC MMWR Weekly. April 20, 2001 / 50(15);293-7.

Commonwealth of Virginia. 2005. Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy.

ELI. 1999. Locating Livestock: How Water Pollution Control Efforts Can Use Information From State Regulatory Programs. Environmental Law Institute. Research Report 1999. ELI Project #941718.

Knauf, A.J. 2001. The Southview Farm Case: A giant step to end special treatment for agriculture under environmental laws.

Pugh, S. 2001. Letter regarding: The Agricultural Stewardship Act and TMDLs. February 13, 2001.

Roanoke Times. 1997a. *E. coli* cases pit health officials against boaters, swim at your own risk. Roanoke Times. November 9 1997. Page B1.

Roanoke Times. 1997b. Meeting taps concerns over lake's water quality, some want education, others regulation, to prevent sickness. Roanoke Times. November 15, 1997. Page B1

Roanoke Times. 1998a. Confirmed *E. coli* count now at 9. Roanoke Times. August 22, 1998.

Roanoke Times. 1998b. *E. coli* levels hard to track. Roanoke Times. October 19, 1998. Page C1.

Roanoke Times. 1998c. State tests confirm *E. coli* infections still no source determined. Roanoke Times. August 19, 1998.

Roanoke Times. 2000. Health Dept. shuts off tap on Crystal Spring's water. Roanoke Times. June 6, 2000. Page A1.

Swann, C. 1999. A survey of residential nutrient behaviors in the Chesapeake Bay. Widener Burrows, Inc. Chesapeake Bay Research Consortium. Center for Watershed Protection. Ellicott City, MD. 112pp.

EPA. 1999. Guidance for Water Quality-Based Decisions: The TMDL Process.

VADEQ and VADCR. 2002. Fecal Coliform TMDL for Blacks Run, Rockingham

VADEQ. 1998. 303(d) Total Maximum Daily Load Priority List and Report.

VCE. 1996. Controlled grazing of Virginia's pastures, by Harlan E. White and Dale D. Wolf, Virginia Cooperative Extension Agronomists; Department of Forages, Crop, and Soil Environmental Sciences, Virginia Tech. Publication Number 418-012. July 1996.

VCE. 1998a. Mastitis cost? by Gerald M. (Jerry) Jones, Extension Dairy Scientist, Milk Quality and Milking Management, Virginia Tech. Dairy Pipeline. December 1998.

VCE. 1998b. Safe water for horses, questions about water testing, by Larry Lawrence, Extension Animal Scientist, Horses, Animal and Poultry Sciences, Virginia Tech. Livestock Update. December 1998. Available at:

VCE. 2000. Feeder and stock health and management practices, by John F. Currin and W. D. Whittier, Extension Specialists, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech. Publication Number 400-006. January 2000.

GLOSSARY

303(d). A section of the Clean Water Act of 1972 requiring states to identify and list water bodies that do not meet the states' water quality standards.

ACP. Agricultural Conservation Program.

Allocations. *That portion of a receiving water's loading capacity attributed to one of its existing or future pollution sources (nonpoint or point) or to natural background sources. (A wasteload allocation [WLA] is that portion of the loading capacity allocated to an existing or future point source, and a load allocation [LA] is that portion allocated to an existing or future nonpoint source or to natural background levels. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)*

ASA. Agricultural Stewardship Act.

Best management practices (BMPs). *Methods, measures, or practices determined to be reasonable and cost-effective means for a landowner to meet certain, generally nonpoint source, pollution control needs. BMPs include structural and nonstructural controls and operation and maintenance procedures.*

Bioassessment. Evaluation of the condition of an ecosystem that uses biological surveys and other direct measurements of the resident biota.

cfu. colony-forming units.

Clean Water Act (CWA). *The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The Clean Water Act (CWA) contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is Section 303(d), which establishes the TMDL program.*

Conventional pollutants. *As specified under the Clean Water Act, conventional contaminants include suspended solids, coliform bacteria, high biochemical oxygen demand, pH, and oil and grease.*

CREP. Conservation Reserve Enhancement Program.

CRP. Conservation Reserve Program.

CWA. Clean Water Act, 1972.

CWSRF. Clean Water State Revolving Fund.

DMME. Virginia Department of Mines, Minerals, and Energy.

E. coli (Escherichia coli). One of the groups of fecal coliform bacteria associated with the digestive tract of warm-blooded animals used as indicator organisms (organisms indicating presence of pathogens) to detect the presence of pathogenic bacteria in the water.

Ecoregion. A region defined in part by its shared characteristics. These include meteorological factors, elevation, plant and animal speciation, landscape position, and soils.

Ecosystem. *An interactive system that includes the organisms of a natural community association together with their abiotic physical, chemical, and geochemical environment.*

Effluent limitation. *Restrictions established by a state or USEPA on quantities, rates, and concentrations in pollutant discharges.*

Endpoint. *An endpoint (or indicator/target) is a characteristic of an ecosystem that may be affected by exposure to a stressor. Assessment endpoints and measurement endpoints are two distinct types of endpoints commonly used by resource managers. An assessment endpoint is the formal expression of a valued environmental characteristic and should have societal relevance (an indicator). A measurement endpoint is the expression of an observed or measured response to a stress or disturbance. It is a measurable environmental characteristic that is related to the valued environmental characteristic chosen as the assessment endpoint. The numeric criteria that are part of traditional water quality standards are good examples of measurement endpoints (targets).*

EQIP. Environmental Quality Incentives Program.

fecal coliform (FC). Indicator organisms (organisms indicating presence of pathogens) associated with the digestive tract.

FSA. Farm Service Agency.

FTE. Full-Time Equivalents.

Geometric mean. A measure of the central tendency of a data set that minimizes the effects of extreme values.

GIS. Geographic Information System. A system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. (Dueker and Kjerne, 1989).

GWLF. *Generalized Watershed Loading Function. A watershed loading model developed to assess non-point source flow and sediment and nutrient loading from urban and rural watersheds.*

HSPF. Hydrological Simulation Program – Fortran. A computer simulation tool used to mathematically model nonpoint source pollution sources and movement of pollutants in a watershed.

Impairment. A detrimental effect on the biological integrity of a water body that prevents attainment of the designated use.

Indicator organism. *An organism used to indicate the potential presence of other (usually pathogenic) organisms. Indicator organisms are usually associated with the other organisms, but are usually more easily sampled and measured.*

LIP. Landowner Incentive program

Margin of safety (MOS). *A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody (CWA Section 303(d)(1)(C)). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by the USEPA either individually or in state/USEPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).*

Memorandum of Understanding (MOU). A memorandum of understanding (MOU) may be used as a confirmation of agreed upon terms when an oral agreement has not been reduced to a formal contract. It may also be a contract used to set forth the basic principles and guidelines under which the parties will work together to accomplish their goals.

MS4. Municipal Separate Stormwater Sewer System.

National Pollutant Discharge Elimination System (NPDES). *The national program for issuing, modifying, revoking and re-issuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Clean Water Act.*

Nonpoint sources (NPS). *Pollution that originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff.*

NPSAC. Nonpoint Source Advisory Committee.

NRCS. Natural Resources Conservation Service.

NTU (Nested TMDL Unit). A watershed area having relatively consistent land cover, soils, and ecology that is expected to have similar TMDL study conclusions. The building blocks for NTUs are USGS 12-digit hydrologic units.

OSTS. Onsite sewage treatment systems (*e.g.,* septic systems and alternative waste treatment systems).

Phased/staged approach. *Under the phased approach to TMDL development, load allocations and waste load allocations are calculated using the best available data and information recognizing the need for additional monitoring data to accurately characterize*

sources and loadings. The phased approach is typically employed when nonpoint sources dominate. It provides for the implementation of load reduction strategies while collecting additional data.

Point source. *Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river.*

Pollutant. *Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. (CWA section 502(6)).*

Pollution. *Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.*

Public comment period*. The time allowed for the public to express its views and concerns regarding action by the USEPA or states (e.g., a* Federal Register *notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).*

Publicly owned treatment works (POTW). *Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.*

Rapid Bioassessment Protocol II (RBP II). A suite of measurements based on a quantitative assessment of benthic macroinvertebrates and a qualitative assessment of their habitat. RBP II scores are compared to a reference condition or conditions to determine to what degree a water body may be biologically impaired.

Riparian areas. *Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones.*

Riparian zone. *The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.*

Runoff. *That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.*

SE/R-CAP. Southeast Rural Community Assistance Project.

Sediment. In the context of water quality, soil particles, sand, and minerals dislodged from the land and deposited into aquate systems as a result of erosion.

***Septic system**. An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.*

***Sewer.** A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.*

Source. An origination point, area, or entity that releases or emits a stressor. A source can alter the normal intensity, frequency, or duration of a natural attribute, whereby the attribute then becomes a stressor.

SPCA. Society for the Prevention of Cruelty to Animals.

Staged Implementation. A process that allows for the evaluation of the adequacy of the TMDL in achieving the water quality standard. As stream monitoring continues to occur, staged or phased implementation allows for water quality improvements to be recorded as they are being achieved. It also provides a measure of quality control, and it helps to ensure that the most cost-effective practices are implemented first.

Stakeholder. Any person with a vested interest in the TMDL development.

TDN. total digestible nutrients.

TMDL Implementation Plan. A document required by Virginia statute detailing the suite of pollution control measures needed to remediate an impaired stream segment. The plans are also required to include a schedule of actions, costs, and monitoring. Once implemented, the plan should result in the previously impaired water meeting water quality standards and achieving a "fully supporting" use support status.

Total Dissolved Solids (TDS). A measure of the concentration of dissolved inorganic chemicals in water.

***Total Maximum Daily Load (TMDL).** The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural background, plus a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.*

Total Suspended Solids (TSS). Usually fine sediments and organic matter. Suspended solids limit sunlight penetration into the water, inhibit oxygen uptake by fish, and alter aquatic habitat.

TRC. Total Residual Chlorine. A measure of the effectiveness of chlorinating treated wastewater effluent.

USDA. United States Department of Agriculture.

USDHHS. .. United States Department of Health and Human Services

USEPA. United States Environmental Protection Agency.

Use Attainability Analysis (UAA). A UAA is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in the Federal Regulations.

VADACS. Virginia Department of Agriculture and Consumer Services.

VADCR. Virginia Department of Conservation and Recreation.

VADEQ. Virginia Department of Environmental Quality.

VASCI. Virginia Stream Condition Index.

VCE. Virginia Cooperative Extension.

VDH. Virginia Department of Health.

VDOF. Virginia Department of Forestry.

Watershed. *A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.*

WHIP. USDA Wildlife Habitat Incentive Program. WHIP is a voluntary program for landowners and land users who want to develop or improve wildlife habitat on private agriculture-related lands.

WQIA. Water Quality Improvement Act.

WQIP. Water Quality Improvement Plan.

WQMIRA. Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or NPS management measures.

WQMP. Water Quality Management Plan.

WRP. Wetland Reserve Program.

APPENDIX A:
WORKING GROUP AND STEERING COMMITTEE MINUTES AND REPORTS

Kickoff Meeting Minutes
Lebanon Town Hall, Lebanon, VA
May 24, 2012

There were 5 people in attendance.

The meeting acquainted attendants with the Implementation Planning process. In addition it was a time to introduce key players from local and state organizations, to recognize potentially critical input from stage and federal government representatives, and to identify concerned citizens in the area that make the difference in implementation.

The IP process was outlined including a proposed schedule of work and the administrative structure.

It was emphasized that in order for the water quality problems to be resolved, local input was critical. This is also necessary for a viable and successful IP.

1st Agricultural/Residential Working Group Meeting Notes
Lebanon Town Hall, Lebanon, VA
May 24, 2012

There were 5 people in attendance.

The members of the committee include citizens from the watershed, along with representatives from the local Soil and Water Conservation District, VADEQ, VDH, and VADCR. Discussion focused on the current status of agriculture in the watershed, stream fencing and riparian buffer practices (e.g. LE-1T and WP-2T) for which financial assistance (cost share) is available through the State Cost Share Program, and the maintenance issues involved with these practices.

Middle Clinch River and Tributaries TMDL Implementation Plan

Government Work Group Meeting Minutes
USDA Service Center, Lebanon, VA
October 17, 2012

Participants

Angela Ball, Clinch Valley SWCD
James Wise, Clinch Valley SWCD
Brian Stanley, VDH
Patrick Lizon, DCR
Martha Chapman, DEQ

Technical Assistance and Timeline

Everyone in the work group agreed technical assistance costs have increased, especially considering training and travel. For the Middle Clinch watershed, everyone agreed that one FTE at a cost of $80K would be adequate.

The group also discussed the timeline and agreed a longer timeline, 6-8 years, for the stage I goals would be necessary. The remainder of the timeline, 2-7 years, should be devoted to stage II goals. Everyone agreed more resources should be focused on stage I.

The group also agreed that citizen monitoring would be effective in this watershed if it could be worked out with the Lonesome Pine SWCD's citizen lab. The focus of citizen monitoring in the Middle Clinch watershed would be to identify places for DEQ to conduct follow-up monitoring.

Agriculture

The Clinch Valley SWCD agreed to provide their average cost list to more accurately reflect the cost of BMPs.

The group agreed that both the SL-6T and WP-4 practice should be included. The number of WP-2s should be reduced and a % of the systems be SL-6s.

Residential

Everyone agreed soils in the Middle Clinch watershed indicate a need for more alternate waste treatment systems.

In 2008, the Clinch Valley SWCD obtained a small grant to do a septic pump-out program. The program was extremely successful and Clinch Valley SWCD is interested in providing another similar program should they find grant funds to support it.

The group agreed there is not much public sewer service available in the watershed and the potential for future sewer connections should be adjusted to less than 10% possibly down to

as little as 5%. If the current public sewer access is expanded there is a county ordinance that requires mandatory connections.

Everyone agreed the best place to focus pet waste education is the Town of Lebanon. It is the main urban area in the watershed and does have parks with pet traffic.

BMP Estimates- Residential

The group agreed that of the failing septic systems 50% could be corrected with repairs and 50% would require replacement. Everyone also agreed of those to be replaces 60% would be a typical system and 30% would require an alternative waste treatment system. The number that could be connected to public sewer should be reduced to around 5%.

The cost per unit for a septic tank pump-out needs to be increased to $300 per 1,000 gallons. The cost for the installation of a conventional septic system needs to be increased to $8,000. The cost for an alternative waste treatment system needs to be approximately $15,000 to $25,000 if an on-site system and approximately $9,000 if a discharging system.

Monitoring

Most of the monitoring stations in the Middle Clinch watershed are ambient stations that will fall into the regular ambient monitoring cycle. The one station on the mainstem of the Clinch River is a trend station and will be visited every other month.

Middle Clinch River and Tributaries TMDL Implementation Plan

2nd Agricultural/Residential Working Group Meeting Notes
USDA Service Center, Lebanon, VA
January 8, 2013

There were 12 people in attendance at the meeting.

The group thought there was probably a half dozen beef operations that could use loafing lot or waste storage bmps.

They agreed that so long as we used the cost list provided by the Clinch Valley SWCD, the costs would be okay.

The other main discussion included putting the WQ11 practice on the potential bmp list. This is an area with a lot of karst and the potential for pollutants to reach a lot of springs and wells.

The group felt it necessary to reduce the fencing estimates by about 15%. The residential costs and numbers are okay.

Middle Clinch River and Tributaries TMDL Implementation Plan

Steering Committee Meeting Minutes
USDA Service Center, Lebanon, VA
November 5, 2013

There were 7 people in attendance at the meeting.

The coordinator reviewed the history of the Middle Clinch TMDL and the IP processes for current and new members of the committee. Nineteen permits were added to the TMDL in order to account for newly issued or overlooked permits. Participants and major agency changes have occurred as well.

The draft presentation for the final meeting was circulated and carefully reviewed. This provided an opportunity to review with, and clarify for, the committee many technical details of the TMDL and of the IP. The background for Nested TMDL Development Units (NTU's) was also reviewed. Changes to the presentation particularly dealt with the tone of the message in the eyes of the public.

Middle Clinch River and Tributaries TMDL Implementation Plan

Final Meeting Minutes
Lebanon Town Hall, Lebanon, VA
November 5, 2013

There were 5 people in attendance.

The purpose of the meeting was to present the final plan for TMDL implementation.