Water Quality Improvement Plan

BUFFALO, COLLIERS and CEDAR CREEKS

A plan to reduce bacteria and sediment in the water

Technical Document

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Prepared by

VA Department of Environmental Quality

In Cooperation with

Local Stakeholders

Virginia Tech Biological Systems Engineering

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Local landowners and stakeholders

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1. INTRODUCTION

1.1 Background

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 streams do not meet state water quality standards for protection of the five beneficial uses: fishing, swimming, shellfish, aquatic life, and 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 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. Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed, measures must be taken to reduce pollution levels in the stream. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". A TMDL Implementation Plan describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in order to meet the water quality goals established by the TMDL.

1.2 Designated Uses and Applicable Water Quality Standards

Water quality standards are designed 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:

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.

1.2.1 Bacteria Water Quality Criterion (9 VAC 25-260-170)

In order to protect human health during primary contact recreation (e.g., swimming), the Commonwealth of Virginia has set limits on the amount of specific fecal bacteria in all state waters. The bacteria criterion for freshwater in place when Cedar Creek, Buffalo Creek and Colliers Creek were initially listed as impaired was based on fecal coliform. Sufficient fecal coliform bacteria standard violations were recorded at the Virginia Department of Environmental Quality (VADEQ) water quality monitoring stations to indicate that the recreational use designations were not being supported in Cedar Creek, Buffalo Creek and Colliers Creek (VADEQ, 2002, 2004, 2006).

Studies have shown that there is a stronger correlation between the concentration of *Escherichia coli (E. coli)* and the incidence of gastrointestinal illness than there is with fecal coliform (USEPA, 1986), so the state transitioned from a fecal coliform standard to an *E. coli* standard in 2008. All freshwaters were subject to the *E. coli* standard, and until June 30, 2008, an interim fecal coliform standard also applied to any sampling stations with fewer than 12 *E. coli* samples.

As a part of VADEQ's triennial review of water quality standards, revisions to the applicable bacteria standard were proposed in March 2008. The proposed revisions removed the interim fecal coliform criterion and revised the *E. coli* criterion to remove the single-sample maximum of 235 cfu/100ml. The revised criterion consists of only the *E. coli* geometric mean criterion of 126 cfu/100ml (State Water Control Board, SWCB, 2011).

Since this revised standard was approved by the State Water Control Board in October 2008, it was considered the applicable water quality standard for the development of the Cedar Creek, Buffalo Creek and Colliers Creek bacteria TMDLs. In 2010 the South Fork Buffalo Creek was initially listed as impaired based on the current *E. coli* criterion (VADEQ, 2010). The North Fork Buffalo Creek was listed as impaired based on the same criterion in 2012 (VADEQ, 2014). Bacteria TMDLs were developed for Buffalo Creek, Colliers Creek, South Fork Buffalo Creek, North Fork Buffalo Creek, and Cedar Creek (herein referred to as the Buffalo and Cedar Creeks bacteria TMDLs) in 2013 using the current water quality standard (VADEQ, 2013). In addition

to meeting the geometric mean criterion, the TMDLs were also developed to meet the *E. coli* instantaneous target concentration of 235 cfu/100ml with a violation rate of less than 10.5%. Meeting this target provided consistency with VADEQ assessment guidance (VADEQ, 2007).

1.2.2 Benthic Water Quality Criterion (9 VAC 25-260-20)

The water quality standard supported through biological monitoring is Virginia's narrative General Standard (9 VAC 25-260-20, also known as the Aquatic Life Use standard) which states in part:

> *A. All state waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are … harmful to human, animal, plant, or aquatic life.*
>
> *Specific substances to be controlled include, but are not limited to: floating debris, oil scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled.* (SWCB, 2011)

The biological monitoring program in Virginia used to evaluate compliance with the above standard is run by VADEQ. Evaluations of monitoring data from this program focus on the benthic (bottom-dwelling) macro (large enough to see) invertebrates (insects, mollusks, crustaceans, and annelid worms) and are used to determine whether or not a stream segment has a benthic impairment. Changes in water quality generally result in alterations to the quantity and diversity of the benthic organisms that live in streams and other water bodies. In addition to being the major intermediate constituent of the aquatic food chain, benthic macro-invertebrates are "living recorders" of past and present water quality conditions. This is due to their relative immobility and their variable resistance to the diverse contaminants that are introduced into streams. The community structure of these organisms provides the basis for the biological evaluation of water quality.

Colliers Creek was initially listed as impaired in 2010 due to water quality violations of the general aquatic life (benthic) standard (VADEQ, 2010). Based on a stressor analysis, the most probable stressor contributing to the impairment of the benthic community in Colliers Creek is sediment. Therefore, a sediment TMDL was developed in 2013 to address the Colliers Creek biological impairment (VADEQ, 2013).

1.3 Attainability of 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 bacteria standard described in Section 1.2.1 of this report 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 swimming use for secondary contact in cases of: 1) natural contamination by wildlife, 2) small stream size, and 3) lack of accessibility to children, as well as due to widespread socio-economic impacts resulting from the cost of improving a stream to a “swimmable” status.

The re-designation of the current swimming use in a stream 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.

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of *E. coli* (other than wildlife), the stream will not attain standards. In such a case, after demonstrating that the source of *E. coli* contamination is natural and uncontrollable by effluent limitations and BMPs, the state may decide to re-designate the stream’s use for secondary contact recreation or to adopt site specific criteria based on natural background levels of *E. coli*. All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process.

2. 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 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 (VADEQ and VADCR, 2003):

- 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 (USEPA, 1999). 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 effort.

3. REVIEW OF TMDL DEVELOPMENT

3.1 Background

Cedar Creek (VAV-I28R_CEC01A00), Buffalo Creek (VAV-I38R_BLD01A00, VAV-I38R_BLD02A04), and Colliers Creek (VAV-I38R_CLL01A00) were listed as impaired on Virginia's 303(d) lists due to water quality violations of the fecal coliform standard between 2002 and 2006. South Fork Buffalo Creek (VAV-I38R_SBF01A00) and North Fork Buffalo Creek (VAV-I38R_NBF01A00) were listed due to water quality violations of the *E. coli* standard on Virginia's 305(b)/303(d) Water Quality Assessment Integrated Report in 2010 and 2012, respectively. Colliers Creek (VAV-I38R_CLL01A00) was also listed as impaired due to water quality violations of the general aquatic life (benthic) standard on Virginia's 2010 305(b)/303(d) Water Quality Assessment Integrated Report. VADEQ has described the impaired segments as presented in Table 3.1 and Figure 3.1.

Table 3.1. Impaired stream segments addressed in the Buffalo Creek, Colliers Creek and Cedar Creek TMDL implementation plan.

Impaired Segment	VAHU6 code	HU12 code	Size	Initial Listing Year	Description
Cedar Creek (VAV-I28R_CEC01A00)	JU59	020802011504	11.49 miles	2002	extending from the headwaters downstream to its confluence with the James River
Buffalo Creek (VAV- I38R_BLD01A00, VAV- I38R_BLD02A04)	JU85	020802020505	15.51 miles	2004	extending from its confluence with North/South Fork Buffalo Creek downstream to its confluence with the Maury River
Colliers Creek (VAV-I38R_CLL01A00)	JU84	020802020504	13.77 miles	2006	extending from the headwaters downstream to its confluence with Buffalo Creek
South Fork Buffalo Creek (VAV-I38R_ SBF01A00)	JU82	020802020502	13.24 miles	2010	extending from the headwaters downstream to its confluence with Buffalo Creek
North Fork Buffalo Creek (VAV-I38R_ NBF01A00)	JU83	020802020503	7.28 miles	2012	extending from the headwaters downstream to its confluence with Buffalo Creek

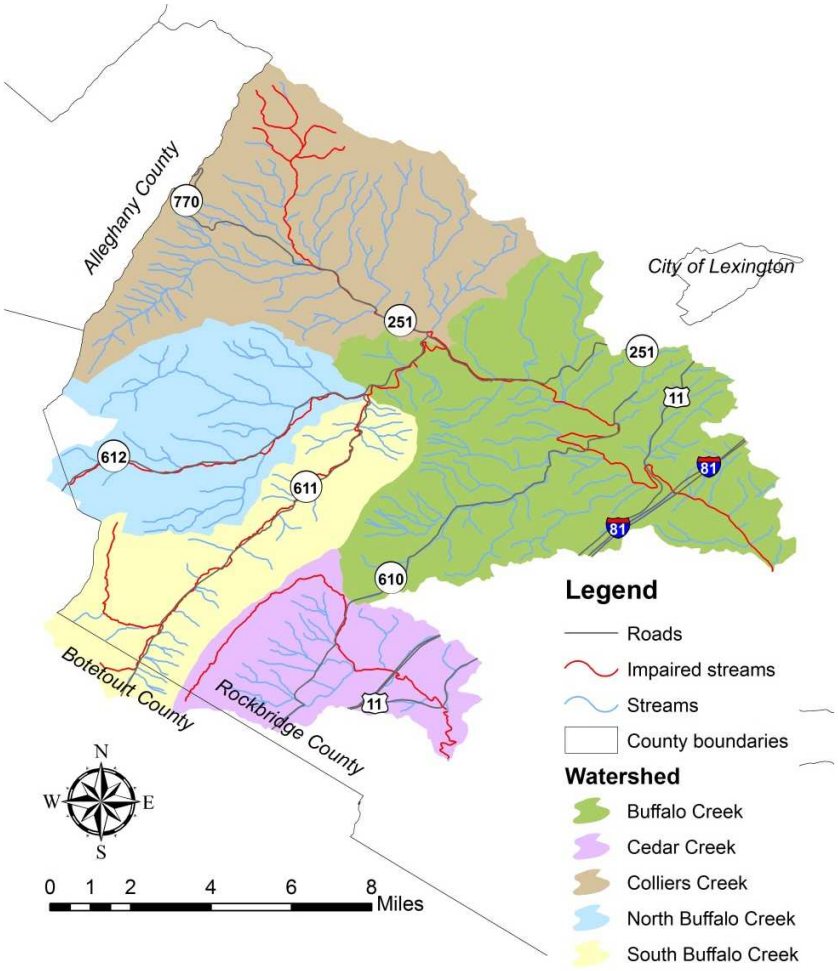

Figure 3.1. Location of the Buffalo Creek and Cedar Creek watersheds and impaired stream segments.

Buffalo Creek and its tributaries (Colliers Creek, South Fork Buffalo Creek, and North Fork Buffalo Creek) and Cedar Creek are located primarily in Rockbridge County, Virginia with a small portion of the South Fork Buffalo Creek, North Fork Buffalo Creek and Cedar Creek watersheds in Botetourt County. All five watersheds are part of the James River Basin. There are 324 miles of streams in the watersheds, which total approximately 89,456 acres (140 miles^2). Forest is the predominant land use in the watersheds (Table 3.2, Figure 3.2). According to the 2012 Census of Agriculture, the average farm in Rockbridge County is 202 acres, with over 50% of primary operators identifying their primary occupation as something other than farming.

While the county ranked 9th in the state for the total sales of milk from cows, the average net cash income for a farm in Rockbridge County was estimated at $2,239 (USDA, 2012).

Table 3.2. Land use area in the Buffalo Creek and Cedar Creek watersheds. Table also shows percent total watershed area for each land use category.

Land use	Watershed: Acres (% total acreage)					TOTAL
	Buffalo Creek	*Colliers Creek*	*North Fork Buffalo Creek*	*South Fork Buffalo Creek*	*Cedar Creek*	
Cropland	81 (0.3%)	58 (0.3%)	50 (0.4%)	12 (0.1%)	99 (1.0%)	300 (0.3%)
Forest	17,886 (61.6%)	17,272 (73.8%)	10,980 (83.3%)	12,135 (89.1%)	7,536 (73.7%)	65,809 (73.6%)
Pasture	8,949 (30.8%)	4,850 (20.7%)	1,720 (13.0%)	1,104 (8.1%)	1,887 (18.4%)	18,510 (20.7%)
Residential	2,106 (7.3%)	1,178 (5.0%)	411 (3.1%)	368 (2.7%)	695 (6.8%)	4,758 (5.3%)
Water	5 (<0.1%)	33 (0.1%)	28 (0.2%)	0 (0.0%)	13 (0.1%)	79 (0.1%)
TOTAL	**29,027**	**23,391**	**13,189**	**13,619**	**10,230**	**89,456**

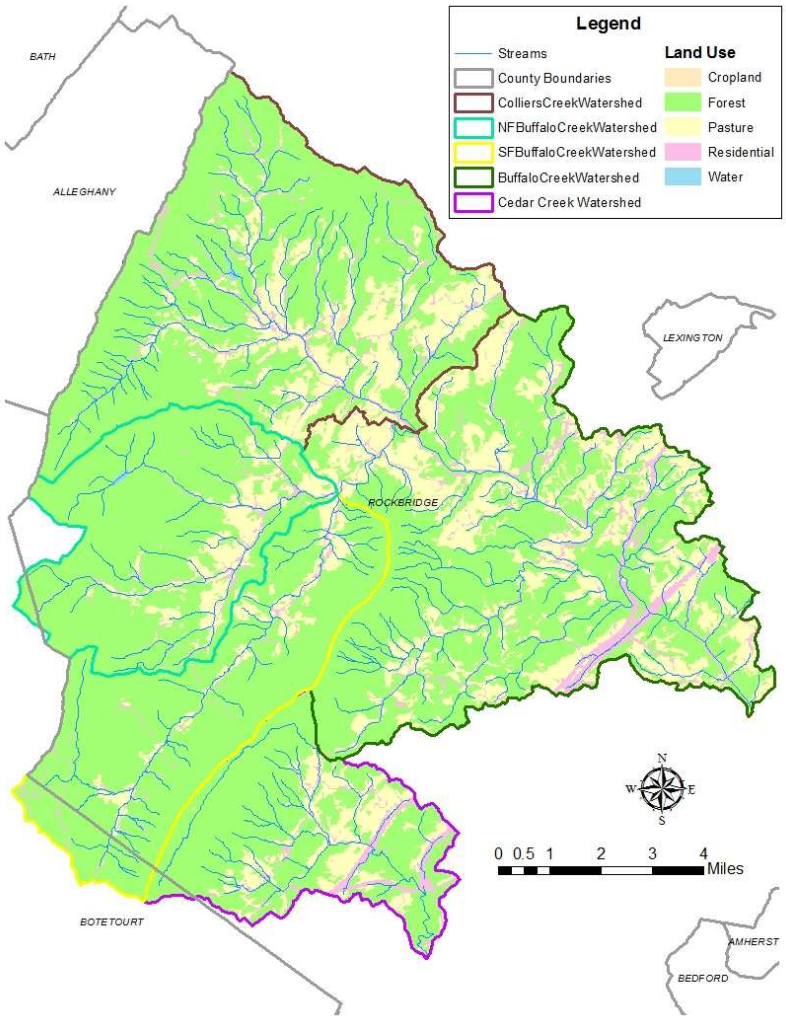

Figure 3.2. Land uses in the Buffalo Creek and Cedar Creek watersheds.

Virginia Tech's Department of Biological Systems Engineering was contracted by the Virginia Department of Environmental Quality (VADEQ) to develop TMDLs for Cedar Creek and the Maury River and select tributaries (Buffalo Creek, Colliers Creek, North Fork Buffalo Creek, South Fork Buffalo Creek) in 2013 and the TMDL study was completed in September 2013 (VADEQ, 2013). Only the Cedar Creek and Buffalo Creek watersheds are included in this TMDL implementation plan in order to keep the implementation plan at a scale that allows for comprehensive implementation and measurable water quality improvements. The TMDL study is posted at http://www.deq.virginia.gov.

3.2 Water Quality Monitoring Data

Data collected from one biological monitoring station in Colliers Creek were used to list Colliers Creek as impaired for aquatic life use and to develop the sediment TMDL for Colliers Creek. Data collected from two ambient water quality monitoring stations in Cedar Creek and four ambient water quality monitoring stations Buffalo Creek and its tributaries were used to list these streams as impaired by fecal bacteria and to develop the bacteria TMDLs for the streams. Table 3.3 provides a summary of the data collected from these stations and Figure 3.3 shows the locations of the stations.

Table 3.3. DEQ biological and water quality monitoring stations in the Buffalo Creek and Cedar Creek watersheds.

Station ID	Stream Name	Monitoring Type	Number of Samples	Violation Rate	Period of Record
2-BFN000.07	North Fork Buffalo Creek	*E. coli*	12	16.7%	2007 - 2008
2-BFS000.15	South Fork Buffalo Creek	*E. coli*	23	47.8%	2007 – 2012
2-BLD000.22	Buffalo Creek	*E. coli*	29	24.1%	2003 - 2012
2-CLL001.99	Colliers Creek	*E. coli*	23	21.7%	2007 - 2012
2-CLL003.21	Colliers Creek	*biological*	4	100%	2007 - 2008
2-CEC000.04	Cedar Creek	*E. coli*	47	14.9%	2008 – 2012
2-CEC003.60	Cedar Creek	*E. coli*	47	48.9%	2008 – 2012

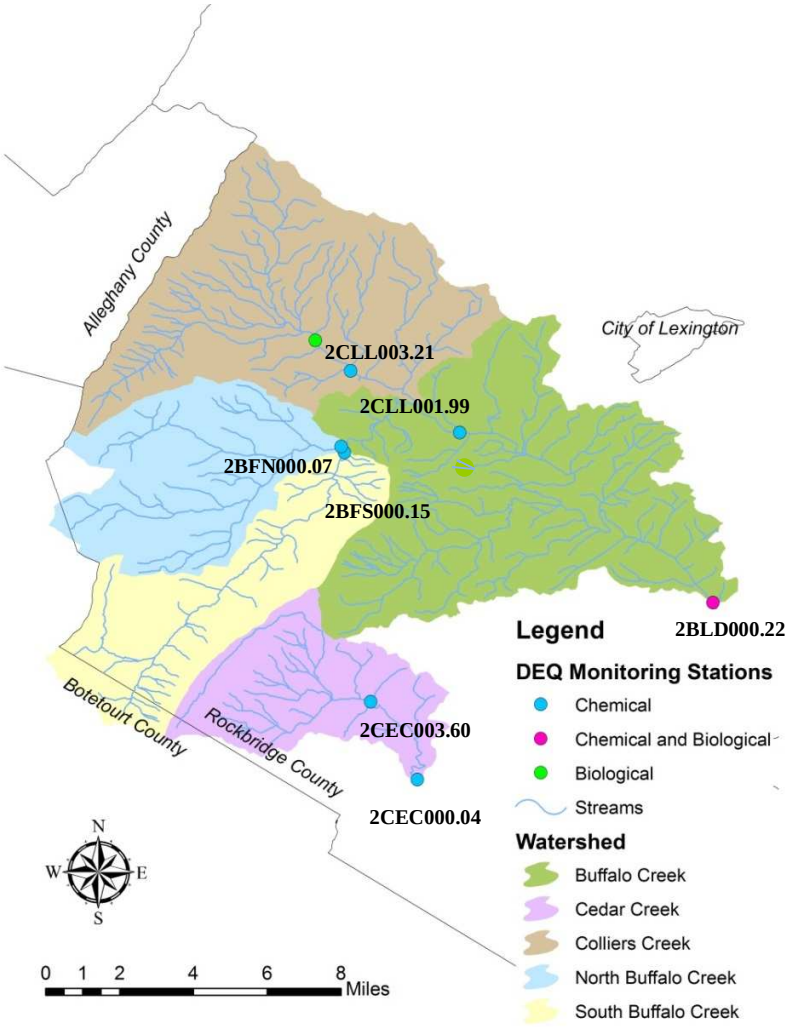

Figure 3.3. VADEQ monitoring stations in used for TMDL development in Buffalo Creek and Cedar Creek watersheds.

3.3 Water Quality Modeling

3.3.1 Bacteria

The Hydrologic Simulation Program – FORTRAN (HSPF) version 12 (Bicknell et al., 2005; Duda et al., 2001) was used to model fecal coliform transport and fate in the Buffalo Creek and Cedar Creek watersheds. ArcGIS 10 GIS software was used to display and analyze landscape information for the development of input for HSPF. The HSPF watershed model simulates pollutant accumulation, die-off, and washoff according to the distribution of land uses, soils, and geographic features in a watershed. HSPF then simulates the routing of water and pollutants

through the stream channel network, considering instream processes such as die-off. In the Buffalo Creek and Cedar Creek bacteria TMDLs, a source assessment of fecal coliform bacteria was performed for the watersheds. Fecal coliform was then simulated as a dissolved pollutant using the HSPF model, and concentrations were translated to *E. coli* concentrations using VADEQ's translator equation (VADEQ, 2003).

To clearly identify sources of fecal coliform, each watershed was divided up into smaller sub-watersheds (Figure 3.4). The sources and their respective fecal coliform contributions were identified for each smaller sub-watershed based on land use and climate data, and human, livestock and wildlife populations. The HSPF model was then used to simulate the transport of these pollutant loads to the Cedar Creek and Buffalo Creek and its tributaries.

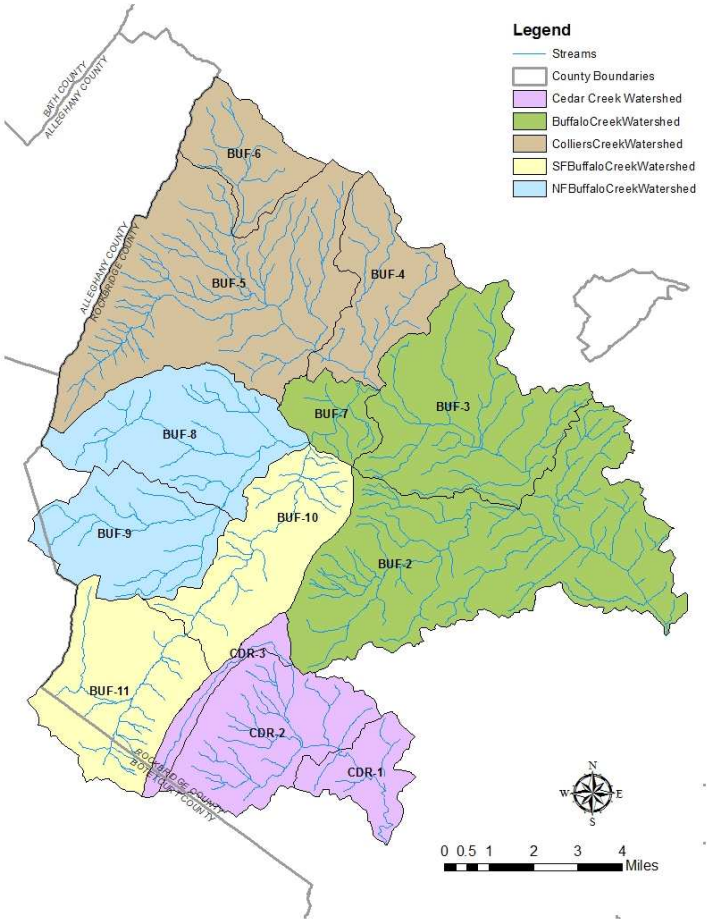

Figure 3.4. Sub-watersheds used for TMDL development.

3.3.2 Sediment

Virginia does not have existing in-stream criteria for sediment; therefore, a reference watershed approach was used to define allowable TMDL loading rates in the Colliers Creek watershed. This approach pairs two watersheds: one that is supportive of their designated use(s) and one whose streams are impaired. The Buffalo Creek watershed was selected as the TMDL reference for Colliers Creek. The TMDL sediment load was defined as the modeled sediment load for existing conditions from the non-impaired Buffalo Creek watershed, area-adjusted to the Colliers Creek watershed. The Generalized Watershed Loading Function (GWLF) model, originally developed by Haith et al. (1992), with modifications by Evans et al. (2001), Yagow et al. (2002), and Yagow and Hession (2007) was used for comparative modeling for both Colliers Creek and Buffalo Creek.

3.4 Source Assessment

Potential sources of bacteria and sediment considered in the development of the TMDLs included both point source and nonpoint source contributions.

3.4.1 Point Sources

A TMDL's waste load allocation accounts for the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Point sources of fecal coliform bacteria include all municipal and industrial plants that treat human waste and are issued individual permits by VADEQ, as well as private residences that fall under Virginia Pollutant Discharge Elimination System (VPDES) general permits. These point sources are required to maintain an *E. coli* discharge concentration no greater than 126 cfu/100mL. The point sources of bacteria in the watersheds are listed in Table 3.4, along with their permitted discharges and load allocations in the TMDLs. The waste load allocation for each point source was set at the permitted load. Point sources of sediment in the Colliers Creek watershed include the four general discharge permits listed in Table 3.4 (sub-watersheds BUF-4, BUF-5, and BUF-6) for single family homes.

Table 3.4. Permitted bacteria and sediment sources in the Buffalo Creek and Cedar Creek watersheds.

Permit Number	Facility Name	Sub-watershed	Design Flow (mgd*)	Permitted *E. coli* Conc. (cfu/100 mL)	*E. coli* Load (cfu/yr)	Permitted Average TSS** Conc. (mg/L)	TSS Load (tons/yr)
VAG408147	SFH†	BUF-6	0.001	126	1.74×10^9	30	0.04
VAG401984	SFH	BUF-6	0.001	126	1.74×10^9	30	0.04
VAG401347	SFH	BUF-5	0.001	126	1.74×10^9	30	0.04
VAG408147	SFH	BUF-4	0.001	126	1.74×10^9	30	0.04
VAG408015	SFH	BUF-3	0.001	126	1.74×10^9	N/A††	N/A
VAG408016	SFH	BUF-3	0.001	126	1.74×10^9	N/A	N/A
VAG408153	SFH	BUF-2	0.001	126	1.74×10^9	N/A	N/A
VAG408220	SFH	BUF-2	0.001	126	1.74×10^9	N/A	N/A
VA0024101	Natural Bridge of Virginia	CDR-3	0.099	126	1.72×10^{11}	N/A	N/A
VAG401974	SFH	CDR-2	0.001	126	1.74×10^9	N/A	N/A

**million gallons per day*
***total suspended solids*
†single family home
††not applicable for this study

3.4.2 Nonpoint Sources - Bacteria

Nonpoint source pollution originates from sources across the landscape (e.g., agriculture and urban land uses) and is delivered to waterbodies by rainfall and snowmelt. In some cases, a precipitation event is not required to deliver nonpoint source pollution to a stream (e.g., pollution from leaking sewer lines or livestock directly defecating in a stream). Nonpoint sources of bacteria in the watersheds included residential sewage treatment systems, land application of waste, livestock, wildlife, and domestic pets. Bacteria 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 into the stream). Land-based nonpoint sources are represented as an accumulation of bacteria on the 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 maximum accumulation was adjusted seasonally to account for changes in die-off rates, which are dependent on temperature and moisture conditions. Direct loads such as straight pipes are modeled similarly to point sources since they do not require a runoff event for delivery to the stream. Both point and nonpoint sources of

bacteria in the Buffalo Creek and Cedar Creek watersheds are summarized in Table 3.5 and Table 3.6, respectively.

Table 3.5. Estimated annual fecal coliform bacteria load in the Buffalo Creek watershed by source.

Source		Annual Fecal Coliform Load ($x10^{11}$cfu/yr)	Percentage of Annual Load (%)
Land based sources	Cropland	507	0.2%
	Pasture	192,110	94.8%
	Residential	3,816	1.9%
	Forest	4,248	2.1%
	Permitted point sources	0.1	<0.1%
Direct sources	Straight pipes	62	<0.1%
	Livestock in stream	1,553	0. 8%
	Wildlife in stream	249	0.1%
TOTALS		**202,545**	**100%**

Table 3.6. Estimated annual fecal coliform bacteria load in the Cedar Creek watershed by source.

Source		Annual Fecal Coliform Load ($x10^{11}$cfu/yr)	Percentage of Annual Load (%)
Land based sources	Cropland	80	0.4%
	Pasture	21,592	94.2%
	Residential	563	2.5%
	Forest	493	2.2%
	Permitted point sources	0.4	<0.1%
Direct sources	Straight pipes	16	0.1%
	Livestock in stream	131	0.6%
	Wildlife in stream	38	0.2%
TOTALS		**22,913**	**100%**

3.4.3 Nonpoint Sources - Sediment

TMDLs must be developed for a specific pollutant(s). Benthic assessments are very good at determining if a particular stream segment is impaired or not but they usually do not provide enough information to determine the cause(s) of the impairment. The process outlined in the Stressor Identification Guidance Document (USEPA, 2000) was used to separately identify the most probable stressor(s) for Colliers Creek. A list of candidate causes was developed from published literature and VADEQ staff input. Chemical and physical monitoring data provided evidence to support or eliminate potential stressors. Individual metrics for the biological and habitat evaluation were used to determine if there were links to a specific stressor(s). Land use

data as well as a visual assessment of conditions along the stream provided additional information to eliminate or support candidate stressors. This stressor analysis identified sediment as the Most Probable Stressor for aquatic life in Colliers Creek.

Sediment is delivered to the Colliers Creek watershed through surface runoff (rural and urban areas), streambank erosion, point sources, and natural erosive processes. The sediment process is a natural and continual process that is often accelerated by human activity. During runoff events (natural rainfall or irrigation), sediment is transported to streams from land areas (e.g., agricultural fields, lawns, forest, etc.). Rainfall energy, soil cover, soil characteristics, topography, and land management affect the magnitude of sediment loading. Agricultural management activities such as overgrazing (particularly on steep slopes), high tillage operations, livestock concentrations (along stream edge and uncontrolled access to streams), forest harvesting, and construction (roads, buildings, etc.) accelerate erosion at varying degrees. During dry periods, sediment from air or traffic builds up on impervious areas and is transported to streams during runoff events.

The 2013 TMDL identified the primary nonpoint sources of sediment in Colliers Creek as runoff from pasture, hay land and forest (Table 3.7).

Table 3.7. Estimated annual sediment load in the Colliers Creek watershed by land use.

Land Use/ Source Group	Existing Sediment Load (tons/year)
Row Crops	78.3
Pasture	8,689.4
Hay	1,355.2
Forest	1,092.8
Harvested Forest	92.3
Developed	755.0
Channel Erosion	103.7
Permitted WLA	103.4
Total Load	**12,270.1**

3.5 TMDL Allocation Scenarios

3.5.1 Bacteria Allocation Scenario

The TMDL includes reduction scenarios needed to meet the *E. coli* water quality standard. Different scenarios were evaluated to identify scenarios for implementation that meet the

calendar-month geometric mean bacteria standard (126 cfu/100 mL for *E. coli*) with zero violations. The MOS (margin of safety) was implicitly incorporated into each TMDL by conservatively estimating several factors affecting bacteria loadings, such as animal numbers, production rates, and contributions to streams. A preferred scenario was selected by a technical advisory committee for each watershed during the TMDL development process (Table 3.8). The TMDLs for Buffalo Creek, Colliers Creek, North Fork Buffalo Creek, South Fork Buffalo Creek, and Cedar Creek were derived from the preferred reduction scenarios identified in the TMDL (Table 3.9). An implicit margin of safety is included in the TMDL equations.

Table 3.8. Fecal coliform reduction scenarios needed to meet the *E. coli* geometric mean standard.

Watershed	Fecal Coliform Loading Reductions (%)						% Violation of *E. coli* standard (Geometric Mean)
	Livestock direct deposit	Pasture	Cropland	Straight pipes & failing septic	Residential	Wildlife direct deposit	
Buffalo Creek	95%	65%	30%	100%	10%	75%	0.00%
Colliers Creek	99%	75%	30%	100%	10%	40%	0.00%
NF Buffalo Creek	75%	50%	30%	100%	10%	0%	0.00%
SF Buffalo creek	99%	75%	30%	100%	10%	60%	0.00%
Cedar Creek	99%	50%	10%	100%	0%	55%	0.00%

Table 3.9. TMDL equations for Buffalo Creek, Colliers Creek, North Fork Buffalo Creek, South Fork Buffalo Creek, and Cedar Creek expressed as average annual and daily *E. coli* loads.

Watershed	Wasteload Allocation (WLA)		Load Allocation (LA)		Margin of Safety (MOS)	TMDL	
	Annual (cfu/yr)	Daily (cfu/day)	Annual (cfu/yr)	Daily (cfu/day)		Annual (cfu/yr)	Daily (cfu/day)
Buffalo Creek	1.91×10^{12}	5.23×10^{9}	9.33×10^{13}	6.07×10^{12}	Implicit	9.53×10^{13}	6.07×10^{12}
Colliers Creek	4.75×10^{11}	1.30×10^{9}	2.29×10^{13}	1.79×10^{12}	Implicit	2.34×10^{13}	1.79×10^{12}
NF Buffalo Crk	6.52×10^{11}	1.79×10^{9}	3.19×10^{13}	1.01×10^{12}	Implicit	3.25×10^{13}	1.01×10^{12}
SF Buffalo Crk	2.01×10^{11}	5.51×10^{8}	9.87×10^{12}	1.04×10^{12}	Implicit	1.01×10^{13}	1.04×10^{12}
Cedar Creek	5.01×10^{11}	1.37×10^{9}	1.58×10^{13}	7.83×10^{11}	Implicit	1.63×10^{13}	7.84×10^{11}

3.5.2 Sediment Allocation Scenario

The Colliers Creek sediment TMDL was developed using Buffalo Creek as the reference watershed. The target TMDL load for Colliers Creek is the average annual load from the area-adjusted Buffalo Creek watershed under existing conditions. The sediment TMDL for Colliers Creek includes three components – WLA, LA, and MOS. The margin of safety was explicitly set

to 10% to account for uncertainty in developing sediment TMDLs. The WLA was calculated as the sum of the four permitted point source loads and future growth. The future growth WLA was estimated as 1% of the TMDL. The reductions required to meet the TMDL considering future growth are shown in Table 3.10. Two sediment reduction alternatives were presented in the TMDL report and are listed in Table 3.11

Table 3.10. Sediment TMDL equations for Colliers Creek expressed as average annual and daily sediment loads.

TMDL	WLA		LA	MOS
(tons/yr)				
10,321.4	103.4		9,185.9	1,032.1
	general permits aggregate WLA	0.17 tons/yr		
	Future Growth	103.21 tons/yr		
(tons/day)				
86.54	0.28		77.60	8.65

Table 3.11. Source reductions needed to meet the sediment TMDL for Colliers Creek.

Land Use/ Source Group	Existing Sediment Load (tons/yr)	Scenario 1		Scenario 2	
		Reduction	Load	Reduction	Load
Row Crops	78.3		78.3		78.3
Pasture	8,689.4	27.3%	6,313.8	33.0%	5,818.3
Hay	1,355.2	27.3%	984.7		1,355.2
Forest	1,092.8		1,092.8		1,092.8
Harvested Forest	92.3		92.3		92.3
Developed	755.0	27.3%	548.6	10.0%	679.5
Channel Erosion	103.7	27.3%	75.3	33.0%	69.4
Permitted WLA	103.4		103.4		103.4
Total Load	12,270.1		**9,289.3**		**9,289.3**
Target Allocation Load =	**9,289.3**				
% Reduction Needed =	24.3%				

3.6 Implications of the TMDLs on the Implementation Plan

Based on the bacteria reductions developed for the TMDL, it is clear that significant reductions will be needed to meet the water quality standard for bacteria, particularly with respect to direct deposition from livestock. In addition, all uncontrolled discharges and failing septic systems must be identified and corrected. Additionally, substantial reductions in bacteria from wildlife in all watersheds except North Fork Buffalo Creek would be necessary in order to meet the TMDL for *E. coli*.

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. Wildlife direct deposition will not be explicitly addressed by this implementation plan. All efforts will be directed at controlling anthropogenic sources.

4. PUBLIC PARTICIPATION

Collecting input from the public on conservation and outreach strategies to include in the TMDL Implementation Plan was a critical step in this planning process. Since the plan will be implemented by watershed stakeholders on a voluntary basis, local input and support are the primary factors that will determine the success of this plan.

4.1 Public Meetings

A public meeting was held on the evening of May 8, 2014 at the Effinger Fire Hall to kick off the development of the implementation plan. This meeting served as an opportunity for local residents to learn more about the problems facing the creeks and work together to come up with new ideas to protect and restore water quality in their community. This meeting was publicized through notices to local media outlets, email announcements, invitations mailed to riparian landowners, and fliers posted throughout the watersheds. Approximately 40 people attended the meeting.

The meeting began with a brief presentation on existing water quality conditions in the streams and what types of actions and information could be included in the implementation plan to improve water quality. Following the presentation, attendees split up into two working groups: a residential group and an agricultural group. The working groups discussed how residential and agricultural land use practices are affecting the quality of these streams and then reviewed different land use management practices that could be included in the cleanup plan. TMDL staff from Virginia's Department of Environmental Quality facilitated these discussions.

The final public meeting was held on October 28, 2014 at the Natural Bridge Park and Historic Hotel with 83 people attending.

4.2 Agricultural Working Group

The role of the Agricultural Working Group was to review conservation practices and outreach strategies from an agricultural perspective, identify any obstacles (and solutions) related to BMP implementation, and to provide estimates on the type, number, and costs of BMPs.

During their first meeting on May 8, 2014, the agricultural working group discussed the general state of agriculture in the region and characteristics of typical farms in the watersheds.

Participants agreed that there has not been much change in farming and land use in Rockbridge County recently. Some farmland is leased through long term leases. Most of the farmers who are leasing land also own land nearby. There is a very high rate of land conservation (easements) in Rockbridge County and even new land owners who are not actively farming are largely committed to keeping their land in agriculture.

The group discussed strategies to get the word out to the agricultural community regarding financial assistance for BMPs and the existence of conservation programs. Confidence and trust were noted as key components to working with the agricultural community. The group also discussed different fencing programs, maintenance needs, and fencing setback requirements. Thirty-five foot buffers and 10 foot setback fencing were two options the group felt would be appropriate for these streams.

A second agricultural working group meeting was held at the Palmer Community Center on June 25, 2014. The group reviewed summaries of the extent of BMP implementation that would be needed to remove the creeks from the impaired waters list. The group discussed pasture BMP scenarios to address bacteria coming from pasture land. Rotational grazing and improved pasture management systems were determined to be key components in the plan. The group discussed waste storage facilities and whether there remains an unmet need for storage in the watersheds. Most of the farmers that need storage already have it; however, the group thought that there was probably still a need for one or two facilities. It was noted that most of the farms in the watershed have pretty small herds, and that there are only a handful of larger farms. As a follow-up to the meeting, Nesha McRae provided a page from the 2012 Ag Census showing cattle inventories for farms in Rockbridge County.

The group discussed characteristics of some of the different options for livestock exclusion from streams that are available through state and federal cost share programs. The group felt that total exclusion with off stream watering was going to be a hard sell, but that some farmers might be interested in installing exclusion systems if limited access points to the stream could be provided for watering. Due to the cost of exclusion systems and the extent of work associated with installation, it was suggested that some farmers may want to install fencing in phases, starting out with just a couple of fields and a limited access point. Once farmers are able to see how the new set up works for them, they may be willing to do more at a later date.

A third agricultural working group meeting was held at the Palmer Community Center on August 7, 2014. The group reviewed a final agricultural BMP implementation scenario for the watersheds. It was explained that the reductions needed in the South Fork Buffalo and Cedar Creek are greater than those of the other streams. As a result, more extensive BMP implementation will be needed in these watersheds.

The group reviewed a cost list for BMPs. Considering existing funding levels for BMP cost share programs at the state and federal level, it is expected that financial assistance should be available at a level sufficient to help landowners achieve implementation goals over several years. The group discussed the importance of emphasizing the benefits of agricultural BMPs in order to encourage widespread adoption by landowners. It was suggested that the water quality improvement plan include benefits for landowners whose primary occupation is farming, as well as benefits for the landowners with smaller, hobby farms. The group discussed several different time frames for implementation along with what has been adopted in other watersheds like Hays Creek (also in Rockbridge County). The group agreed that 10 years would be a good goal for accomplishment of BMPs needed to remove the streams from the impaired waters list. An interest was expressed in initiating a citizen monitoring network. In addition, concerns were expressed about the future of regulation of the agricultural community in an effort to protect water quality.

Minutes from the agricultural working group meetings as well as some follow-up information provided after the second agricultural working group meeting are provided in Appendix A.

4.3 Residential Working Group

The primary role of the Residential Working Group was to discuss methods needed to reduce human and pet sources of bacteria entering the creeks, 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.

At their first meeting on May8th, the residential working group discussed septic system maintenance needs in the community. Participants felt that more education and outreach efforts are necessary to address septic system maintenance needs, and that funding will be critical since most homeowners with failing septic systems or straight pipes will not be able to fix their systems without financial assistance. Grant funds should be targeted at homes in the floodplain,

and to those without treatment systems that are having the greatest impact on water quality. The group felt that free or discounted septic pump-outs and inspections would also be a good way to encourage homeowners to maintain their systems. The group recommended that a volunteer labor force be formed to assist with outreach and implementation efforts. Local organizations that could provide some assistance were identified including universities, churches, Habitat for Humanity, Rockbridge Area Conservation Council, Ruritan Clubs, and Community Foundation.

The group discussed the cost of a typical repair of a malfunctioning septic system. It was estimated that these can cost anywhere from $1,800-$5,000. It was noted that the highly engineered alternative waste treatment systems can cost as much as $30,000. Several participants expressed an interest in volunteer water quality monitoring and suggested several groups that could assist with that effort including VA Master Naturalists, Master Gardeners, VA Military Institute and Washington and Lee University.

A second residential working group meeting was held on July 10, 2014 at the Natural Bridge Hotel. During this meeting, the group agreed that a septic tank pumpout assistance program could serve as a valuable outreach tool. The group reviewed the costs of septic system practices and discussed options for targeting of outreach for septic BMPs. Areas with a high potential for failing septic systems and straight pipes include Possum Hollow Road, Colliers Creek as it comes out of the national forest, and Rapps Mill in the South Fork Buffalo watershed. Potential partner organizations for a citizen monitoring program were identified including the Effinger Ruritan Club and several local churches (Rapps Mill Church and Collierstown Presbyterian Church).

The group discussed the potential for a pet waste education program in the watersheds. Participants agreed that this would not be very successful considering the rural nature of the area. However, representatives from Natural Bridge Hotel noted that a pet waste station would be beneficial since guests with pets do come through occasionally. The group discussed sources of sediment in the Colliers Creek watershed and potential BMPs for residential areas. Overall the group felt that the contribution of sediment from residential areas is pretty minimal. The group agreed that a seven year timeline would be appropriate for meeting implementation goals.

Minutes from the residential working group meetings are provided in Appendix A.

4.4 Steering Committee

The Steering Committee met on September 11, 2014 at the Palmer Community Center to discuss plans for the final public meeting and to review the draft implementation plan prior to the final public meeting on October 28, 2014. The group provided comments on the draft plan and helped to develop a final agenda for the meeting.

5. IMPLEMENTATION ACTIONS

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, we must also develop an estimate of the number of each practice that would be needed in order to meet the water quality goals established during the TMDL study.

5.1 Identification of Best Management Practices

Potential best management practices, their associated costs and pollutant reduction efficiencies, and potential funding sources were identified through review of the TMDL, input from the working groups, and literature reviews. Measures that can be promoted through existing programs were identified, as well as those that are not currently supported by existing programs and their potential funding sources. Some best management practices had to be included in order to meet the water quality goals established in the TMDL, while others were selected through a process of stakeholder review and analysis of their 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 bacteria identified by the TMDL study dictated some of the control measures that must be employed during implementation in order to meet the pollutant reductions specified in the TMDL.

Livestock Exclusion

In order to meet the bacteria reductions in direct 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. While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, the inclusion of a streamside buffer strip helps to reduce bacteria, sediment and nutrient loads in runoff. The incorporation of effective buffers (35 foot minimum

width) 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. State and federal conservation agencies including the Virginia Department of Conservation and Recreation (DCR) and the Natural Resources Conservation Service (NRCS) have incorporated livestock exclusion practices into their agricultural cost share programs that offer farmers greater flexibility in fencing options. This flexibility allows farmers with limited pasture acreage to exclude livestock from the stream while not sacrificing a significant amount of land for grazing.

Septic Systems and Straight Pipes

The 100% reduction in loads from straight pipes and failing septic systems is a pre-existing legal requirement. The options identified for correcting straight pipes and failing septic systems include: repair of an existing septic system, installation of a septic system, and installation of an alternative waste treatment system. It is anticipated that a significant portion of straight pipes will be located in areas where an adequate site for a septic drain field is not available. In these cases, the landowner will have to consider an alternative waste treatment system.

5.1.2 Control Measures Selected through Stakeholder Review

In addition to the control measures that were directly prescribed by the TMDLs, a number of measures were needed to control fecal bacteria and sediment from land-based sources. Various scenarios were developed and presented to working groups. All scenarios began with the best management practices that were prescribed by the TMDL such as livestock exclusion and eliminating straight pipes. Next, series of established best management practices were examined by the working groups, who considered both their economic costs and the water quality benefits

that they produced. The majority of these practices are included in state and federal agricultural cost share programs that promote conservation. In addition, innovative and site specific practices suggested by local producers and technical conservation staff were considered

The final set of BMPs identified and the efficiencies used in this study to estimate needs are listed in Table 5.1.

Table 5.1. Best management practices and associated pollutant reductions

BMP Type	Description	Bacteria Reduction	Sediment Reduction	Reference
Livestock stream exclusion	Livestock exclusion from waterway	100%	LU Change	1, 4
Streambank stabilization	Streambank stabilization	N/A	54.25 lbs/ft/yr	5
Pasture	Streamside buffer (35-100 feet)	40%	40%	2, 5
	Improved pasture management	50%	30%	3, 5
	Permanent vegetative cover on critical areas	LU Change	LU Change	4
	Reforestation of highly erodible pasture/cropland	LU Change	LU Change	4
	Small acreage grazing system (equine)*	40%	40%	2, 5
	Manure storage facility	80%	N/A	3
	Stormwater control structure	88%	49%	7
Cropland	Stripcropping	25%	25%	2, 5
	Continuous no-till	70%	70%	2, 5
	Riparian buffers	40%	40%	2, 5
Straight pipes and septic systems	Septic tank pumpout	5%	N/A	6
	Septic system repair	100%	N/A	1
	Septic system replacement	100%	N/A	1
	Alternative waste treatment system	100%	N/A	1
Pet waste	Pet waste disposal station	100%	N/A	1
Developed	Bioretention filters	80%	80%	8
	Stormwater clarifier	97%	99%	9

*Practice includes a stream exclusion fencing requirement, but is shown under pasture BMPs to demonstrate land based component and associated pollution reduction benefit

References
1. Removal efficiency is defined by the practice
2. Bacteria efficiency assumed to be equal to sediment efficiency.
3. VADCR and VADEQ. 2003. Guidance manual for Total Maximum Daily Load Implementation Plans. Available at: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLImplementation/TMDLImplementationPlanGuidanceManual.aspx
4. Based on differential loading rates to different land uses.
5. Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use and HGMR and pollutant
6. Bacteria efficiency assumed equal to nitrogen removal efficiency - Chesapeake Assessment Scenario Tool - BMP effectiveness values by land use and HGMR and pollutant
7. Center for Watershed Protection. 2007. National Pollutant Removal Performance Database, Version 3.
8. USEPA-CBP. 2006. Nonpoint source best management practices currently used in Scenario Builder for Phase 5.0 of the Chesapeake Bay Program Watershed Model. Revised 02/09/2011
9. Horsley (1995) in: Design of Filtering Systems, Richard A. Claytor, Chapter 4, pg. 27

5.2 Quantification of Control Measures

The quantity of control measures recommended during implementation was determined through spatial analyses, modeling alternative implementation scenarios, and using input from the working groups. Data on land use, stream networks, and elevation were used in spatial analyses to develop estimates of the number of control measures recommended overall, in each watershed, and within smaller sub-watersheds. Data from the VADCR Agricultural BMP Database and the Natural Bridge Soil and Water Conservation District (SWCD) showing where best management practices are already in place in the watersheds were considered when developing these estimates. In addition, census data were used in order to quantify septic system repairs and replacements needed in order to meet the reductions specified in the TMDL. Estimates of the amount of residential on-site waste treatment systems, 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 pollutant reduction efficiencies to their associated bacteria and sediment 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. 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 failing septic systems, sewer line overflows and leaks.

5.2.1 Agricultural Control Measures

Livestock Exclusion BMPs

The TMDL reduction scenario shown in Table 3.8 includes recommendations of a 99% reduction in direct deposition of livestock manure in Buffalo Creek, Colliers Creek, South Fork Buffalo Creek and Cedar Creek, and a 75% reduction in North Fork Buffalo Creek. In addition, a 65% reduction in bacteria from pasture is needed in Buffalo Creek, a 75% reduction in Colliers Creek and South Fork Buffalo Creek, and a 50% reduction in North Fork Buffalo Creek and Cedar Creek in order to meet the bacteria TMDL. A 30% reduction in bacteria from cropland is needed in all of the Buffalo Creek watersheds and a 10% reduction in Cedar Creek. In addition, 3,000 feet of streambank stabilization will be needed to achieve sediment reduction goals for Colliers Creek. Consequently, this plan includes recommendations for livestock exclusion practices implemented in conjunction with streambank stabilization. To estimate fencing needs, the perennial stream network was overlaid with land use using GIS mapping software (ArcView v.10.1). Stream segments that flowed through or were adjacent to land use areas that had a potential for supporting cattle (*e.g.,* pasture) were identified using 2011 VBMP Orthophotography and the 2011 National Hydrography Dataset (NHD) streams layer. If the stream segment flowed through the land-use area, it was assumed that fencing was needed on both sides of the stream. 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. 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. Following GIS analyses of fencing needs, the VADCR Agricultural BMP Database was queried to identify the amount of livestock exclusion systems already in place in the watersheds. Any fencing installed was subtracted from the length of potential fencing in the watershed (Table 5.2). Table 5.3 shows the amount of livestock exclusion stream fencing and systems installed to date in the watersheds.

Table 5.2. Stream fencing needs summary.

Sub-watershed	Total potential fencing (ft)	Fencing inst. to date (ft)	Fencing still needed (ft)	Fencing still needed (miles)
Buffalo Creek: 95% Exclusion Goal				
BUF-2	56,108	29,831	24,864	4.7
BUF-3	58,602	8,092	47,985	9.1
BUF-7	19,122	222	17,955	3.4
Subtotals	***133,832***	***38,145***	***90,804***	***17***
Colliers Creek: 99% Exclusion Goal				
BUF-4	33,166	8,655	24,266	4.6
BUF-5	71,274	5,050	65,555	12.4
BUF-6	3,699	0	3,662	0.7
Subtotals	***108,139***	***13,705***	***93,483***	***18***
North Fork Buffalo Creek: 75% Exclusion Goal				
BUF-8	11,187	3,392	5,846	1.1
BUF-9	13,956	0	10,467	2.0
Subtotals	***25,143***	***3,392***	***16,313***	***3***
South Fork Buffalo Creek: 99% Exclusion Goal				
BUF-10	35,172	20,000	15,020	2.8
BUF-11	10,096	0	9,995	1.9
Subtotals	***45,268***	***20,000***	***25,015***	***5***
Cedar Creek: 99% Exclusion Goal				
CDR-1	0	0	0	0
CDR-2	37,288	18,385	18,714	3.6
CDR-3	5,136	0	5,085	1.0
Subtotals	***42,424***	***18,385***	***23,799***	***5***
TOTALS	***354,806***	***93,627***	***261,179***	***50***

Table 5.3. Livestock exclusion systems in the watershed tracked through the VADCR Agricultural BMP database: *August 1998 – June 2014*.

Sub-watershed	Practice	Extent installed (linear ft)	Total # of practices
Buffalo Creek	CREP grazing land protection (CRSL-6)	3,392	1
	CREP streambank protection (CRWP-2)	5,257	2
	Stream exclusion with grazing land management (SL-6)	29,496	25
Colliers Creek	Stream exclusion with grazing land management (SL-6)	13,705	8
NF Buffalo Creek	Stream exclusion with grazing land management (SL-6)	3,392	4
SF Buffalo Creek	Stream exclusion with grazing land management (SL-6)	20,000	1
Cedar Creek	CREP grazing land protection (CRSL-6)	3,850	1
	CREP streambank protection (CRWP-2)	3,850	1
	Stream exclusion with grazing land management (SL-6)	9,785	3
	Streambank protection (WP-2)	900	1
TOTALS		**93,627**	**47**

NOTE: Table does not include data from systems that were not installed through government cost share programs. CRP and EQIP data were not available.

It is expected that the majority of livestock exclusion fencing will be accomplished through the VA Agricultural BMP Cost Share Program and federal NRCS cost-share programs. Some applicable cost-shared BMPs for livestock exclusion in the programs are the SL-6 (Stream Exclusion with Grazing Land Management), the SL-6T (Stream Exclusion with Grazing Land Management for TMDL Implementation Practice), the LE-1T (Livestock Exclusion with Riparian Buffers for TMDL Implementation), the LE-2T (Livestock Exclusion with Reduced Setback for TMDL Implementation), and CREP (the Conservation Reserve Enhancement Program). In order to determine the appropriate mix of these practices to include in the implementation plan, tax parcel data was utilized in conjunction with local data from the VADCR Agricultural BMP Database to determine typical characteristics (e.g., streamside fencing length per practice) of livestock exclusion systems in the region. In addition, input was collected from the Agricultural Working Group, NRCS and the Natural Bridge SWCD regarding typical components of each system, associated costs, and preferred fencing setbacks. These characteristics were then utilized to identify the mix of fencing practices available through state and federal cost share programs to include in the implementation plan (Table 5.4).

Table 5.4. Estimate of full streamside exclusion fencing systems needed by sub-watershed.

Sub-watershed	SL-6/LE-1T/SL-6T fencing		LE-2T fencing		WP-2T fencing		CREP fencing	
	Linear feet	Systems	Linear feet	Systems	Linear feet	Systems	Linear feet	Systems
Buffalo Creek								
BUF-2	7,459	3.73	14,918	8.29	1,243	1.04	1,243	0.50
BUF-3	14,395	7.20	28,791	15.99	2,399	2.00	2,399	0.96
BUF-7	5,387	2.69	10,773	5.99	898	0.75	898	0.36
Subtotals	***27,241***	***14***	***54,482***	***30***	***4,540***	***4***	***4,540***	***2***
Colliers Creek								
BUF-4	7,280	3.64	14,560	8.09	1,213	1.01	1,213	0.49
BUF-5	19,666	9.83	39,333	21.85	3,278	2.73	3,278	1.31
BUF-6	1,099	0.55	2,197	1.22	183	0.15	183	0.07
Subtotals	***28,045***	***14***	***56,090***	***31***	***4,674***	***4***	***4,674***	***2***
North Fork Buffalo Creek								
BUF-8	1,754	0.88	3,508	1.95	292	0.24	292	0.12
BUF-9	3,140	1.57	6,280	3.49	523	0.44	523	0.21
Subtotals	***4,894***	***2***	***9,788***	***6***	***815***	***1***	***815***	***0***
South Fork Buffalo Creek								
BUF-10	4,506	2.25	9,012	5.01	751	0.63	751	0.30
BUF-11	2,999	1.50	5,997	3.33	500	0.42	500	0.20
Subtotals	***7,505***	***4***	***15,009***	***8***	***1,251***	***1***	***1,251***	***1***
Cedar Creek								
CDR-1	0	0	0	0	0	0	0	0
CDR-2	5,614	2.81	11,228	6.24	936	0.78	936	0.37
CDR-3	1,525	0.76	3,051	1.69	254	0.21	254	0.10
Subtotals	***7,139***	***3***	***14,279***	***8***	***1,190***	***1***	***1,190***	***0***
TOTALS	***74,824***	***37***	***149,648***	***83***	***12,470***	***11***	***12,470***	***5***

The Stream Exclusion with Grazing Land Management (SL-6) offers 75%-100% cost share for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a 35 foot setback (required). The Stream Exclusion with Grazing Land Management for TMDL Implementation Practice (SL-6T) offers 75% cost share for off stream watering, establishment of a rotational grazing system, stream crossings, and stream exclusion fencing with a 35 foot setback (required). The LE-1T (Livestock Exclusion with Riparian Buffers for TMDL Implementation) is very similar to the SL-6T except that 85% cost share is provided and applicants may not receive funding to install hardened winter feeding pads. It was

estimated that approximately 30% of fencing in the watershed would be installed using these practices.

The Livestock Exclusion with Reduced Setback Practice (LE-2T) only requires a 10 foot setback for stream fencing. Cost share is provided for stream fencing and cross fencing, stream crossings, and off stream waterers at a rate of 50%. It was estimated the 60% of livestock exclusion would be accomplished through the LE-2T practice.

The WP-2T system includes streamside fencing, hardened crossings, and a 35-ft buffer from the stream. 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, this practice is seldom used because it does not provide cost share for the development of a water supply, this was reflected in the number of systems noted in the Ag BMP Database in Rockbridge County. Consequently, it was estimated that only 5% of fencing in the watersheds would be accomplished using the WP-2T practice.

Fencing through the Conservation Reserve Enhancement Program (CREP) was also included in implementation scenarios. This program has not been very popular in the watersheds to date; consequently, it was estimated that 5% of fencing would be installed through this federal program.

Land Based Agricultural BMPs

In order to meet the bacteria and sediment reductions outlined in the TMDLs, best management practices to treat land-based sources of the pollutants must also be included in implementation efforts. Table 5.5 provides a summary of land based agricultural BMPs by watershed needed to achieve water quality goals.

Table 5.5. Land based agricultural BMPs needed to reach the TMDL.

Land use	BMP	Extent (acres, unless noted otherwise)					
		Buffalo Creek	Colliers Creek	NF Buffalo Creek	SF Buffalo Creek	Cedar Creek	TOTAL
Streambank	Streambank stabilization (*linear feet*)	0	3,000	0	0	0	3,000
Pasture	Improved pasture management	7,588	4,689	1,307	1,062	1,819	16,465
	Reforestation of highly erodible pasture	89	97	17	22	19	244
	Permanent vegetation on critical areas	9	5	3	1	0	18
	Small acreage grazing system (equine, system/acres)*	2/8	2/10	0	1/6	0	5/24
	Waste storage facility (beef cattle, *system*)	1	1	0	0	0	2
	Water retention structures (*acres treated*)	0	2,114	0	769	0	2,883
Cropland	Continuous no-till	4	3	2	1	10	20
	Contour strip-cropping	0	0	0	0	3	3
	Riparian buffers	2	1	1	1	1	6

*Practice includes a stream exclusion fencing requirement, but is shown under pasture BMPs to demonstrate land based component and associated pollution reduction benefit

Grazing Systems and Improved Pasture Management

Establishment of rotational grazing systems for cattle was recommended in conjunction with livestock exclusion projects. The majority of fencing programs will provide cost share for the establishment of cross fencing and alternative watering sources in order to establish these systems. In cases where livestock exclusion is not necessary, improved pasture management was prescribed. Like a grazing system, improved pasture management allows a farmer to better utilize grazing land and associated forage production. Improved pasture management includes:

- Implement a current nutrient management plan
- Maintain adequate soil nutrient and pH levels
- Manage livestock rotation to paddock subdivisions to maintain minimum grazing height recommendations and sufficient rest periods for plant recovery

- Maintain adequate and uniform plant cover (≥ 60%) and pasture stand density
- Locate feeding and watering facilities away from sensitive areas
- Manage distribution of nutrients and minimize soil disturbance at hay feeding sites by unrolling hay across the upland landscape in varied locations
- Designate a sacrifice lot/paddock to locate cattle for feeding when adequate forage is not available in the pasture system. Sacrifice lot/paddock should not drain directly into ponds, creeks or other sensitive areas and should not be more than 10% of the total pasture acreage.
- Chain harrow pastures to break-up manure piles after livestock are removed from a field at least twice a year to uniformly spread the manure load, or manage manure distribution through rotational grazing.

Reforestation and Permanent Vegetation

Farmers can utilize cost share programs to convert highly erodible pasture such as areas with steep slopes and poor vegetative cover to forest. These types of pasture typically produce a lower yield of forage for livestock making them less optimal for grazing or cutting hay. In addition, establishing permanent vegetation on small degraded sites with excessive erosion will stabilize the area and protect water quality by reducing bacteria and sediment runoff.

Waste Storage Facilities and Water Retention Structures

Waste storage facilities that temporarily store beef cattle manure give producers greater control of when and where manure nutrients are spread, and also reduce the chance for manure to contaminate water resources. Manure from loafing areas, feedlots, and calving pens can be scraped up and temporarily stockpiled before application to cropland or pastureland. Water retention structures such as erosion control dams, desilting reservoirs, or sediment basins have the capacity to treat large volumes of runoff before it enters the stream.

Cropland Management Practices

A series of cropland management practices are included to control cropland runoff contributing bacteria and sediment to the streams. Continuous no-till is a practice that is becoming widely adopted in the region. By reducing tillage of the soil, farmers are able to conserve valuable soil and fertilizer and increase organic matter, which is an important factor in determining soil quality. The strip cropping practice promotes growing crops in a systematic arrangement of strips or bands across the general land slope. Types of strip cropping include contour, field or buffer. There are limited opportunities for cropland riparian buffers in the watersheds since most of the agricultural land next to the streams is currently in pasture. However, in areas where crops are

grown next to a stream, riparian buffers are an effective practice for filtering and reducing the bacteria and sediment load to the streams.

5.2.2 Residential and Urban Control Measures

Failing Septic Systems and Straight Pipes

All straight pipes and failing septic systems must be identified and corrected during implementation based on preexisting legal requirements. Table 5.6 shows the estimated number of failing septic systems and straight pipes by watershed. The number of potential straight pipes in the Buffalo Creek and Cedar Creek watersheds was estimated in the TMDL study using 2010 U.S. Census Bureau block demographics. The number of failing septic systems in the watershed was estimated based on the age of homes and standard failure rates for septic systems of that age. Homes with septic systems were broken into three age categories (prior to 1970, 1970-1989, or after 1989) based on 2010 census block group data. The percentage of homes within each age category was calculated for each census block group and these percentages were applied to the homes in each sub-watershed based on the block group that had the greatest coverage of the sub-watershed. Septic system failure rates for houses pre-1970, 1970-1989, and post- 1989 were assumed to be 40%, 20%, and 3%, respectively. Based on these failure rates, there are an estimated 418 failing septic systems in the Buffalo Creek and Cedar Creek watersheds (VADEQ, 2013).

Straight pipe numbers and potential locations were estimated based on proximity of homes to the stream and their age. Consultations with watershed stakeholders during TMDL development were also considered in development of these estimates. Based on these criteria, it was estimated that there are 24 straight pipes in the watersheds.

Table 5.6. Failing septic systems and straight pipes in the watersheds.

Watershed	Total Septic Systems	Estimated Failing Septic Systems	Estimated Straight Pipes
Buffalo Creek	739	180	5
Colliers Creek	456	111	6
NF Buffalo Creek	126	31	2
SF Buffalo Creek	163	42	6
Cedar Creek	205	54	5
TOTAL	**1,689**	**418**	**24**

Based on input from the Rockbridge County Health Department and observations from septic system maintenance projects in the region, it was estimated that 50% of failing septic systems could be corrected with a repair; the remaining 50% would need to be replaced. Of the systems that need to be replaced, a portion will require alternative waste treatment systems due to the geology present at the site, or a lack of space necessary for a conventional drainfield. Table 5.7 shows a breakdown of the septic system and straight pipe replacements. Based on existing conditions in the watersheds, it was estimated that approximately 20% of septic system replacements would be done with alternative waste treatment systems and the remaining 80% could be done using conventional septic systems. It was estimated that 25% of the conventional septic systems replacements would require a pump. No opportunities for connecting houses to public sewer are available in the watersheds.

Table 5.7. Repairs and replacements of failing septic systems and straight pipes.

Watershed	Septic system repair	Replace with conventional system	Replace with conventional system with pump	Replace with alternative system	Septic tank pumpout
Buffalo Creek	90	55	19	21	185
Colliers Creek	56	35	12	16	114
NF Buffalo Creek	16	11	4	4	32
SF Buffalo Creek	21	14	5	8	41
Cedar Creek	26	18	6	9	52
TOTAL	**209**	**133**	**46**	**58**	**424**

Because homes with straight pipes are more likely to have conditions that do not allow for installation of a conventional drainfield (older homes, smaller lots, home is located close to the stream), it was estimated that only 53% of straight pipes in the watershed could be corrected with the installation of a conventional system, and 47% would need to be replaced with an alternative waste treatment system.

A septic tank pumpout program was also discussed as a good way to heighten local awareness of septic system maintenance needs and to locate failing septic systems. Such a program could be implemented on a limited basis, targeting homes in close proximity to the creeks. The estimates

shown in Table 5.7 are based on pumping out septic tanks for 25% of households in each watershed.

Urban Implementation Actions

Based on the characteristics of the watersheds and existing land use patterns, opportunities for urban BMPs are limited. The residential working group discussed potential sites for improved stormwater management and identified a few opportunities at the Natural Bridge Hotel for the installation of stormwater BMPs. The hotel and tourist attraction includes close to ten acres of parking lots, for which upgrades in stormwater management could be implemented. Potential projects are identified in Table 5.8 below. Rain gardens are specially designed to catch runoff from pavement and rooftops and allow it to infiltrate down through the soil where pollutants are filtered out. A stormwater clarifier serves as a settling tank that removes solids, oil, gas and other pollutants from stormwater runoff. The clarifier consists of a series of chambers and filters that allow for settling and filtration of pollutants. The installation of two pet waste stations was recommended for the Hotel. These public pet waste disposal stations will include signage, disposal bags, and a waste receptacle to dispose of pet waste.

Table 5.8. Urban stormwater BMPs in the Cedar Creek watershed.

BMP	Units	Extent
Rain gardens	acres treated	5
Stormwater clarifier	acres treated	7
Pet waste station	stations	2

5.3 Technical Assistance and Education

In order to get landowners involved in implementation, it will be necessary to initiate education and outreach strategies and provide technical assistance with the design and installation of various best management practices. 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.

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

Agricultural Programs

- Make contact with landowners in the watersheds to make them aware of implementation goals, cost-share assistance, and voluntary options that are available to agricultural producers interested in conservation. Simplify paperwork as much as possible and provide funding commitments in writing.
- Provide technical assistance for agricultural programs (*e.g.*, survey, design, layout, and approval of installation).
- Develop and distribute educational materials. Include concrete economics with respect to costs and benefits of BMPs. Distribute materials through existing media outlets including: *The Weekender, Farm Credit Newsletter and Knowledge Center*, Rockbridge Co-op Bulletin Board, Farm Bureau, Tractor Supply, and Ruritan Clubs.
- Organize educational programs for farmers including farm tours in partnership with VA Cooperative Extension. Share information on how to address issues with implementing BMPs on leased land. Host a field day to highlight the benefits of rotational grazing on a local farm.
- Establish a "rainy day fund" or fencing insurance program to cover repair costs when livestock stream exclusion fencing is washed out.
- Locate funds for a "Flexible Fencing Program" modeled after the program implemented in the Shenandoah Valley. Explore opportunities to partner with the Chesapeake Bay Funders Network or other organizations to secure private funds to support the program.
- Establish a citizen monitoring program in the watersheds.

Residential Programs

- Identify straight-pipes and failing septic systems (*e.g.*, contact landowners in through mailings).
- Develop and distribute educational materials (e.g., septic system maintenance guide).
- Provide additional outreach and financial assistance to low income property owners in the watershed. Consider current literacy rates in development of outreach strategies to reach this sector of the population. Develop a volunteer labor force with assistance from within the community. Potential partners include: universities, churches, Habitat for Humanity, Rockbridge Area Conservation Council, Ruritan Clubs, Natural Bridge/VA Conservation Legacy Fund and the Community Foundation.
- Offer long term low interest loans to homeowners who cannot afford their portion of the cost of a repair or a septic system replacement.
- Partner with VA Cooperative Extension's Master Well Owner Network to host a clinic on well safety and potential drinking water contamination from failing septic systems.
- Consider partnerships with non-governmental organizations in development of a septic system assistance program. Distrust of the government will be an obstacle to effective outreach and having local partners could help to address this issue.

- Establish a citizen monitoring program to locate problem areas in the watersheds. Interest was expressed in targeted monitoring in the South Fork of the Buffalo watershed. Explore partnerships with the Effinger Ruritan Club and local churches (Rapps Mill Church, Collierstown United Methodist Church, Oxford Presbyterian Church, & Collierstown Presbyterian Church).

In addition to the specific outreach activities mentioned above, opportunities for more general education and outreach were identified. Boxerwood Education Association was noted as a key partner for outreach to local schools. Through their direct connections with area schools and teachers, they could work with local students to generate fliers and videos about the project along with residential and agricultural BMPs. These projects would thus educate local students and their families.

A critical component in the successful implementation of this plan is the availability of knowledgeable staff to work with landowners on implementing conservation practices. While this plan provides a general list of practices that can be implemented in the watershed, property owners face unique management challenges including both design challenges and financial barriers to implementation of practices. Consequently, technical assistance from trained conservation professionals is a key component to successful BMP implementation. Technical assistance includes helping landowners identify suitable BMPs for their property, designing BMPs and locating funding to finance implementation.

The staffing level needed to implement the agricultural and residential components of the plan was estimated based on discussions with stakeholders and the staffing levels used in similar projects. Staffing needs were quantified using full time equivalents (FTE), with one FTE being equal to one full-time staff member. Natural Bridge SWCD staff shared information on staff time spent implementing the Hays Creek TMDL Implementation Plan, which is also located in Rockbridge County. One position has been created for this effort. A comparative analysis of the two watersheds and BMPs needed to meet TMDL goals was performed. Based on this analysis and discussions with the working groups, it was determined that one FTE would be needed to provide the technical assistance needed for agricultural and residential implementation in the Buffalo Creek and Cedar Creek watersheds.

6. COSTS AND BENEFITS

6.1 Agricultural BMPs

The costs of agricultural best management practices included in the implementation plan were estimated based on data for Rockbridge County from the VADCR Agricultural BMP Database, the NRCS and Natural Bridge SWCD cost lists for BMP components, input from Natural Bridge SWCD and NRCS staff, and input from the agricultural working group.

The total cost of livestock exclusion systems includes not only the costs associated with fence installation, repair, and maintenance, but also the cost of developing alternative water sources for SL-6, SL-6T, LE-1T, LE-2T, and CREP. It should be noted that CREP does not pay for cross fencing to establish a rotational grazing system; however, this program is commonly combined with state programs that can cover these costs. 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 an upfront incentive payment on $0.50 per linear foot to maintain stream fencing as part of the WP-2T practice. However, this practice has not been commonly used in the watershed since it does not provide cost share for alternative water systems. In addition, the average cost of fence maintenance is typically significantly higher. In developing the cost estimates for fence maintenance shown in Table 6.1, a figure of $3.50/linear foot of fence was used. It was estimated that approximately 10% of fencing would need to be replaced over the 15 year timeline of this project.

The majority of agricultural practices recommended in the implementation plan are included in state and federal cost share programs. These programs offer financial assistance in implementing the practices and may also provide landowners with an incentive payment to encourage participation. However, it should be noted that these programs typically cover 75% of the cost of a BMP and require that the landowner cover the full cost of the practice up front and then receive reimbursement. Reimbursements are usually issued quickly and there is a low interest loan program available through VADEQ; however, this may still be an obstacle for some landowners interested in participating. Consequently, both the potential cost to landowners and the cost to state and federal programs must be considered. Table 6.1 shows total agricultural BMP costs by watershed.

6.2 Residential and Urban/Developed Area BMPs

The costs of recommended residential and urban BMPs were estimated using input from the Rockbridge County Health Department and the residential working group (Table 6.2).

6.3 Total Implementation Costs

Total estimated BMP implementation costs are shown in Table 6.3. In Table 6.4, implementation costs are shown for two stages of implementation. These stages and the associated timeline are explained in greater detail in Chapter 7, Section 7.1.

Table 6.1. Agricultural BMP implementation costs by watershed.

Practice	Cost share code	Units	Unit cost	Cost by Watershed					TOTAL
				Buffalo Creek	Colliers Creek	NF Buffalo Creek	SF Buffalo Creek	Cedar Creek	
Livestock exclusion with riparian buffers	CREP	system	$40,683	$77,062	$76,063	$13,273	$20,354	$19,364	$206,115
	WP-2T	system	$8,500	$33,543	$33,108	$5,778	$8,860	$8,429	$89,718
	SL-6/LE-1T /SL-6T	system	$32,830	$466,401	$460,355	$80,335	$123,188	$117,196	$1,247,475
Livestock exclusion with reduced setback	LE-2T	system	$31,305	$988,303	$975,492	$170,229	$261,035	$248,338	$2,643,396
Livestock exclusion fence maintenance (15 yrs)	N/A	feet	$3.50	$33,149	$32,719	$5,710	$8,755	$8,330	$87,295
Streambank stabilization	WP-2A	feet	$150	$0	$450,000	$0	$0	$0	$450,000
Improved pasture management	EQIP (529,512)	acres	$100	$758,800	$468,900	$130,700	$106,200	$181,900	$1,646,500
Reforestation of erodible pasture	FR-1	acres	$330	$29,370	$32,010	$5,610	$7,260	$6,270	$80,520
Permanent vegetation on critical areas	SL-11	acres	$1,200	$10,800	$6,000	$3,600	$1,200	$0	$21,600
Small acreage grazing system (equine)	SL-6AT	system	$20,000	$40,000	$40,000	$0	$20,000	$0	$100,000
Waste storage facility (beef cattle)	WP-4	facility	$75,000	$75,000	$75,000	$0	$0	$0	$150,000
Water retention/control structure (pasture)	WP-1	ac. treated	$138	$0	$291,732	$0	$106,122	$0	$397,854
Continuous no-till	SL-15	acres	$100	$400	$300	$200	$100	$1,000	$2,000
Contour strip cropping	SL-3	acres	$100	$0	$0	$0	$0	$300	$300
Riparian buffers on cropland	FR-3/WQ-1	acres	$1,000	$2,000	$1,000	$1,000	$1,000	$1,000	$6,000
TOTAL ESTIMATED COST				$2,514,828	$2,942,679	$416,435	$664,074	$592,127	$7,128,773

Table 6.2. Residential and urban/developed BMP implementation costs by watershed.

Practice	Cost share code	Units	Unit cost	Cost by Watershed					TOTAL
				Buffalo Creek	Colliers Creek	NF Buffalo Creek	SF Buffalo Creek	Cedar Creek	
Septic tank pumpout	RB-1	pumpout	$285	$52,725	$32,490	$9,120	$11,685	$14,820	$120,840
Septic system repair	RB-3	repair	$3,000	$270,000	$168,000	$48,000	$63,000	$78,000	$627,000
Septic system replacement	RB-4	system	$8,000	$448,000	$288,000	$80,000	$120,000	$144,000	$1,080,000
Septic system replacement w/pump	RB-4P	system	$9,000	$171,000	$108,000	$27,000	$45,000	$54,000	$405,000
Alternative waste treatment system	RB-5	system	$20,000	$400,000	$260,000	$80,000	$140,000	$180,000	$1,060,000
Pet waste stations	N/A	number	$1,300	$0	$0	$0	$0	$2,600	$2,600
Rain gardens	N/A	acres treated	$12,000	$0	$0	$0	$0	$60,000	$60,000
Stormwater clarifier	N/A	acres treated	$1,500	$0	$0	$0	$0	$10,500	$10,500
TOTAL ESTIMATED COST				$1,341,725	$856,490	$244,120	$379,685	$543,920	$3,365,940

Table 6.3. Total BMP implementation costs by watershed.

BMP Type	Cost by Watershed					TOTAL
	Buffalo Creek	Colliers Creek	NF Buffalo Creek	SF Buffalo Creek	Cedar Creek	
Agricultural	$2,514,828	$2,942,679	$416,435	$664,074	$592,127	$7,128,773
Residential	$1,341,725	$856,490	$244,120	$379,685	$543,920	$3,365,940
TOTAL	$3,856,552	$3,799,169	$660,553	$1,043,759	$1,136,047	$10,496,080

Table 6.4. Phased BMP implementation costs by watershed.

Stage	Cost by Watershed					TOTAL
	Buffalo Creek	Colliers Creek	NF Buffalo Creek	SF Buffalo Creek	Cedar Creek	
Stage 1 (Yrs 1-10)	$3,048,881	$2,994,741	$516,759	$1,043,759	$1,136,047	$8,740,187
Stage 2 (Yrs 11-15)	$807,671	$804,428	$143,794	$0	$0	$1,755,893
TOTAL	$3,856,552	$3,799,169	$660,553	$1,043,759	$1,136,047	$10,496,080

6.4 Technical Assistance

Technical assistance costs were estimated for one full time position using a cost of $50,000/position per year. This figure is based on the existing staffing costs included in the Virginia Department of Environmental Quality's grant agreement with the Natural Bridge Soil and Water Conservation District for the Hays Creek watershed. Based on the 15 year timeline of this plan (described in great detail in the Implementation Timeline section of this plan), this would make the total cost of technical assistance approximately $750,000. When factored into the cost estimate for BMP implementation shown in Table 6.3, this would make the total cost of implementation approximately $11.25M.

6.5 Benefit Analysis

The primary benefit of implementing this plan will be cleaner water in the Buffalo Creek and Cedar Creek and their tributaries. Specifically, *E. coli* contamination in the creeks will be reduced to meet water quality standards. In addition, sediment levels in Colliers Creek will be reduced to a level that allows the stream to host a healthy and diverse population of aquatic life. 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. The restoration of the aquatic community in Colliers Creek through reductions in sediment loading to the creek may result in improvements to quality of life for local residents. Recreational opportunities like fishing and bird watching may be enhanced as improvements to the aquatic community make their way up the food chain.

An important objective of the implementation plan is to foster continued economic vitality. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document 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, and private sewage system maintenance 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.

6.5.1 Agricultural Practices

It is recognized that every farmer faces unique management challenges that may make implementation of some BMPs more cost effective than others. Consequently, costs and benefits of the BMPs recommended in this plan must be weighed on an individual basis. The benefits highlighted in this section are based on general research findings. Additional economic costs and benefits analyses of these practices at the local level was identified as a much needed outreach tool by the steering committee and agricultural working group.

Restricting livestock access to streams and providing them with clean water source has been shown to improve weight gain and milk production in cattle (Zeckoski et al., 2007). Studies have shown that increasing livestock consumption of clean water can lead to increased milk and butterfat production and increased weight gain (Landefeld et al, 2002). Table 6.5 shows an example of how this can translate into economic gains for producers. 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, coccidian 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.

Table 6.5. Example of increased revenue due to installing off-stream waterers (Surber et al., 2005).

Typical calf sale weight	Additional weight gain due to off-stream waterer	Price	Increased revenue due to off stream waterer
500 lbs/calf	5% or 25 lbs	$0.60 per lb	$15/calf

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.

6.5.2 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 ($285) in comparison to repairing or replacing an entire system ($8,000 to $20,000). Additionally, the repair/replacement and pump-out programs will benefit owners of private sewage (*e.g.*, septic) systems, particularly low-income homeowners, by sharing the cost of required maintenance.

In addition to the benefits to individual landowners, the economy of the local community will be stimulated through expenditures made during implementation, and the infusion of dollars from funding sources outside the impaired areas. Building contractors and material suppliers who deal with septic system pump-outs, private sewage system repair and installation, fencing, and other BMP components can expect to see an increase in business during implementation. Additionally, income from maintenance of these systems should continue long after implementation is complete. As will be discussed in greater detail in Chapter 9, a portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which, in turn, will allow for individual landowners to participate in implementation.

6.5.3 Urban Stormwater Practices

Opportunities for enhanced stormwater management have been identified at the Natural Bridge Hotel, located in the Cedar Creek watershed. The primary benefits of stormwater management practices to private property owners include flood mitigation and improved water quality. In addition, urban BMPs have a number of economic benefits to localities. Increased retention of stormwater on site can lower peak discharges, thereby reducing the drainage infrastructure needed to prevent flooding. This can result in cost savings to local governments through reduced engineering and land acquisition costs, and reduced materials and installation costs for stormwater culverts and streambank armoring to prevent scour. Lastly, implementation of urban BMPs greatly reduces soil erosion and sediment transport to our rivers, streams and lakes. A

1993 study of the economic cost of erosion-related pollution showed that national off-site damages from urban sediment sources cost between $192 million and $2.2 billion per year in 1990 dollar values (Paterson et al, 1993). This cost range would be far greater today if adjusted for inflation.

6.5.4 Watershed Health and Associated Benefits

Focusing on reducing bacteria and sediment in the Buffalo Creek and Cedar Creek watersheds will have associated watershed health benefits as well. Reductions in streambank erosion, excessive nutrient runoff, and water temperature are additional benefits associated with streamside buffer plantings. In turn, reduced nutrient loading and erosion and cooler water temperatures improves habitat for fisheries, which provides associated benefits to anglers and the local economy.

Riparian buffers can also improve habitat for wildlife such as ground-nesting quail and other sensitive species. Data collected from Breeding Bird Surveys in Virginia indicate that the quail population declined 4.2% annually between 1966 and 2007. Habitat loss has been cited as the primary cause of this decline. As a result, Virginia has experienced significant reductions in economic input to rural communities from quail hunting. The direct economic contribution of quail hunters to the Virginia economy was estimated at nearly $26 million in 1991, with the total economic impact approaching $50 million. Between 1991 and 2004, the total loss to the Virginia economy was more than $23 million from declining quail hunter expenditures (VDGIF, 2009). Funding is available to assist landowners in quail habitat restoration (see Chapter 9).

7. MEASUREABLE GOALS AND MILESTONES

Given the scope of work involved with implementing this TMDL, full implementation and de-listing from the Virginia Section 305(b)/303(d) list could be expected within 15 years provided that full funding for technical assistance and BMP cost share were available. Described in this section are a timeline for implementation, water quality and implementation goals and milestones, and strategies for targeting of best management practices.

7.1 Milestone Identification

The end goals of implementation are restored water quality of the impaired waters and subsequent de-listing of the waters 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 best management practices through the Virginia Agricultural Cost-Share Program and continued water quality monitoring.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of 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 and areas of highest interest first. For instance, the TMDL study indicated runoff from pasture contributes over 90% of the total bacteria load in Buffalo Creek and Cedar Creek. Concentrating on implementing pasture management practices within the first several years may provide the highest return on water quality improvement with less cost to landowners. Implementation has been divided into two stages: 2015-2025 and 2025-2030. Tables 7.1 – 7.5 show implementation and water quality improvement goals for each watershed in each implementation stage.

Table 7.1. Staged implementation goals and percent of land use receiving BMP by stage for Buffalo Creek.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Livestock exclusion	Livestock exclusion with riparian buffers	CREP	feet	2,343	2,197	2.5	2
		SL-6/LE-1T/SL-6T		14,057	13,185	15	14
		WP-2T		2,343	2,197	2.5	2
	Livestock exclusion with reduced setback	LE-2T		28,113	26,369	30	27
Pasture	Improved pasture management	EQIP (529,512)	acres	7,588	0	86	0
	Riparian buffers	CREP, SL-6T, WP-2T		25	24	1	1
	Permanent vegetation on critical areas	SL-11		9	0	0.1	0
	Reforestation of erodible pasture	FR-1		89	0	1	0
	Small acreage grazing system (Equine)	SL-6A		8	0	0.1	0
	Waste storage facility	WP-4	system	1	0	N/A	N/A
Cropland	Continuous no-till	SL-15A	acres	4	0	5	0
	Riparian buffers	FR-3/WQ-1		2	0	29	0
Residential septic	Septic tank pumpouts	RB-1	pumpout	185	0	25	0
	Septic system repair	RB-3	repair	90	0	50	0
	Septic system replacement	RB-4	system	56	0	30	0
	Septic system replacement with pump	RB-4P		19	0	10	0
	Alternative waste treatment	RB-5		20	0	10	0
Average annual *E. coli* load (cfu/yr) (Existing= 2.24 x 10^{14} cfu/yr)				$1.44x10^{14}$	$1.23x10^{14}$		
% Violation of the Single Sample *E. coli* standard (235 cfu/100mL) Existing condition = 23.4%				10.47%	6.57%		
% Violation rate of the Geometric Mean *E. coli* standard (126 cfu/100mL) Existing condition = 36.7%				22.92%	6.25%		

% of stream length accessible to livestock.
% of total land use area.
% of riparian cropland area.
% of total septic systems.
% of failing septic systems and straight pipes.

Table 7.2. Staged implementation goals and percent of land use receiving BMP by stage for Colliers Creek.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Livestock exclusion	Livestock exclusion with riparian buffers	CREP	feet	2,581	2,093	2.5	2
		SL-6/LE-1T/SL-6T		15,487	12,558	15	14.5
		WP-2T		2,581	2,093	2.5	2
	Livestock exclusion with reduced setback	LE-2T		30,974	25,115	30	29.5
Streambank	Streambank stabilization	WP-2A	feet	3,000	0	3	0
Pasture	Improved pasture management	EQIP (529,512)	acres	4,380	309	92	8
	Riparian buffers	CREP, SL-6T, WP-2T		29	24	2	2
	Permanent vegetation on critical areas	SL-11		5	0	0.1	0
	Reforestation of erodible pasture	FR-1		48	49	1	1
	Small acreage grazing system (Equine)	SL-6A		10	0	0.2	0
	Waste storage facility	WP-4	system	1	0	N/A	N/A
	Water control structures	WP-1	acres-treated	0	2,114	0	45
Cropland	Continuous no-till	SL-15A	acres	3	0	5	0
	Riparian buffers	FR-3/WQ-1		1	0	35	0
Residential septic	Septic tank pumpouts	RB-1	pumpout	114	0	25	0
	Septic system repair	RB-3	repair	56	0	50	0
	Septic system replacement	RB-4	system	36	0	30	0
	Septic system replacement with pump	RB-4P		12	0	10	0
	Alternative waste treatment	RB-5		13	0	10	0
Average annual *E. coli* load (cfu/yr) (Existing= 7.97 x 10^{13} cfu/yr)				$4.70x10^{13}$	$2.87x10^{13}$		
% Violation of the Single Sample *E. coli* standard (235 cfu/100mL) Existing condition = 27.2%				10.40%	6.98%		
% Violation rate of the Geometric Mean *E. coli* standard (126 cfu/100mL) Existing condition = 38.3%				29.17%	14.58%		
Average annual sediment load (T/yr) (TMDL goal = 9,289.27)				9,289.22	8,966.06		
% Reduction in sediment load (TMDL goal = 24%)				24%	27%		

Table 7.3. Staged implementation goals and percent of land use receiving BMP by stage for North Fork Buffalo Creek.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Livestock exclusion	Livestock exclusion with riparian buffers	CREP	feet	435	381	2	1.5
		SL-6/LE-1T/SL-6T		2,610	2,284	12	11
		WP-2T		435	381	2	1.5
	Livestock exclusion with reduced setback	LE-2T		5,220	4,568	24	21
Pasture	Improved pasture management	EQIP (529,512)	acres	1,307	0	77	0
	Riparian buffers	CREP, SL-6T, WP-2T		5	2	1	1
	Permanent vegetation on critical areas	SL-11		3	0	0.2	0
	Reforestation of erodible pasture	FR-1		17	0	1	0
Cropland	Continuous no-till	SL-15A	acres	2	0	5	0
	Riparian buffers	FR-3/WQ-1		1	0	13	0
Residential septic	Septic tank pumpouts	RB-1	pumpout	32	0	25	0
	Septic system repair	RB-3	repair	16	0	50	0
	Septic system replacement	RB-4	system	10	0	30	0
	Septic system replacement with pump	RB-4P		3	0	10	0
	Alternative waste treatment	RB-5		4	0	10	0
Average annual *E. coli* load (cfu/yr) (Existing= 6.52 x 10^{13} cfu/yr)				4.18×10^{13}	3.72×10^{13}		
% Violation of the Single Sample *E. coli* standard (235 cfu/100mL) Existing condition = 22.5%				10.27%	5.13%		
% Violation rate of the Geometric Mean *E. coli* standard (126 cfu/100mL) Existing condition = 46.7%				27.08%	0.00%		

Table 7.4. Staged implementation goals and percent of land use receiving BMP by stage for South Fork Buffalo Creek.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Livestock exclusion	Livestock exclusion with riparian buffers	CREP	feet	1,251	0	5	0
		SL-6/LE-1T/SL-6T		7,505	0	30	0
		WP-2T		1,251	0	5	0
	Livestock exclusion with reduced setback	LE-2T		15,009	0	59	0
Pasture	Improved pasture management	EQIP (529,512)	acres	1,062	0	99	0
	Riparian buffers	CREP, SL-6T, WP-2T		14	0	5	0
	Permanent vegetation on critical areas	SL-11		1	0	0.1	0
	Reforestation of erodible pasture	FR-1		22	0	2	0
	Small acreage grazing system (Equine)	SL-6A		6	0	0.6	0
	Water control structures	WP-1	acres-treated	769	0	72	0
Cropland	Continuous no-till	SL-15A	acres	1	0	5	0
	Riparian buffers	FR-3/WQ-1		1	0	31	0
Residential septic	Septic tank pumpouts	RB-1	pumpout	41	0	25	0
	Septic system repair	RB-3	repair	21	0	50	0
	Septic system replacement	RB-4	system	15	0	30	0
	Septic system replacement with pump	RB-4P		5	0	10	0
	Alternative waste treatment	RB-5		7	0	10	0
Average annual *E. coli* load (cfu/yr) (Existing= 4.15 x 10^{13} cfu/yr)				$1.15x10^{13}$	$1.15x10^{13}$		
% Violation of the Single Sample *E. coli* standard (235 cfu/100mL) Existing condition = 20.8%				10.47%	10.47%		
% Violation rate of the Geometric Mean *E. coli* standard (126 cfu/100mL) Existing condition = 43.4%				18.75%	18.75%		

Table 7.5. Staged implementation goals and percent of land use receiving BMP by stage for Cedar Creek.

BMP Type	Description	BMP code	Units	Extent		% Land use treated	
				Stage 1	Stage 2	Stage 1	Stage 2
Livestock exclusion	Livestock exclusion with riparian buffers	CREP	feet	1,190	0	5	0
		SL-6/LE-1T/SL-6T		7,140	0	30	0
		WP-2T		1,190	0	5	0
	Livestock exclusion with reduced setback	LE-2T		14,279	0	59	0
Pasture	Improved pasture management	EQIP (529,512)	acres	1,819	0	98	0
	Riparian buffers	CREP, SL-6T, WP-2T		11	0	2	0
	Reforestation of erodible pasture	FR-1		19	0	1	0
Cropland	Continuous no-till	SL-15A	acres	10	0	10	0
	Strip cropping	SL-3		3	0	3	0
	Riparian buffers	FR-3/WQ-1		1	0	50	0
Residential septic	Septic tank pumpouts	RB-1	pumpout	52	0	25	0
	Septic system repair	RB-3	repair	26	0	50	0
	Septic system replacement	RB-4	system	18	0	30	0
	Septic system replacement with pump	RB-4P		6	0	10	0
	Alternative waste treatment	RB-5		9	0	10	0
Pet waste	Pet waste stations	N/A	system	2	0	N/A	N/A
Developed	Rain gardens	N/A	acres-treated	5	0	1	0
	Stormwater clarifier	N/A	acres-treated	7	0	1	0
Average annual *E. coli* load (cfu/yr) (Existing= 3.83 x 10^{13} cfu/yr)				$1.78x10^{13}$	$1.78x10^{13}$		
% Violation of the Single Sample *E. coli* standard (235 cfu/100mL) Existing condition = 43.7%				10.18%	10.18%		
% Violation rate of the Geometric Mean *E. coli* standard (126 cfu/100mL) Existing condition = 56.7%				16.67%	16.67%		

7.2 Water Quality Monitoring

Improvements in water quality will be evaluated through water quality monitoring conducted at VADEQ monitoring stations located in the watersheds (

Figure 7.1, Table 7.6). The map in Figure 7.1 below shows stations that are part of VADEQ's Ambient Monitoring Program, wherein bi-monthly watershed monitoring takes place on a rotating basis for two consecutive years of a six-year assessment cycle. Trend stations are also highlighted on the map. These stations are part of a regular monitoring cycle and are not typically rotated on an off of the monitoring schedule. In cases where the monitoring station used to place a stream on the impaired waters list is a trend station (shown in green and blue in

Figure 7.1), monitoring will continue as usual. For the other ambient monitoring stations, monitoring will begin no sooner than the second odd numbered calendar year following the initiation of TMDL implementation. Beginning implementation monitoring after 2 to 3 years of TMDL implementation will help ensure that time has passed for remedial measures to have stabilized and BMPs to have become functional. At a minimum, the frequency of sample collections will be every other month for two years. After two years of bi-monthly monitoring an assessment will be made to determine if the segments are no longer impaired. If full restoration, as defined in the current or most recent version of the DEQ Final Water Quality Assessment Guidance Manual, has been achieved, monitoring will be suspended. If the two listing stations shown on the map, or any other stations associated with this implementation plan have three or more exceedances of the bacteria standard within this two year period, monitoring will be discontinued for two years. Bi-monthly monitoring will be resumed for another two years on the odd numbered calendar year in the third two-year period of the six year assessment window. After this, the most recent two years of data will be evaluated, and the same criteria as was used for the first two year monitoring cycle will apply.

Intensive, one-year monthly sampling may occur within any single calendar year. It is generally preferred to conduct sampling over a two year period to help minimize the effect of fluctuating climate conditions related to dry and wet events.

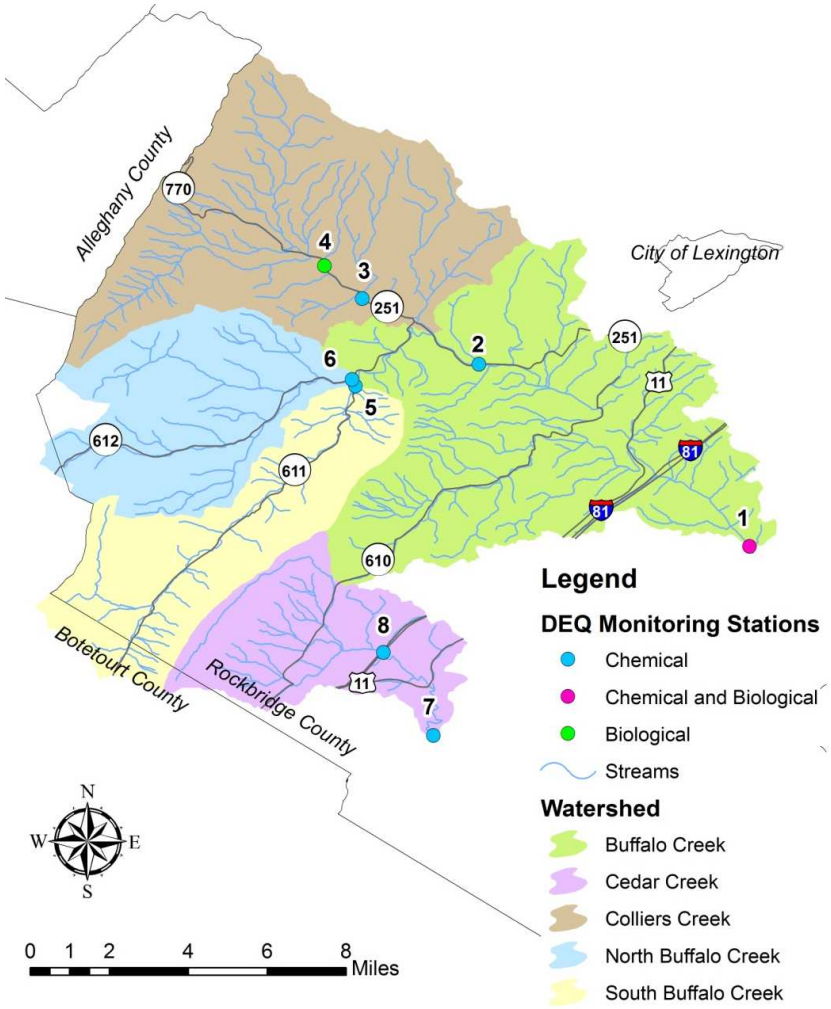

Figure 7.1. VADEQ monitoring stations and station type following TMDL IP completion.

Table 7.6. Station location descriptions for VADEQ monitoring stations.

Station #	Stream	River mile	Description
1	Buffalo Creek	0.22	private bridge off Rt. 700
2	Buffalo Creek	11.9	Rt. 251 bridge near Murat
3	Colliers Creek	1.99	Rt. 644 bridge
4	Colliers Creek	3.21	~1/2 mile downstream of Rt. 655
5	South Fork Buffalo Creek	0.15	Rt. 611 bridge
6	North Fork Buffalo Creek	0.07	Rt. 611 bridge
7	Cedar Creek	0.04	Rt. 608 bridge
8	Cedar Creek	3.60	Rt. 609 bridge

There is the potential for additional monitoring at a subset of stations in the watersheds where continual VADEQ monitoring is conducted on a bi-monthly basis beginning on the next odd number calendar year after the initiation of implementation. This will require an additional funding source and can only be accomplished with sufficient resources to

support needs of the data users, and only if watershed conditions and stakeholder support are suitable to this strategy. These monitoring stations will be located in the watersheds based on TMDL implementation funds, either state, federal, or other sources, becoming available.

Citizen monitoring is another very useful tool for measuring improvements in water quality. Virginia Save Our Streams is a program of the Izaak Walton League of America that trains individuals in biological monitoring methods, including many Rockbridge County residents. VADEQ also provides citizen monitoring training and funding for Coliscan monitoring for bacteria. A Coliscan monitoring training session was held by VADEQ on November 18, 2014 for interested citizens following the final public meeting for the implementation plan development. Thirteen local residents attended the training session, where they received training in monitoring protocols and supplies for monthly sampling. Volunteers selected sites throughout the watersheds for sampling on a monthly basis in 2015 (Figure 7.2). The results of this monitoring effort will be used to refine outreach efforts based on identification of hotspots or problem areas in the watersheds.

7.3 Targeting

Implicit in the process of a staged implementation is targeting of best management practices. Targeting ensures optimum utilization of limited technical and financial resources. The agricultural working group discussed potential targeting strategies of fencing practices and other agricultural BMPs. The group discussed the best ways to identify and correct problem areas in the watershed that may be contributing a large amount of pollution to the streams. Citizen monitoring was identified as a good way to identify these areas. Citizen monitoring sample sites should be located in areas of the river where watershed residents have access and typically swim. These areas should be targeted for outreach in the event that monitoring shows high levels of *E. coli*. The agricultural working group discussed the challenges of BMP implementation on rented land, and agreed that it might be more worthwhile to focus outreach efforts in the Buffalo Creek and Colliers Creek watersheds where there are more large, operator owned farms.

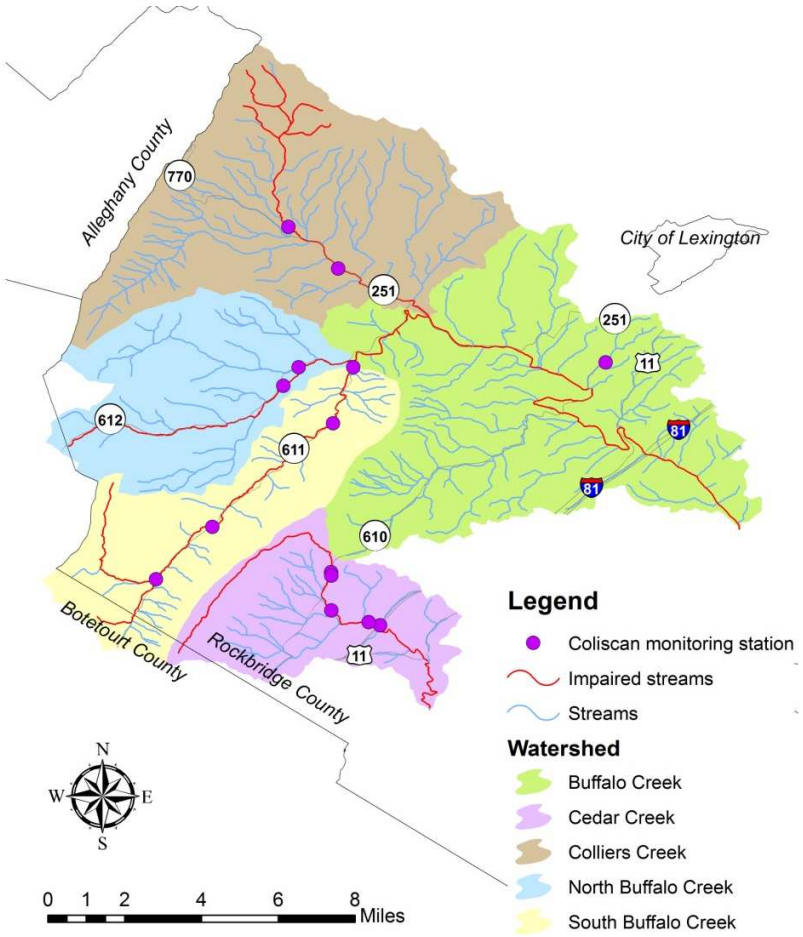

Figure 7.2. Coliscan monitoring station locations for citizen monitoring in 2015.

The residential working group identified areas in the watersheds that are most likely to have straight pipes and failing septic systems and should therefore be targeted for implementation first. These areas included homes along Possum Hollow Road, Colliers Creek as it comes out of the National Forest, and Rapps Mill in the South Fork Buffalo Creek watershed. Citizen monitoring was also identified as a good tool for improved targeting of outreach efforts for residential BMPs and locating failing septic systems and straight pipes.

7.4 Fencing Prioritization by Sub-watershed

In order to prioritize segments of the creeks for livestock exclusion fencing, each watershed was divided up into a series of smaller sub-watersheds, and an analysis of the water quality benefits of livestock exclusion was performed for each sub-watershed based on 1) the extent of pasture next to the stream 2) the number of livestock in the watershed and 3) the proximity of the stream segment to the headwaters. The sub-watersheds were

then ranked in ascending order based on the ratio of bacteria loading per fence length, and proximity to the headwaters. These rankings were modified to reflect input from the agricultural working group regarding characteristics of farms in the watersheds (Figure 7.3). Due to the fact that there are a greater number of large, operator-owned farms in the Buffalo and Colliers Creek watersheds, it was determined that fencing would be of greater interest in these areas. The South and North Forks of the Buffalo and Cedar Creek have more rented land, making livestock exclusion more challenging.

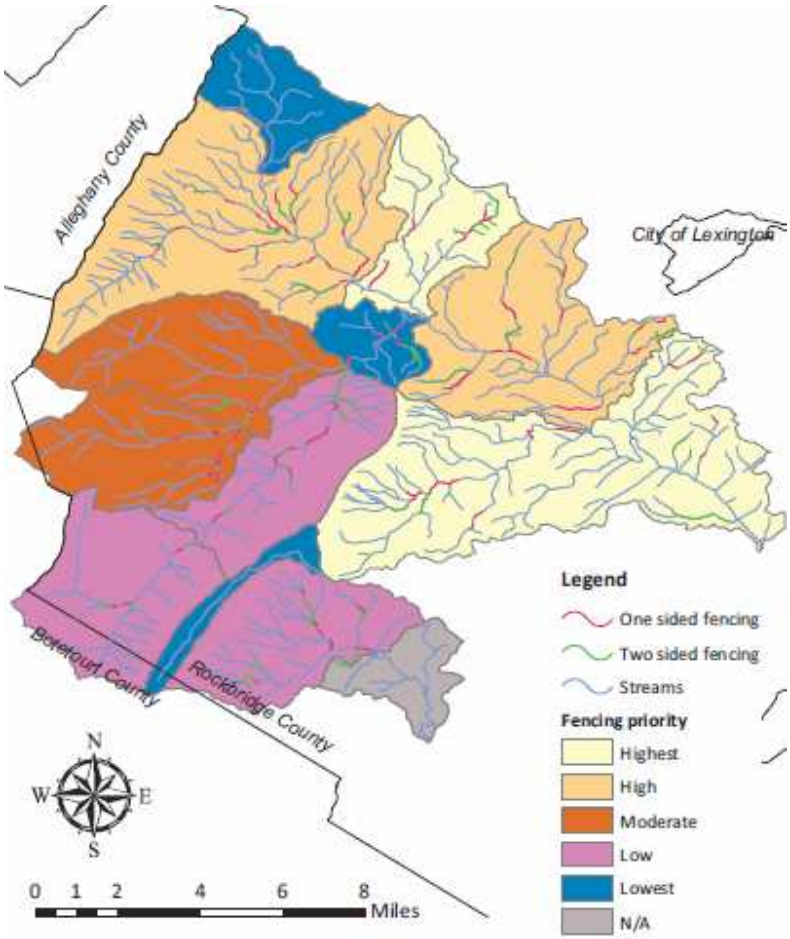

Figure 7.3. Livestock stream exclusion prioritization by sub-watershed for the Buffalo Creek and Cedar Creek watersheds.

8. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this plan is dependent on stakeholder participation and strong leadership on the part of both community members and conservation organizations. The Natural Bridge Soil and Water Conservation District currently covers the watersheds with respect to administration of the VA Agricultural BMP Cost Share Program. Additional partners will be necessary in order to address residential implementation needs including the Rockbridge County Health Department. The following sections in this chapter describe the responsibilities and expectations for the various components of implementation.

8.1 Partner Roles and Responsibilities

8.1.1 Watershed Landowners

The majority of practices recommended in this plan are related to agriculture since it is a predominant land use in the watersheds. Participation from local farmers is thus a key factor to the success of this plan. Consequently, it is important to consider characteristics of farms and farmers in the watersheds that will affect the decisions farmers make when it comes to implementing conservation practices on their farms. For example, the average size of farms is an important factor to consider, since it affects how much land a farmer can give up for a riparian buffer. The average age of a farmer, which was 60 in Virginia in 2012, may also influence their decision to implement best management practices, particularly if they are close to retirement and will be relying on the sale of their land for income during retirement. In such cases, it may be less likely that a farmer would be willing to invest a portion of their income in best management practices. Table 8.1 provides a summary of relevant characteristics of farmers and producers in Rockbridge County from the 2007 and 2012 Agricultural Census. These characteristics were considered when developing implementation scenarios, and should be utilized to develop suitable education and outreach strategies.

Table 8.1. Characteristics of farms and farmers in Rockbridge County.

Characteristic *Source: 2012 Agricultural Census*	**Number**
Number of farms	833
Land in farms (acres)	168,376
Full owners of farms	545
Part owners of farms	252
Tenants	36
Operators identifying farming as their primary occupation	353
Operators identifying something other than farming as their primary occupation	480
Average age of primary operator	61
Average size of farm (acres)	202
Average value of farmland ($/acre)	$4,296
Average net cash farm income of operation ($)	$2,239
Average farm production expenses ($)	$39,055
Farms with internet access	601
Farm typology (acres) *Source: 2007 Agricultural Census*	
Small family farms: retirement and residential/lifestyle	72,174
Small family farms: farming occupation	33,730
Large and very large family farms	16,955
Nonfamily farms	4,977

In addition to local farmers, participation from homeowners, local government staff and elected officials is critical to the success of this plan. Elected officials and local government staff make important decisions with respect to land use and development that are likely to affect water quality. It is critical that the goals of this plan are considered as these decisions are evaluated and made. Residential property owners will need to ensure that their septic systems are regularly pumped and inspected (every 3-5 years).Though the amount of bacteria that is coming from failing septic systems and straight pipes is minimal compared to livestock, human waste carries with it pathogens that can cause health problems above and beyond those associated with livestock waste.

8.1.2 Natural Bridge SWCD and Natural Resource Conservation Service

During the implementation project, the SWCD and NRCS will continue to reach out to farmers in the watersheds and provide them with technical and financial assistance with conservation practices. Their responsibilities include promoting available funding and the benefits of BMPs and providing assistance in the survey, design, and layout of agricultural BMPs. However, currently the dedicated staff is not available to work solely in the five watersheds covered in this plan, meaning that agricultural BMP implementation goals cannot be met without additional resources. SWCD and NRCS staff can assist with conducting outreach activities in the watersheds to encourage participation in conservation programs; although staff time for targeted outreach activities such as mailing out newsletters and organizing field days is limited. Should funding for additional staff to implement this plan become available, the Natural Bridge SWCD would be well suited to administer an agricultural BMP program.

Dedicated staff is currently not available to lead efforts to correct failing septic systems and straight pipes. The Natural Bridge SWCD is currently implementing a residential septic program in the nearby Hays Creek watershed. Since they have trained and experienced staff, they could take the lead in administering a residential cost share program as well should funding become available.

8.1.3 Rockbridge County

Decisions made by local governments regarding land use and zoning will play an important role in the implementation of this plan. This makes the Rockbridge County Board of Supervisors and the Planning Commission key partners in long term implementation efforts. Currently, Rockbridge County has zoning and land use policies in place that support the preservation of agricultural land and encourage good stewardship of natural resources. The county administers an easement agreement program, which has helped to encourage land conservation across the county. Based on feedback from the agricultural working group, the Buffalo Creek and Cedar Creek watersheds and their tributaries have not been subject to intense development pressures, making it likely that the predominant land uses in the watershed will remain agriculture and forest. Local government support of land conservation will become increasingly important as greater numbers of conservation measures are implemented across the

watersheds. Ensuring that land remains in agriculture and forest will allow the practices installed to continue to benefit water quality. The Rockbridge Area Conservation Council may serve as a critical partner in this effort.

8.1.4 Virginia Department of Environmental Quality

The Virginia Department of Environmental Quality (VADEQ) has a lead role in the development of TMDL implementation plans to address non-point source pollutants such as bacteria from straight pipes, failing septic systems, pet waste, agricultural operations, and stormwater that contribute to water quality impairments. VADEQ provides available grant funding and technical support for the implementation of NPS (non-point source) components of TMDL implementation plans. VADEQ will work closely with project partners including the Natural Bridge Soil and Water Conservation District to track implementation progress for best management practices. In addition, VADEQ will work with interested partners on grant proposals to generate funds for projects included in the implementation plan. When needed, VADEQ will facilitate additional meetings of the steering committee to discuss implementation progress and make necessary adjustments to the implementation plan.

VADEQ is also responsible for monitoring state waters to determine compliance with water quality standards. VADEQ will continue monitoring water quality in the Buffalo Creek and Cedar Creek watersheds and their tributaries in order to assess water quality and determine when restoration has been achieved and the streams can be removed from Virginia's impaired waters list.

8.1.5 Virginia Department of Conservation and Recreation

The Virginia Department of Conservation and Recreation (VADCR) administers the Virginia Agricultural Cost Share Program, working closely with Soil and Water Conservation Districts to provide cost share and operating grants needed to deliver this program at the local level. VADCR works with the SWCDs to track BMP implementation as well. In addition, VADCR administers the state's Nutrient Management Program, which provides guidelines and technical assistance to producers in appropriate manure and poultry litter storage and application, as well as application of commercial fertilizer.

8.1.6 Virginia Department of Health

The Virginia Department of Health (VDH) is responsible for adopting and implementing regulations for onsite wastewater treatment and disposal. The Sewage Handling and Disposal Regulations require homeowners to secure permits for handling and disposal of sewage (e.g. repairing a failing septic system or installing a new treatment system). VDH staff provide technical assistance to homeowners with septic system maintenance and installation, and respond to complaints regarding failing septic systems and straight pipes.

8.1.7 Other Potential Local Partners

There are numerous opportunities for future partnerships in the implementation of this plan and associated water quality monitoring. A list of additional organizations and entities with which partnership opportunities should be explored is provided below:

- VA Cooperative Extension (VCE)
- Chesapeake Bay Funders Network
- Master Well Owner Network (through VCE)
- Rockbridge Area Conservation Council
- Local churches
- Valley Conservation Council
- Effinger Ruritan Club
- Conservation Partners, LLC
- Farm Credit
- Natural Bridge Park and Historic Hotel
- VA Conservation Legacy Fund
- Upper James RC&D
- Boxerwood Gardens

8.2 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 Programs, and local comprehensive plans.

Coordination of the implementation project with these existing programs could result in additional resources and increased participation.

8.2.1 Rockbridge County Land Use Plan

One of the objectives of Rockbridge County Land Use Plan is the "conservation of open space with the County and...long-term preservation and maintenance of valuable natural resource areas..." Several of the strategies listed in the plan supporting this objective will also help to meet the goals of this water quality improvement plan including:

- Define specific valuable natural resources (i.e. viewsheds, aquifer recharge areas, drainage ways and open space) which the County wants to preserve and identify these resources on a map to be used as a planning base map.
- Identify specific measures to aid the County in its ongoing efforts to preserve rivers and streams for the purpose of preserving their natural beauty and environmental attributes, while maximizing recreation potential and conservation opportunities, and locate specific geographic areas where these measures may be applied.
- Develop a wellhead protection program to safeguard public water supply systems.
- Coordinate environmental preservation efforts with neighboring jurisdictions and establish an action plan targeting environmental concerns that require a regional approach.

8.2.2 Virginia's Phase II Chesapeake Bay Watershed Implementation Plan

Virginia's Watershed Implementation Plan (WIP) outlines a series of BMPs, programs and regulations that will be implemented across the state in order to meet nitrogen, phosphorous and sediment loading reductions called for in the Chesapeake Bay TMDL, completed in December 2010. The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay are in place by 2025, with at least 60% of the actions completed by 2017. A number of the BMPs included in this implementation plan are also found in Virginia's WIP. Consequently, Rockbridge County will be able to track and receive credit for program in meeting Phase II WIP goals while also working towards implementation goals established in this plan to improve local water quality. For more

information about Virginia's Phase II WIP, please visit DEQ's webpage: http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay.aspx.

8.2.3 Buffalo Creek/Purgatory Mountain Special Project Area

The Buffalo Creek-Purgatory Mountain Special Project Area (SPA) was established by the VA Outdoors Foundation (VOF) in June 2013. The 178,000 acre area includes the watersheds covered in this water quality improvement plan, in addition to land in northern Botetourt County. With this designation, this area has been recognized by VOF for its unique natural resources, making conservation easements of particular importance for the purposes of preservation and habitat improvement. This area serves as an important wildlife corridor, as it is one of the last largely forested connections between the Allegheny and Blue Ridge Mountains. Consequently, Rockbridge Area Conservation Council and other state and local partners are working with VOF to conduct outreach on land conservation, easement opportunities, and the importance of wildlife corridors. The objectives of this water quality improvement effort go hand in hand with those of the SPA initiative. Opportunities to collaborate on outreach efforts should be considered as partners move forward with implementation of the water quality improvement plan.

8.2.4 Additional Natural Resource Management and Conservation Planning

There are a number of organizations working to implement natural resource management and land conservation plans in the watersheds. The Virginia Department of Game and Inland Fisheries is currently working to implement the "Northern Bobwhite Quail Action Plan for Virginia," which includes a series of recommended management practices that will also help to improve water quality by reducing runoff and filtering out pollutants before they reach the stream. Trout Unlimited has a "Trout in the Classroom" program to engage local schools and students in learning about the importance of clean water and high quality aquatic habitat to support trout and other aquatic species. This type of outreach and education will also support the water quality improvement goals included in this plan. In addition, a number of organizations including the Virginia Outdoors Foundation and the Nature Conservancy are working to preserve agricultural land in Virginia through conservation easements. These easements can include some form of riparian buffer protection, and also help to ensure the longevity of efforts made to implement conservation practices on agricultural land. Whenever possible, efforts should

be made to integrate the implementation of these and other conservation-related plans that will impact water quality with this plan for the Buffalo Creek and Cedar Creek watersheds.

8.3 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 four state agencies responsible for regulating activities that impact water quality in Virginia. These agencies are VADEQ, VADCR, VDH, 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 to 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 holds the responsibility for addressing nonpoint sources (NPS) of pollution as of July 1, 2013.

VADCR is responsible for administering the Virginia Agricultural Cost Share and Nutrient Management Programs. Historically, most VADCR programs have dealt with agricultural NPS pollution through education and voluntary incentives. These 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 three staff members dedicated to enforcing the Agricultural Stewardship Act, and a small amount of funding is available to support water quality sampling. The Agricultural Stewardship Act is entirely complaint-driven.

VDH is responsible for maintaining safe drinking water measured by standards set by the EPA. Their duties also include septic system regulation and, historically, regulation of biosolids land application on permitted farmland sites. Like VDACS, VDH's actions are complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. In relation to these TMDLs, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes.

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.

8.4 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 TMDLs be calculated for streams to meet water quality standards. TMDL implementation plans are not required in the Federal Code; however, Virginia State Code does include 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.

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.

9. FUNDING

A list of potential funding sources available for implementation has been developed. A brief description of the programs and their requirements is provided in this chapter. Detailed descriptions can be obtained from the Natural Bridge SWCD, VADEQ, VADCR, NRCS, and VCE.

9.1 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 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 great impact on water quality. Cost-share is typically 75% of the actual cost, not to exceed the local maximum.

9.2 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, is allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. Any practice approved by the local SWCD Board must be completed within the taxable year in which the credit is claimed. The credit is only allowed for expenditures made by the taxpayer from funds of his/her own sources. The amount of the credit cannot exceed $17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed. 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.

9.3 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 participating lending institutions.

9.4 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 must be needed by the small business to comply with the federal Clean Air Act, or it will 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.

9.5 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 both point and non-point source pollution remediation are administered through VADEQ. Most WQIF grants provide matching funds on a 50/50 cost-share basis.

9.6 Conservation Reserve Program (CRP)

Through this program, cost-share assistance is available to establish cover of trees or herbaceous vegetation on cropland. Offers for the program are ranked, accepted and processed during fixed signup periods that are announced by FSA. 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. 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. 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.

9.7 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 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.

9.8 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. 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.

9.9 EPA Section 319 Grant Project Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement NPS programs. The VADEQ administers the money annually on a competitive grant basis to fund TMDL implementation projects, outreach and educational activities, water quality monitoring, and technical assistance for staff of local sponsor(s) coordinating implementation. In order to meet eligibility criteria established for 319

funding, all proposed project activities must be included in the TMDL implementation plan covering the project area. In addition, this plan must include the nine key elements of a watershed based plan identified by EPA (see Guidance Manual for TMDL Implementation Plans, VA Departments of Conservation and Recreation and Environmental Quality, July 2003).

9.10 Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners who want to develop or improve wildlife habitat on private agricultural lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. In Virginia, these plans are 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. 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.

9.11 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. Easement participants must have owned the land for at least one year.

9.12 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 staff across the region. They can provide (at no cost): 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.

9.13 National Fish and Wildlife Foundation (NFWF)

The National Fish and Wildlife Foundation administers the Chesapeake Bay Stewardship Fund, which is dedicated to the protection and restoration of the Chesapeake Bay. The Stewardship Fund is supported through partnerships with government agencies and private corporations, and typically awards $8 million to $12 million per year through two competitive grant programs and a technical assistance program. Larger “Innovative Nutrient and Sediment Reduction Grants” are available to non profits, local governments and state agencies, while smaller “Small Watershed Grants” are available to non profits

and local governments. A request for grant proposals is typically issued in the spring of each year, and awards are made in the late summer/early fall. Additional information on the program may be found at: http://www.nfwf.org/chesapeake/Pages/home.aspx.

9.14 Regional Conservation Partnership Program

The Regional Conservation Partnership Program (RCPP) was authorized through the 2014 Farm Bill. This 5-year program promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. he RCPP competitively awards funds to conservation projects designed by local partners specifically for their region. Eligible partners include agricultural or silvicultural producer associations, farmer cooperatives, state or local governments, municipal water treatment entities, conservation-driven nongovernmental organizations and institutions of higher education. Under RCPP, eligible landowners of agricultural land and non-industrial private forestland may enter into conservation program contracts or easement agreements under the framework of a partnership agreement. The Chesapeake Bay watershed is one of the eight "Critical Conservation Areas" identified for this program. These areas receive 35% of program funding.

9.15 Virginia Natural Resources Commitment Fund

The fund was established in the Virginia Code as a subfund of the Water Quality Improvement Fund in 2008. Monies placed in the fund are to be used solely for the Virginia Agricultural BMP Cost Share Program as well as agricultural needs for targeted TMDL implementation areas.

9.16 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.

9.17 Chesapeake Bay Funders Network

The Funders Network is a collaborative of funding organizations that provides opportunities for funders to pool resources and work together on shared interests in the Chesapeake Bay watershed. The funders make collaborative decisions on funding initivatives and specials projects (unsolicited proposals are not excepted. Implementation of a "Flexible Fencing Program" in the watersheds using private funding was identified as a way to increase interest in livestock stream exclusion. The program that has been implemented in the Shenandoah Valley with support from the Chesapeake Bay Funders Network was identified as a good model. Typically a 5-year contract is required, and farmers are offered more flexibility with the materials that they use and where the fence is placed. Should funding become available, some of the fencing goals established in this plan would be met using this program.

9.18 Wetland and Stream Mitigation Banking

Mitigation banks are sites where aquatic resources such as wetlands, streams and streamside buffers are restored, created, enhanced, or in exceptional circumstances, preserved expressly for the purpose of providing compensatory mitigation in advance of authorized impacts to similar resources. Mitigation banking is a commercial venture that provides compensation for aquatic resources in financially and environmentally preferable ways. Not every site or property is suitable for mitigation banking. Mitigation banks are required to be protected in perpetuity, to provide financial assurances and long term stewardship. The mitigation banking process is overseen by an Inter-Agency Review Team made up of state and federal agencies and chaired by DEQ and Army Corps of Engineers.

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APPENDICES

APPENDIX A: Working Group Meeting Minutes

Buffalo Creek, Colliers, and Cedar Creek: Agricultural Working Group Meeting

May 8, 2014

Effinger Fire Hall

NOTE: A sign in sheet was not circulated during the meeting so a complete participants list is not available.

Nesha McRae, from the VA Department of Environmental Quality began the meeting with a general discussion about agriculture in the region. Participants agreed that there has not been much change in farming and land use in Rockbridge County recently. A few farms have been divided into smaller parcels for homes and farmettes. Some farmland is leased through long term leases. Most of the farmers who are leasing land also own land nearby. There is a very high rate of land conservation (easements) in Rockbridge County and even new land owners who are not actively farming are largely committed to keeping their land in agriculture. Some children are returning home to farm after going off to school, so there are some younger farmers in the area, but not many. Generally speaking, the smaller farmettes or hobby farms are well managed. These are generally sheep and horse farms. Fox hunting remains popular in the county. The Rockbridge Hunt is a popular organization for local fox hunters.

The group discussed strategies to get the word out to the agricultural community regarding financial assistance for Best Management Practices (BMPs) and the existence of conservation programs. One participant noted that he did not like when scare tactics were used. For example, he has heard people say that farmers better hurry up and install BMPs now while the money is there; otherwise they will have to pay for everything on their own when BMPs become mandatory. Confidence and trust were noted as key components to working with the agricultural community. Several participants stated that they prefer to see things in writing regarding financial assistance. There is some skepticism about these programs and the financial assistance that is available. Having commitments made in writing will help to alleviate those concerns. The financial benefits of implementing BMPs need to be stressed in communications with farmers. The availability of new technology should also be integrated into promotion of BMPs, particularly to younger farmers. Concrete economics are very important and should be clearly spelled out in promotional materials. Several suggestions were made regarding ways to distribute information including: churches, newspaper columns (should be submitted by different people on a regular basis), The Weekender, Farm Credit Newsletter and Knowledge Center (Matt L. is the contact), Ruritan clubs, and the Co-Op bulletin board. It was also noted that there is an active forestry group through Dabney

Lancaster Community College. Insurance agents were identified as a good potential partner in outreach as well. Many of these programs are confusing and intimidating. Good technical staff is needed to explain things and simplify all of these programs and paperwork. There remains a group of farmers who just are not reachable. They do not participate in these sorts of meetings or in local organizations. It was suggested that if community leaders participate, then others may follow. These key decision makers should be convinced of the benefits of BMPs first.

The group moved on to discuss livestock stream exclusion practices and associated maintenance concerns. It was noted that farmers may be able to get some assistance from the Soil and Water Conservation District to put their fence back up if it washes out. It will just depend on the availability of cost share funds. The Flexible Fencing Program that was implemented in Augusta and Rockingham Counties was discussed as a way to get more farmers to put up fences. The contract periods for these projects are only five years compared to 10 or 15 with some state and federal programs. In addition, the fencing materials are not as expensive to replace if the fence washes out. This program is supported through private funds from the Chesapeake Bay Funders Network. One participant explained that with farming, cash flow is more uncertain. If a fence washes out when cash flow is down, that could be a real problem for a farmer. A rainy day fund or some sort of insurance for fencing was identified as a good way to address this problem.

The group discussed different fencing programs and fencing setback requirements. One participant said that they did not think anyone in the watershed would be willing to put in a 100 foot buffer. A 35 foot buffer would be possible, and some would consider the 10 foot setback fencing. Fencing out the smaller creeks in the watershed will be an issue. The size of farms, slope, and the amount of land that they have next to the stream needs to be considered. If a farmer has a number of small creeks running across their farm, it may not be possible for them to fence out all of the streams. Maintaining wells is also a concern. The group discussed allowing limited access points to the stream in case wells malfunctioned. Headwaters Soil and Water Conservation District is currently looking at the use of existing technology to create alerts for farmers when a well is not working.

The group discussed good meeting locations and times. Evening was identified as the best time for meetings, preferably 7:00. It was suggested that the 3rd Thursday of each month be avoided. The Effinger Fire Hall was identified as a good meeting location as well.

Buffalo Creek, Colliers, and Cedar Creek: Agricultural Working Group Meeting #2
Palmer Community Center
June 25, 2014

Participants

Tommy Harris	Kermit Rockett	Phillip Hurst
Sandra Stuart	Louis Eaton	Chris Mihalkovic
Barbara Dowell	Will Harris	Nesha McRae
Marty Rockett	Mack Hamilton	Lisa Beckstrom

Nesha McRae, from the VA Department of Environmental Quality began the meeting by reviewing main points from the last meeting held on May 8, 2014 at the Effinger Fire Hall. During this meeting, concerns were expressed that efforts to restore the Chesapeake Bay would infringe on private property rights if goals were not met for livestock exclusion. Nesha emphasized that livestock exclusion is a voluntary measure, and that it will not be required through the water quality improvement plan. In addition, an excerpt from the Commonwealth's Watershed Implementation Plan was circulated to the group, which outlined a contingency plan if milestones were not met. Contingencies did not include mandatory livestock exclusion or other requirements that would impede on property rights. Nesha explained the differences between the Chesapeake Bay Watershed Implementation Plan and the proposed Buffalo Creek, Colliers, and Cedar Creek Water Quality Improvement Plan. The Chesapeake Bay is impaired due to nutrient and sediment loading whereas Buffalo, Colliers, and Cedar Creeks are impaired by bacteria. In addition, Colliers Creek has an aquatic life impairment that has been attributed to excess sediment in the creek. Both plans are similar in their goal of restoring these waterways, but the latter will solely address local water quality using solutions vetted by the local community. It was also noted that based on an update provided in a recent report by the Chesapeake Bay Foundation, Virginia has exceeded the livestock stream exclusion goal established for 2015 in the Watershed Implementation Plan.

Some participants expressed concerns regarding chemicals sprayed along road rights-of-way (R/W) near the creeks and potential effects on aquatic life. Nesha noted that she had been contacted by a local resident regarding a specific location in Collierstown where herbicide spraying has been completed by VDOT. This site is located near one of DEQ's stream monitoring stations. She discussed this with VDOT personnel, who explained that chemicals used for spraying in areas like this next to a stream are safe for usage by waterways. Several participants requested the names of the herbicides used along road R/W. DEQ will provide participants with this information, and will check with DEQ biologists to see any

significant impacts to the benthic community may have been captured during the time of herbicide application. Spraying outside of the road R/W (areas where plant growth may hinder views) has also been observed in the watersheds. One participant noted that their hazelnut trees, which are located outside of the R/W had been sprayed even when "don't spray signs" were posted. Nesha offered to follow-up with VDOT on this additional concern.

Pasture and Cropland Best Management Practices (BMPs)

The group moved on to review a series of pasture and cropland BMP scenarios that are expected to meet the goal of removing the streams from the impaired waters list. All of the scenarios included significant goals for improved pasture management in the watersheds. One of the participants noted that they had begun installation of a rotational grazing system for their operation, and that the greatest challenge/expense is getting water to the different paddocks. In some cases, the only water source is an on-site spring. The group discussed the idea of holding a field day at their farm once the grazing system was complete in order to demonstrate how they work. The group discussed waste storage facilities and whether there remains an unmet need for storage in the watersheds. Most of the farmers that need storage already have it; however, the group thought that there was probably still a need for 1 or 2 facilities. Someone asked if there is data on the average number of cows in a herd in Rockbridge County. The estimates in the BMP scenarios showed that one waste storage facility would be treating manure from an average of 100 cattle. It was noted that most of the farms in the watershed have pretty small herds, and that there are only a handful of larger farms. Nesha offered to check the 2013 Census of Agriculture and report back to the group on average herd sizes for the county. The group expressed some concerns about cattle exclusion from streams and how this might impact smaller farms in terms of land available for grazing. Sammy Vest with the Natural Bridge Soil and Water Conservation District explained that fencing doesn't have to be placed 35 feet from the stream in order to receive financial assistance through state and federal cost share programs. Fifty percent cost share is available for fencing placed 10 feet from the stream as well. Nesha stated that stream bank stabilization can be done in conjunction with fencing, but this can be costly. There are several grant programs available that can provide funding for streambank stabilization projects on a competitive basis.

Streamside Livestock Exclusion

The group discussed characteristics of some of the different options for livestock exclusion from streams that are available through state and federal cost share programs. The group felt that total exclusion with off stream watering was going to be a hard sell, but that some farmers might be interested in installing exclusion systems if limited access points to the stream could be provided for watering. Sammy Vest explained how these access points work, and it was agreed that they would be more suitable for smaller

tributaries of the creeks. One participant asked about the types of activities that are allowed in streamside buffers established through government cost share programs. Specifically, he was interested in whether or not buffers could be flash grazed by cattle. This used to be allowed in cost share programs, but is now prohibited after a handful of participants commonly left their livestock in the buffers for extended periods of time. Due to the cost of exclusion systems and the extent of work associated with installation, it was suggested that some farmers may want to install fencing in phases, starting out with just a couple of fields and a limited access point. Once farmers are able to see how the new set up works for them, they may be willing to do more at a later date.

The group discussed challenges associated with installing streamside fencing on leased land. There is quite a bit of pasture that is leased in the watersheds, and many landowners are not interested in investing in fencing. It was mentioned that Headwaters Soil and Water Conservation District currently has a grant to explore strategies to encourage BMP installation on leased land. They recently held a land leasing workshop and are also offering financial assistance for fencing with a shorter contract period of 5 years (compared to an average of 10 for typical state cost share programs). A program like this could be explored in the Buffalo and Colliers Creek watersheds as well. Cooperative Extension would be a good partner in this effort.

BMPs for Horse Farms

The group discussed the possibility of including BMPs for horse farms in the watershed. Sammy Vest noted that the regular cost share program that the Soil and Water Conservation District administers does not provide assistance to horse farms. Nesha said that horse farm BMPs had been included in the water quality improvement plan recently completed for Spout Run, which is located in Clarke County. This plan included measures to control barnyard runoff along with manure storage and composting. The state is currently funding implementation of these BMPs through a grant to the county. Some participants thought that BMPs for horse farms should be included in the plan since some of these operations allow their horses stream access. It was also noted that this might “open a can of worms” if the state begins providing cost share to horse farms (local residents might see this as a waste of money if BMPs are installed on properties with one or two horses). Nesha suggested limited BMPs to larger operations that are contributing to the water quality problems.

One participant asked whether karst topography would be considered in the plan. Nesha responded that there are some BMPs that are specifically designed to address karst that could be considered for inclusion in the plan. One participant said that it cost her ~$12,000 to drill a 500 –foot deep well on her property

due to the presence of rock. This needs to be considered in development of cost estimates to provide off stream water to livestock.

Next Steps

The group discussed meeting at the Palmer Community Center again in a month or two at 7 pm. Nesha will send out a summary of the meeting, the additional information that was requested by participants, and a date for the next meeting. The next meeting will cover the remaining items on the agenda not covered in this meeting. The meeting adjourned at 8:30.

The section of an email that Nesha McRae (DEQ) sent on July 3, 2014 to the participants of the 2nd agricultural working group meeting as a follow up to answer some questions that came up during the meeting:

There were a few items that came up during the meeting that I have been working to follow up on. Regarding the question about the type of herbicides that were used by VDOT for application in right of ways next to the creek, Garlon 3A and DMA 4 IVM were used, with Side-Kick as an adjuvant. All of the herbicides they used are aquatic approved so we shouldn't be seeing any negative impacts to stream life as a result. I asked about the rationale behind applying the herbicides rather than letting the vegetation grow. Mainly, it is a safety and maintenance issue. VDOT is required to establish a "clear zone" with the width being determined by speed, slope and traffic of a roadway. This zone has to be clear of fixed objects greater than 4" in diameter. That broadleaf herbicide should take care of weeds and broadleaf shrubs that could cause a problem in this zone. I have another call in to VDOT regarding concerns about additional spraying despite positing of no spray signs.

In addition, I followed up with one of our biologists here at DEQ regarding the timing of their monitoring at the station located on Colliers Creek (about ½ mile below Rt. 655) where spraying occurred earlier this year. The monitoring data from this spring (collected June 9, 2014) hasn't been entered into our database yet, but once it's in our system, I can check to see if there is anything that stands out in terms of impacts of earlier herbicide application.

I also searched the 2012 Ag Census along with the 2007 Census and cattle inventories for farms in Rockbridge County. I extracted the page that included data from Rockbridge and it is attached. This provides you with the number of farms with different ranges of livestock. An explicit average is not identified, but you can get an idea of the spread from this.

Buffalo Creek, Colliers & Cedar Creek: Agricultural Working Group Meeting 3

Palmer Community Center

August 7, 2014

Participants

Tommy Harris	Jeff Waldon	Phillip Hurst
Sandra Stuart	Louis Eaton	Carly Pleines
Barbara Dowell	Will Harris	Nesha McRae
Rachel Pence	Mack Hamilton	Will Harris
Don Kain	Steve Richards	Sammy Vest
Ellis Irvine		

Nesha McRae, from the VA Department of Environmental Quality began the meeting by reviewing main points from the last meeting held on June 25, 2014 at the Palmer Community Center. During this meeting, several participants expressed concerns about herbicide spraying outside of VDOT right of ways. DEQ staff followed up with VDOT after the meeting and information on how to contact VDOT with concerns was distributed to the group. It was also noted that spraying outside of the right of way may be conducted by the local power company if the property is under a transmission line. DEQ also contacted VA Cooperative Extension to discuss the issue of rented land in Rockbridge County with respect to BMP implementation. It was suggested that Tom Stanley (VACE) attend the final public meeting and speak to farmers about this issue. Mr. Stanley has agreed to do this. The group also discussed concerns about future regulations for agriculture in order to protect water quality. One participant explained that he felt that the goals of DEQ are the same as those of the Environmental Protection Agency, and that both organizations continue to further limit the rights of the agricultural community. Concerns were expressed that regulations keep changing and that the implementation of this water quality improvement plan may be voluntary now, but that in the future, farmers may be required to do these things. DEQ staff explained that the current strategy to restore both our local streams and the Chesapeake Bay is incentive based and voluntary when it comes to agriculture. While we cannot predict what the future holds, this is the strategy that the Commonwealth is following today, and we must assume that the plan will be implemented on a voluntary basis.

Agricultural BMP Implementation Scenario

The group reviewed a final agricultural BMP implementation scenario for the watersheds. A handout with a summary of implementation actions along with detailed tables was distributed. The scenario that was shown on the handouts was what would be needed in order to reduce bacteria inputs in the watersheds to the point that the streams could be removed from the impaired waters list. It was explained that the reductions needed in the South Fork Buffalo and Cedar Creek are greater than those of the other streams. As a result, more extensive BMP implementation will be needed in these watersheds. One participant asked about the likelihood of achieving the 99% livestock exclusion goal for these two creeks that was shown in the handouts, and what the repercussions will be if the goal is not met. DEQ staff explained that this is a goal that will be included in the plan because it is what it would take to remove the creeks from the impaired waters list; however, that does not mean that the project has failed if it is not met, or that landowners will be forced to exclude livestock as a result. It was also noted that the actual extent of fencing needed is not that great. The challenge will be getting all landowners in the watershed to participate. This has been accomplished in other watersheds in the region where 100% of livestock have been excluded from the stream voluntarily by landowners.

The group discussed the different types of fencing practices and fencing materials that could be used. Some landowners prefer to use woven wire or field fencing since this material typically does a better job of keeping livestock out as compared to 5-strand smooth wire fencing. However, a farmer installing fence at the top of the streambank might not want to use this material since it is more likely to get washed out during a storm and can be tougher to replace. The costs of woven wire and smooth wire fencing are comparable. One participant noted that a company called “Stay Tuff” makes a high tensile woven wire fence material that is very inexpensive and relatively easy to put up. You also end up using fewer fence posts with this material. It typically runs around $220 for 660 ft of 24” box fencing or $280 for 12” box. One participant asked about running power to wells for livestock. The group discussed how a landowner would want to take advantage of existing meters if possible, but that a utility bill would be part of the cost of installing off stream water. Another participant asked whether cost share is available for excluding livestock from ponds. Sammy Vest (Natural Bridge SWCD) responded that while the SWCD does not cost share on this type of fencing any longer, funding is available from the USDA Natural Resource Conservation Service.

The group discussed the importance of planting the correct plants in riparian buffers and pasture conversion practices. A list of ideal species for the region was developed by a participant during the TMDL development process and could be included as an appendix in the water quality improvement plan. *(The plant guide document referred to is included as Appendix B of this plan.)* Soils should also be considered. One landowner mentioned that he had planted black locusts on some bare ground on his property and that they had done really well in terms of establishing vegetative cover. Walnuts can also be a good species to plant in this area.

BMP Implementation Costs

The group reviewed a cost list for BMPs and associated components of a livestock exclusion system. DEQ staff noted that the total price tag of $1.8M for agricultural BMP implementation is comparably low to estimated agricultural BMP implementation costs in other watersheds where these plans have been developed. Considering existing funding levels for BMP cost share programs at the state and federal level, it is expected that financial assistance should be available at a level sufficient to help landowners achieve implementation goals over several years. Based on several recent experiences participants have had with installing fencing, the costs looked accurate to everyone. A participant expressed his concern about maintaining flood gates on stream crossings and asked who was responsible for repairs if these got washed out. Sammy Vest explained that the property owner was responsible, but that flood gates typically aren't used on crossings. Instead, a landowner could install a single strand of fence, which would be much easier to maintain. One participant mentioned that he had done a tree planting on pasture practice on his property, and that the agency he worked with had him plant loblolly and white pines in a 10x10 grid. This has not worked well from a management perspective since these trees are not of much value to local loggers and are challenging to thin. The cost of this practice could be bumped up a bit with the recommendation to plant hardwoods of greater value that will be easier to manage. The group discussed the cost of waste storage facilities for beef cattle shown in the handout. Several participants thought that $75,000 might be a little high, though it was acknowledged that the cost of these structures can add up quickly. One landowner shared their experiences with pre cast concrete (8-10 foot walls) to construct a waste storage facility. This helped to reduce the cost considerably (about $50,000 for a facility to accommodate 200 head of cattle).

The group discussed the importance of emphasizing the benefits of agricultural BMPs in order to encourage widespread adoption by landowners. One participant asked whether information on benefits should be targeted towards a particular group of landowners, explaining that the benefits might be very different depending on the size and nature of someone's operation. A large landowner whose primary occupation is farming is more likely to be interested in a very detailed breakdown of the financial benefits in terms of weight gain, veterinary bills etc. A smaller landowner who is more of a hobby farmer may be interested in some of the more general quality of life benefits. It was suggested that both types of benefits by noted in the water quality improvement plan. There is not a large amount of data out there right now on the economic benefits of agricultural BMPs, but this sort of information will be very important in getting broad participation in these cost share programs.

BMP Implementation Timeline

The group discussed a timeline for BMP implementation goals shown in the handout. It was explained that this timeline will not be used as an enforcement mechanism, but rather as a guide for implementation and a tool for budgeting. Grant funds have been available to fund TMDL implementation efforts to date, and applicants must use the plan timelines as a guide for establishing project goals. Additional concerns about changing regulations were discussed, particularly in terms of the growing cost of compliance with permits. Since we do not know how regulations are going to change over the next 1-2 decades, projecting a timeline for implementation is challenging. One participant stated that accomplishing these goals is very important since these streams are a shared resource that everyone should be able to enjoy without being concerned about getting sick from the water. It was noted that excluding livestock from streams makes a lot of sense from a management perspective, and that many people floating and swimming in the streams do not realize that there is commonly manure in the water. One participant asked how long it takes for the E.coli bacteria to die off. DEQ staff explained that a large fraction of the bacteria in manure will die off before it reaches the water, but that E.coli is actually just the indicator organism that is used to determine the likelihood that the water is contaminated with harmful pathogens commonly associated with this type of bacteria.

The group discussed several different time frames for implementation along with what has been adopted in other watersheds like Hays Creek (also in Rockbridge County). It was noted that

progress with agricultural BMP implementation has been good in the Hays Creek watershed, but that achieving established goals for residential septic BMPs has been more challenging. This is largely because people are not used to the SWCD offering cost share for these practices, so word has not yet gotten around about the program. DEQ staff noted that 10 years is commonly used as a timeline for removing streams from the impaired waters list. The group took a vote on several potential timelines (10 years, 12 years and 15 years). The majority of participants voted for 10 years. One participant suggested 25 years as well.

One participant asked how progress would be evaluated and what kind of monitoring would be done. DEQ staff explained that they are currently working out the monitoring plan for the watersheds, but that it is likely that monitoring would be delayed for a couple of years in order to allow for BMP implementation efforts to pick up and for BMPs to really start working. Citizen monitoring has been a really effective way to fill in the monitoring gaps and engage local landowners as well. One participant who lives right on one of the creeks said that they would be interested in doing some monitoring. DEQ staff offered to follow up with local landowners on the possibility of putting together a citizen monitoring program in the watersheds.

Next Steps

The group discussed plans for the final public meeting where the water quality improvement plan will be presented to the public. Nesha asked the group about the best time to have the meeting, and explained that current thoughts were to have it in late October in order to get the greatest number of farmers to attend. Participants thought that this would be a good time of year. One participant noted that it will be very important to share the benefits of implementing these practices, and that some attendees may not be very receptive to the idea of implementing BMPs.

Prior to the final public meeting, a steering committee meeting will be held with representatives from both the agricultural and residential working groups. This committee will review the draft plan and help with planning for the final public meeting. They will meet in early September. Tommy Harris volunteered to serve on the committee as a representative of the agricultural working group. Several other attendees said that they might be interested in attending if they are available. Nesha will send an announcement out about this meeting along with a summary of the discussion from this meeting in the coming weeks. The meeting adjourned at 8:40.

Buffalo, Colliers and Cedar Creek: Residential Working Group Meeting

Effinger Fire Hall, Rockbridge County

May 8, 2014

Participants

Bea Brown	Clyde Cooper
Jim Simons	Elizabeth Cooper
Joe Irby	Cathy Campbell
Larry Evans	Steve Richards
Glen Knowles	J. Oscar Hall
Brenda Noto	

The meeting began with a discussion of the cost of septic system maintenance and installation. Participants were surprised to learn that the Health Department recommends pumping out your septic tank every three to five years. One participant noted that they recently had their tank pumped and it cost about $200. It was noted that the highly engineered alternative waste treatment systems can cost as much as $30,000. There is also an inspection fee of $200/year. An operation and maintenance plan is required along with regular pump outs of the system when applicable. Many properties in the area have problems with soil percolation, meaning that the number of failing septic systems that will need to be replaced with alternative waste treatment systems will be high. The group thought that for new properties, 25% of septic systems installed end up being conventional systems while 75% are alternative waste treatment systems.

The group discussed the fact that failing septic systems that are close to streams are likely to be contributing a greater amount of bacteria to the water than those further upland. Correcting or replacing these systems will be important. However, many homeowners in the area do not have the funds available to pay for these corrections on their own. One participant said that Rockbridge County had an ordinance that required a septic tank to be pumped before a house could be sold. Another participant noted that you can't build in the 100 yr floodplain in the county any more. There are many systems that should be "grandfathered" in because it would not be possible to rebuild or relocate their septic systems outside of the floodplain.

The group moved on to discuss ideas for education and outreach for septic systems. It was noted that funding will be critical. One participant estimated that 90% of homeowners will not be able to fix their septic systems without some financial assistance. Grant funds should be targeted at homes in the floodplain, and to those without treatment systems that are having the greatest impact on water quality. Motivating factors should be considered when developing outreach materials. Well testing might be a good way to reach homeowners since a failing septic system can impact well water. Several years ago an organization (possibly Virginia Tech) came to the area and offered well water testing at a discounted rate ($60 versus the typical $250). Something similar could be done in the region once again. Free or discounted septic pump-outs and inspections would also be a good way to encourage homeowners to maintain their systems. It was noted that fear and distrust of the government will be an issue with any type of government sponsored program. If there are other funds available (non-government), that would be helpful.

The Working Group was very concerned with the socioeconomic level of homeowners needing assistance. Many families have lived in the same home for generations with little outside income or assistance. Long term, low-interest loans could be one option along with cost share programs. Assistance from within the community would be preferred over outside help. A volunteer labor force could be mobilized to assist with outreach and implementation efforts. Other local organizations that could provide some assistance were identified including:

- Universities
- Churches
- Habitat for Humanity
- Rockbridge Area Conservation Council
- Ruritan Clubs
- Community Foundation

The group discussed the cost of a typical repair of a malfunctioning septic system. It was estimated that these can cost anywhere from $1,800-$5,000. Several companies do septic tank pump-outs in the Rockbridge County area, including Hamilton, Ayers, and C&S Disposal.

VDH has a map of older systems dated from about 1960 to the present in the county. Participants noted that there is an exemption for outhouses in Rockbridge County legal code provided that they have a tank that can be pumped out (e.g. a Pump-and-Haul system)

Several participants expressed an interest in volunteer water quality monitoring and suggested several groups that could assist with that effort including VA Master Naturalists, Master Gardeners, VA Military Academy and Washington and Lee University.

The group agreed that Thursday nights work well for meetings, but participants would like to consider a different location. The Moose Lodge near Lexington and the Palmer Community Center were suggested as potential locations.

Buffalo, Colliers and Cedar Creek Residential Working Group Meeting #2

Natural Bridge Hotel

July 10, 2014

Participants

Jeff Waldon	Steve Richards	Steve Baldridge
Chris Mihalkovic	Nesha McRae	Robert Hickman
Carly Pleines	Rusty Ford	Sammy Vest
Don Wells Jr.	Sandra Stuart	Marilyn Buerkens
Barbara Walsh		

Nesha McRae, from the VA Department of Environmental Quality began the meeting by summarizing the main points from the first residential working group meeting, which was held on May 8,, 2014 at the Effinger Fire Hall. The group moved on to review a handout showing a scenario for the number of septic system repairs and replacements that will be needed in the watersheds. One participant expressed a concern that the number of straight pipes in the watershed may be underestimated by as much as a factor of 10. Similar concerns were expressed during the development of the TMDL study for the watersheds, so Nesha offered to follow up with other DEQ staff to make sure that this concern was addressed and is reflected in the estimates shared with the group. The group discussed the value of a septic pumpout program in the watershed, wherein landowners could get 50% of the cost of a septic tank pumpout covered through the assistance program. The group agreed that this would be a good tool to get homeowners thinking about septic system maintenance needs. Many people are not aware of the fact that septic tanks need to be regularly pumped. It will be important to share this kind of information with homeowners in order to address failing septic systems in the watershed. Nesha asked the group whether they thought that any local real estate agents could be compelled to provide information regarding septic tanks and pumpout schedules when selling homes. It was noted that some banks require a system to be pumped out before a home is purchased (as a condition of the loan); however, Rockbridge County does not have an ordinance requiring pumpouts. The group discussed potential challenges that may be encountered with program outreach including current literacy rates in the county. It will be challenging to reach some county residents with written materials as a result, though in many cases, these are the

homeowners that could use the greatest degree of assistance. The group reviewed a table showing septic BMP costs. It was noted that the cost of a septic tank pumpout may be a little higher than what is shown in the handout. One participant said that he recently had his tank pumped by a local contractor and the total cost was $285 for a two bedroom, two bathroom home. This participant followed up with DEQ staff after the meeting and noted that this cost may have been a little higher than normal due to the location of the septic system clean out.

Targeting Strategies

The group discussed options for targeting of outreach for septic BMPs. Areas with a high potential for failing septic systems and straight pipes include Possum Hollow Road, Colliers Creek as it comes out of the national forest, and Rapps Mill in the South Fork Buffalo watershed. It may be very difficult to find treatment options for homes in some of these areas based on how close they are to the creek. One participant mentioned that there is a professor at VMI who works with waste treatment systems including hydroponic systems (Dr. Tim Moore). He is currently preparing a proposal for the VA Conservation Legacy Fund to develop a hydroponic system for Natural Bridge Hotel. Another participant asked whether composting or incinerating toilets could be considered in situations where a conventional septic system is not an option. Nesha offered to follow up on this to see if DEQ's Residential Septic Cost Share Program typically covered these types of systems. After the meeting, it was determined that DEQ's program guidance does include these types of systems under the broad category of "alternative waste treatment system." Citizen monitoring was discussed as a good way to locate "hot spots" in a watershed. There may be some interest in this kind of monitoring on the SF Buffalo. Samples could be collected from a couple of bridges upstream towards the headwaters (e.g. Spring Branch). There are not many cattle along this part of the creek, so there is the potential to identify septic problems including straight pipes. Potential partner organizations for a citizen monitoring program were identified including the Effinger Ruritan Club and several local churches (Rapps Mill Church and Collierstown Presbyterian Church).

Pet Waste

The group discussed the potential for a pet waste education program in the watersheds. Participants agreed that this would not be very successful considering the rural nature of the area. Nesha asked if there were any public parks or other areas that might benefit from a pet waste

station. Representatives from Natural Bridge Hotel noted that they could probably use a station there. Occasionally guests with pets do come through.

Sediment BMPs for Colliers Creek

The group discussed sources of sediment in the Colliers Creek watershed and potential BMPs for residential areas. Roads were identified as the most significant source of sediment from "developed"

areas in the watershed. There has been some development up on the mountain in the watershed and there are lots of private dirt and gravel roads that are experiencing some erosion (e.g. Blacks Creek Road). It was suggested that DEQ staff follow up with the Department of Forestry and Rockbridge County Erosion and Sediment Control staff to discuss potential BMPs to address this problem. Overall the group felt that the contribution of sediment from residential areas is pretty minimal.

Implementation Timeline

The group discussed a suitable timeline for accomplishing septic BMP implementation goals for the watersheds. One participant suggested five years. The group discussed the time frame for outreach, and it was noted that it can take a while to make connections and build trust with landowners. Often times it takes a couple of years to do this. Once several landowners have participated in BMP cost share programs and things go well, their neighbors may follow as information is spread through word of mouth. It was also noted that word of mouth can often work better than mailings. A community column in the local paper was identified as another good way to reach people. One participant suggested that funding should be secured for a cost share program before getting more people involved. The group agreed that a seven year timeline would be appropriate for meeting implementation goals.

Next Steps

The next step in the implementation planning process will be to hold a steering committee meeting. This committee is made up of representatives from the two working groups (residential and agricultural). Nesha asked for volunteers. Steve Richards and Jeff Waldon expressed an interest if the meeting is held during the 1st two weeks of September. This group will review the draft plan and assist in plans for the final public meeting. The group discussed potential speakers

for this meeting and it was suggested that a landowner from nearby Hays Creek could speak about their experience with the septic BMP cost share program that the Natural Bridge SWCD has been administering over the past year.

APPENDIX B: Plant Guide

Robert Dowell was actively involved during the development of the TMDLs for the Buffalo Creek and Cedar Creek watersheds. Mr. Dowell compiled the following information on ideal woody plant species for western Virginia riparian systems in 2013 while living in Rockbridge County and briefly serving as assistant horticulturalist at Boxerwood Nature Center & Woodland Garden. The article is based on his observation of the woody plants inhabiting riparian systems in Rockbridge County. Mr. Dowell is currently serving as a term horticulturalist at the Arnold Arboretum of Harvard University.

Streamside Possibilities for Ecological and Economic Success

Establishing Riparian Buffers to Build Wildlife Habitat and Landowner Income

Author: Robert Dowell

Stream sides are often the sites of significant erosion and runoff. Maintaining vegetative strips between streams and pastureland can significantly reduce erosion and runoff. Called **riparian buffers**, these strips of vegetation are best managed through preserving a diversity of woody and herbaceous plant species. Maintaining a high level of biodiversity helps the riparian buffer maintain itself, so in the event a disease or pest eliminates one species member of the buffer, a replacement member species can fill its role.

The roots of woody plants have a primary function in riparian buffers in that they physically hold back horizontally eroding soil, acting as a net catching surface runoff before it reaches waterways. Furthermore, dense tree canopies can intercept rainfall directly, preventing erosion that way. Imagine a pot of soil placed outside in a heavy rainstorm. The heavy rain will splash and splatter the soil. After as little as several minutes the pot may be half empty of its original soil level. Now imagine that same pot of soil with a conical shaped evergreen, such as a hemlock, planted in it. The hemlock sheds off heavy rain, diffusing it so it can't hit the soil as forcefully and as concentrated as if the hemlock were not there.

Many woody plant roots can also assist in a secondary role by absorbing excess manure or synthetic fertilizer runoffs and blocking spray drift. Some even fix atmospheric nitrogen, thereby assisting the growth of other plant species nearby. Still others cast dense shade, sheltering stream waters from summer heat, thereby making the cool stream waters more hospitable to aquatic life.

In any landscape, wild or cultivated, woody plant species form the foundational structure that assists the growth of other plant species and provide habitat for animal species which can also, in turn, contribute to the growth of woody plant species. Though any woody species introduced or native can be a successful part of a riparian system, some are far better suited than others. Riparian habitats are by design in flood plains and therefore experience frequent flooding in comparison to upland habitats. Species unable to tolerate prolonged wet soil such as the common Eastern Red Cedar (*Juniperus virginiana*) are therefore, generally unsuited to riparian environments.

The simple act of fencing out a stream bank from livestock can go a long way toward establishing a riparian buffer, however for more rapid establishment, planting is suggested. The following is a basic list and guideline of the best species and considerations for establishing woody plant species in western Virginia riparian systems. While many species are suitable for riparian habitats, the following are preferred because they are native and therefore pose minimal negative ecological effect. 4 genera in particular are highlighted as the best to consider as they are fast growing and establish quickly on previously non-vegetated ground, are well adapted to wet/dry extremes, and/or may have potential as sources of supplemental income for landowners through agro-forestry and/or crop production.

Hazel- The hazelnut (genus *Corylus*) behaves as either a large, suckering shrub or small tree in the wild. Nut production is heaviest when it is situated in full sun locations, although the plant itself can tolerate significant shade. Its nuts serve as a coveted food for squirrels and blue jays. Its leaves are consumed by numerous caterpillars which in turn feed many birds. The winter blooming catkins, or dangling flowers also feed deer and grouse are an important food source in the lean winter months. This can be a significant asset to landowners who use their lands for hunting.

Native hazels are often found in thickets by streams or fencerows. They are easily propagated by carefully separating a rooted offshoot—called a "sucker"-- and transplanting it to a new location. This is best done in late winter to early spring. Alternatively, the nuts themselves can be harvested in autumn and planted in autumn. Only the American hazelnut (*Corylus americana*) and the beaked hazel (*Corylus cornuta*) should be planted as they are the most resistant to the Eastern Filbert Blight disease which is present throughout Virginia. Exotic European or Asian hazelnuts often sold in garden catalogues may be vulnerable to this lethal disease.

Alder- The alders (genus *Alnus*) along with the hazelnuts, hornbeams, hophornbeams, and birches are in the birch family (Betulaceae). Most members of this family are fast growing streamside species that can colonize on even the most barren soils. Most alders are unique in the birch family in that they can fix atmospheric nitrogen. This trait allows them to fertilize themselves and allows for their rapid growth. They can grow in almost permanently water saturated ground. They are easily propagated from seed, which is naturally dispersed by water. Sow seeds on the soil surface or sow in a container and keep the growing media moist. Alders have been used in soil reclamation projects due to their ability to sequester various heavy metals. Our native speckled alder (*Alnus rugosa*) and smooth alder (*Alnus serrula*) are the best to use.

Willow- The willows (genus *Salix*) are perhaps the best known streamside woody plants. The weeping willow (*Salix alba*) is an exotic introduction to Virginia, serving as a popular ornamental for wet soil. The black willow (*Salix nigra*) is the best candidate for western Virginia stream sides. It is a widely found native and like all willows easy to propagate. Simply clipping off a branch and sticking it in moist soil will produce a new plant. Nearly all willows have the added benefit of secreting a rooting aid substance from their stems. Soaking cuttings of plants in willow water may significantly aid in their rooting.

Birch- Birches (genus *Betula*) are generally not associated with Virginia, with a few exceptions. Southern Appalachia has three common native birch species; the cherry or sweet birch (*Betula lenta*) and the yellow birch (*Betula alleghanensis*). Both species are "black birches" on account of their black bark. The third is the river birch (*Betula nigra*), which is common along streams and is also very common in the

nursery trade. Birches are fast growing and easily propagated from seed. Collect black birch seeds in autumn, when the cones shatter to release the seeds. Sow them on the surface of wet soil, as they need light to germinate. River birch seeds mature in summer and should be planted then. Even when mature, birch canopies remain relatively open and still permit significant undergrowth.

All birches produce excellent lumber and firewood and can be harvested for these purposes sooner than oak or maple species.

It is important to only rely on these three birch species. Exotic white bark birch species are generally less pest resistant and have been known to be affected by *juglone*, a plant growth inhibitor produced by the black walnut (*Juglans nigra*), a commonly found species in western Virginia. Exotic alders may similarly be affected and therefore only our native alders should be used.

Other Species- By no means should you limit your riparian system to aforementioned genera and species alone, but they can serve as an initial framework to allow other woody and herbaceous plants get established. The following is a more broad selection of plants well suited to Rockbridge County. An asterisk (*) indicates a species or genus producing valuable lumber or firewood. Selective harvesting, not clear cutting, should be the operating lumber harvesting practice near waterways to minimize erosion. Also, always investigate species to determine their toxicity to livestock when planting near pasture.

American Hornbeam (*Carpinus caroliniana*)*
American Plum (*Prunus americana*)
American Sweetgum (*Liquidambar styraciflua*)
American Sycamore (*Platanus occidentalis*)
Ashes (*Fraxinus* species)*
Black Cherry (*Prunus serotina*)*
Black Locust (*Robinia pseudoacacia*)*
Black Tupelo (*Nyssa sylvatica*)
Box Elder (*Acer negundo*)
Buttonbush (*Cephalanthus occidentalis*)
Canadian Hemlock (*Tsuga canadensis*)*
Northern Hackberry (*Celtis occidentalis*)
Paw Paw (*Asimina triloba*)
Possumhaw (*Ilex decidua*)
Red Maple (*Acer rubrum*)*
Red Mulberry (*Morus rubra*)
Serviceberries (*Amelanchier* species)
Sourwood (*Oxydendrum arboreum*)
Spicebush (*Lindera benzoin*)
Swamp White Oak (*Quercus bicolor*)*
Tulip Poplar (*Liriodendron tulipifer*a)
Common Witch-hazel (*Hamamelis virginiana*)

Where to find them- Nursery catalogues will commonly carry these plants, although for a higher price than elsewhere. The Virginia Department of Forestry is another good source. Financial resources are available to assist in the cost of planting Lastly, if you have a friend or neighbor with an already established riparian buffer ask if they can supply you with plant material.

Planting and Protection- When planting, keep in mind that although riparian habitats are partially intended to be a source of food and shelter for wildlife, early herbivore damage to young plants can severely damage or even kill them and prevent them from becoming well established. Providing protection in the form of tree tubes or cages made from livestock fence wire for the first few years of life can greatly enhance a plant's chances of playing a prolonged role in riparian habitats

APPENDIX C: Public Outreach

First Public Meeting Flyer

Community Meeting to develop a clean up plan for

BUFFALO, COLLIERS & CEDAR CREEKS

May 8, 2014
7:00-9:00 p.m.

Effinger Fire Hall
2824 Collierstown Road
Lexington, VA

Calling all Buffalo, Colliers and Cedar Creek Watershed Residents:

The Buffalo, Colliers and Cedar Creek watersheds include all of the land area that drains to the creeks when it rains. Over the next six months, The Virginia Department of Environmental Quality and partners will be working closely with interested watershed residents to develop a clean up plan for these creeks. Currently, the creeks are considered unhealthy due to high amounts of fecal bacteria in the water. This means that people face a greater chance of illness or infection when they go swimming in the creeks or get water in their eyes, ears or mouth. Large amounts of sediment in Colliers Creek are also negatively impacting aquatic life in the creek. Input from local residents is needed in order to figure out the best ways to address these problems in the creeks.

If you are interested in learning more about the issues facing the creeks and what local landowners can do to help, please join us!

For more information, contact:
Nesha McRae, VADEQ
(540) 574-7850
nesha.mcrae@deq.virginia.gov

DEQ
Virginia Department of Environmental Quality

First Public Meeting Public Notice and Press Release

Public Notice

DEPARTMENT OF ENVIRONMENTAL QUALITY

NOTICE OF PUBLIC MEETING AND PUBLIC COMMENT

The Department of Environmental Quality (DEQ) seeks written and oral comments from interested persons on the development of a Total Maximum Daily Load (TMDL) Implementation Plan for the Buffalo (North and South Forks), Cedar and Colliers Creek watersheds in Rockbridge County. These creeks were first listed as impaired on the Virginia's 303(d) TMDL Priority List and Report due to violations of the State's water quality standard for bacteria in 2002 (Cedar Creek), 2004 (Buffalo Creek, mainstem), 2006 (Colliers Creek), 2010 (South Fork Buffalo Creek) and 2012 (North Fork Buffalo Creek). The creeks have remained on the 303(d) list for these impairments since then. In addition, Colliers Creek was listed as impaired due to water quality violations of the general aquatic life (benthic) standard in 2010.

The impaired segments of the North and South Forks of the Buffalo and Colliers Creek extend from their headwaters down to their confluence with the mainstem of Buffalo Creek, 7.28, 13.24, and 13.77 miles, respectively. The impaired segment of Buffalo Creek extends 15.51 miles downstream to its confluence with the Maury River. The impaired segment of Cedar Creek extends 11.49 miles from the headwaters to its confluence with the James River.

Section 303(d) of the Clean Water Act and §62.1-44.19:7.C of the Code of Virginia require DEQ to develop TMDLs for pollutants responsible for each impaired water contained in Virginia's 303(d) TMDL Priority List and Report. In addition, Section 62.1-44.19:7.C of the Code of Virginia requires the development of an implementation plan (IP) for approved TMDLs. The IP should provide measurable goals and the date of expected achievement of water quality objectives. The IP should also include the corrective actions needed and their associated costs, benefits, and environmental impacts. Bacteria TMDLs were completed by DEQ for all of the creeks, and a benthic TMDL

addressing sediment was completed for Colliers Creek. The TMDLs were submitted to the Environmental Protection Agency for approval on January 2, 2014. The TMDL report is available on the DEQ website at: www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/DraftTMDLReports.aspx

The first public meeting on the development of this TMDL Implementation Plan will be held on **Thursday, May 8, 2014 at 7:00 p.m**. at the Effinger Fire Hall (2824 Collierstown Rd Lexington, VA).

The public comment period for the first public meeting will end on June 7, 2014. Written comments should include the name, address, and telephone number of the person submitting the comments and should be sent to Nesha McRae, Department of Environmental Quality, P.O. Box 3000, Harrisonburg, VA, 22801, telephone (540) 574-7850 or e-mailed to nesha.mcrae@deq.virginia.gov.

Press Release

May 8, 2014 Meeting to Discuss a Total Maximum Daily Load Implementation Plan for Buffalo, Colliers and Cedar Creeks; Rockbridge County, VA

A public meeting to discuss a water quality improvement plan for Buffalo, Colliers and Cedar Creeks will be held on Thursday, May 8th at the Effinger Fire Hall located at 2824 Collierstown Rd., Lexington, Virginia from 7:00 to 9:00 pm.

Buffalo, Colliers and Cedar Creeks were identified in Virginia's Water Quality Assessment Integrated Report as impaired for violations of *E.coli* bacteria water quality standard. This poses a human health risk for people having primary contact with the water (swimming, splashing water into your eyes, ears or mouth). Bacteria sources identified that may contribute to this impairment include failing septic systems, discharges of untreated human waste (straight pipes), wildlife, and agricultural practices in the area. In addition, Colliers Creek is receiving excessive amounts of sediment from

runoff and streambank erosion, which has left the creek unable to support a healthy and diverse population of aquatic life.

Representatives from the VA DEQ, and other state and local agencies will be on hand to outline efforts to develop a bacteria and sediment reduction plan for the impaired waterways. Participation from local residents in this planning process is a critical part of developing the improvement plan.

The water quality or implementation plan follows Total Maximum Daily Load (TMDL) studies completed in 2013 by the Virginia Department of Environmental Quality. The TMDL studies identified the sources of bacteria and sediment in these impaired watersheds.

The implementation plan will outline what is needed to reduce the sources of bacteria and sediment in the watersheds, their associated costs and benefits, along with measurable goals and an implementation timeline. Corrective actions (also known as best management practices) may include replacing failing septic systems, removing straight pipes, and reducing polluted runoff from agricultural and residential areas. Best management practices for agricultural sources can include streamside livestock exclusion fencing, rotational grazing, streamside plantings of trees or grasses on cropland and pasture, reforestation of erodible pasture and cropland, and planting of cover crops.

Participating in developing the implementation plan is an opportunity for local residents and stakeholders to improve and preserve water resources, increase farm production, and increase property values in the community. Strong local public participation ensures a final implementation plan driven by local input. Community involvement in the creation of the plan and support of its implementation are critical factors in determining its success in improving local water quality.

The public comment period on materials presented at this meeting will extend from May 8, 2014 to June 7, 2014. For additional information or to submit comments, contact Nesha McRae, at the Virginia Department of Environmental Quality, Valley Regional Office, P.O. Box 3000, Harrisonburg, VA, 22801, by phone (540) 574-7850 or by email nesha.mcrae@deq.virginia.gov.

First Public Meeting Landowner Invitation

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
VALLEY REGIONAL OFFICE
4411 Early Road, P.O. Box 3000, Harrisonburg, Virginia 22801
(540) 574-7800 Fax (540) 574-7878
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

Amy Thatcher Owens
Regional Director

April 21, 2014

«Title» «First_Name» «Last_Name»
«Address_corrected»
«City_corrected», «State» «Zip»

Dear «Title» «Last_Name»,
I am writing to invite you to a community meeting to kick off the development of a water quality improvement plan for Buffalo, Colliers and Cedar Creeks in Rockbridge County. The Virginia Department of Environmental Quality and partners including the Natural Bridge Soil and Water Conservation District will be holding the meeting on ***May 8, 2014 at 7:00 p.m. at the Effinger Volunteer Fire House*** (2824 Collierstown Rd., Lexington, VA). The water quality plan will be designed to reduce bacteria in the creeks, which are not meeting Virginia's water quality standard for *E. coli*. This poses a human health risk for people having primary contact with the water (swimming, splashing water in your eyes). In addition, Colliers Creek is receiving excessive amounts of sediment from runoff and streambank erosion, which has left the creek unable to support a healthy and diverse population of aquatic life. State law requires that these problems be addressed through a water quality improvement plan (known as a TMDL Implementation Plan). The development of this plan is the next step in a water quality improvement process that began with a study of these creeks in 2013. Many local residents participated in this process through community meetings and an advisory committee that guided the process of developing the study. We hope that they will remain involved during this next step.

Using local community input, we will develop a plan that can be implemented voluntarily by stakeholders in the watershed. We hope to draw from experiences that local landowners have had implementing conservation practices on their property and collect ideas on community outreach strategies. As a landowner along one of these creeks, your participation in the development of this plan is particularly important if we are to ensure that it includes strategies that the local community can support. During the meeting on the 8th, there will be a brief presentation explaining the planning process that we will use. Following the presentation, we will break out into smaller agricultural and residential working groups. This will be an excellent opportunity to share your thoughts on the types of actions that should be included in the plan, and the best ways to reach out to landowners in the community. We hope to see you there, please feel free to call me in the meantime if you have any questions.

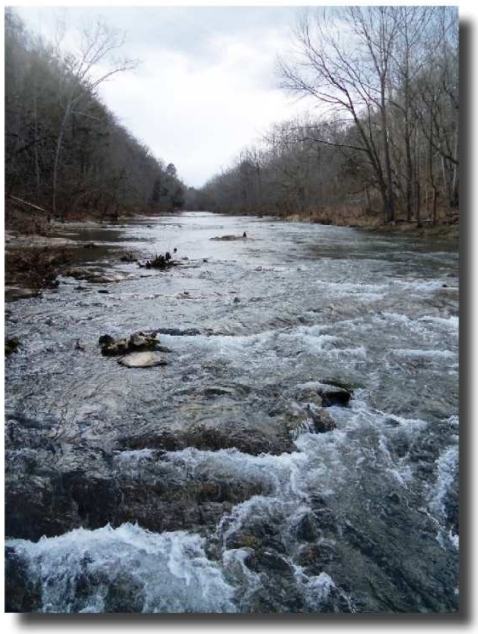
Sincerely,

Nesha McRae, Non Point Source TMDL Coordinator, VADEQ
Phone: (540)574-7850 Email: nesha.mcrae@deq.virginia.gov

Final Public Meeting Flyer

Community Meeting to present a clean up plan for

BUFFALO, COLLIERS & CEDAR CREEKS



October 28, 2014
6:00-8:00 p.m.

Natural Bridge Park and Historic Hotel
15 Appledore Lane
Natural Bridge, VA

Calling all Buffalo, Colliers & Cedar Creek Watershed Residents:

The Buffalo, Colliers and Cedar Creek watersheds include all of the land area that drains to the creeks when it rains. Currently, the creeks are considered unhealthy due to high amounts of fecal bacteria in the water. This means that people face a greater chance of illness or infection when they go swimming in the creeks or get water in their eyes, ears or mouth. Large amounts of sediment in Colliers Creek are also negatively impacting aquatic life in the creek. Over the past six months, the VA Department of Environmental Quality has been working with local residents to develop a plan to address these issues. This draft plan will be presented at the meeting, which will kick off a 30-day public comment period. The meeting will also include:

- **A community supper sponsored by the Upper James RC&D**
- **A presentation from students at Maury River Middle School**
- **Displays from project partners**

Please join us for a meal with friends and neighbors (free of charge) and a great opportunity to learn more about your local streams!

DEQ Virginia Department of Environmental Quality
Virginia Conservation Legacy Fund
Upper James RC&D
Natural Bridge Park and Historic Hotel

Please RSVP to:
Nesha McRae, VADEQ
(540) 574-7850
nesha.mcrae@deq.virginia.gov

Final Public Meeting Public Notice and Press Release

Public Notice

DEPARTMENT OF ENVIRONMENTAL QUALITY

NOTICE OF PUBLIC MEETING AND PUBLIC COMMENT

The Department of Environmental Quality (DEQ) seeks written and oral comments from interested persons on a draft Total Maximum Daily Load (TMDL) Implementation Plan for the Buffalo (North and South Forks), Cedar and Colliers Creek watersheds in Rockbridge County. These creeks were first listed as impaired on the Virginia's 303(d) TMDL Priority List and Report due to violations of the State's water quality standard for bacteria in 2002 (Cedar Creek), 2004 (Buffalo Creek, mainstem), 2006 (Colliers Creek), 2010 (South Fork Buffalo Creek) and 2012 (North Fork Buffalo Creek). The creeks have remained on the 303(d) list for these impairments since then. In addition, Colliers Creek was listed as impaired due to water quality violations of the general aquatic life (benthic) standard in 2010.

The impaired segments of the North and South Forks of the Buffalo and Colliers Creek extend from their headwaters down to their confluence with the mainstem of Buffalo Creek, 7.28, 13.24, and 13.77 miles, respectively. The impaired segment of Buffalo Creek extends 15.51 miles downstream to its confluence with the Maury River. The impaired segment of Cedar Creek extends 11.49 miles from the headwaters to its confluence with the James River.

Section 303(d) of the Clean Water Act and §62.1-44.19:7.C of the Code of Virginia require DEQ to develop TMDLs for pollutants responsible for each impaired water contained in Virginia's 303(d) TMDL Priority List and Report. In addition, Section 62.1-44.19:7.C of the Code of Virginia requires the development of an implementation plan (IP) for approved TMDLs. The IP should provide measurable goals and the date of expected achievement of water quality objectives. The IP should also include the corrective actions needed and their associated costs, benefits, and environmental impacts. Bacteria TMDLs were completed by DEQ for all of the creeks, and a benthic TMDL addressing sediment was completed for Colliers Creek. The TMDLs were submitted to the Environmental Protection Agency for approval on January 2, 2014. The TMDL report is available on the DEQ website at: www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/DraftTMDLReports.aspx

Development of the TMDL implementation plan began in May 2014.

The second and final public meeting on the development of this TMDL implementation plan will be held on ***October 28, 2014, from 6:00 – 8:00 p.m at the Natural Bridge Park and Historic Hotel (15 Appledore Lane, Natural Bridge, VA).*** The meeting will include a community supper, sponsored by the Upper James Resource Conservation and Development Council. Attendees are encouraged to RSVP to Nesha McRae by phone or email (contact information provided below). The implementation plan will be available on the DEQ website the day after the meeting for public comment:

http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/DraftTMDLReports.aspx

The public comment period for the Implementation Plan will end on November 27, 2014. Written comments should include the name, address, and telephone number of the person submitting the comments and should be sent to Nesha McRae, Department of Environmental Quality, P.O. Box 3000, Harrisonburg, VA, 22801, telephone (540) 574-7850 or e-mailed to nesha.mcrae@deq.virginia.gov.

Press Release

October 28, 2014 Meeting to Present a Water Quality Improvement Plan for Buffalo, Colliers and Cedar Creeks; Rockbridge County, VA

A community meeting to present a draft water quality improvement plan for Buffalo, Colliers and Cedar Creeks will be held on Tuesday, October 28th from 6:00 to 8:00 p.m. at the Natural Bridge Park and Historic Hotel, located at 15 Appledore Lane, Natural Bridge, Virginia. The meeting will include supper, sponsored by the Upper James Resource Conservation and Development Council and the Natural Bridge Park and Historic Hotel and provided free of charge to attendees. The VA Department of Environmental Quality will provide a summary of the plan after supper, followed by several speakers covering topics such as leasing of agricultural land in Rockbridge County, septic system maintenance, and water quality monitoring by 8th graders at Maury River Middle School. The meeting will conclude by 8:00 p.m.

Buffalo, Colliers and Cedar Creeks were identified in Virginia's Water Quality Assessment Integrated Report as impaired for violations of *E.coli* bacteria water quality standard. This poses a human health risk for people having primary contact with the water (swimming, splashing water into your eyes, ears or mouth). Bacteria sources identified that may contribute to this impairment include failing septic systems, discharges of untreated human waste (straight pipes), wildlife, and agricultural practices in the area. In addition, Colliers Creek is

receiving excessive amounts of sediment from runoff and streambank erosion, which has left the creek unable to support a healthy and diverse population of aquatic life.

The water quality improvement plan outlines what is needed to reduce the sources of bacteria and sediment in the watersheds, their associated costs and benefits, along with measurable goals and an implementation timeline. Corrective actions (also known as best management practices) include replacing failing septic systems, removing straight pipes, and reducing polluted runoff from agricultural land. Best management practices for agricultural sources include streamside livestock exclusion fencing, rotational grazing, streamside plantings of trees or grasses on cropland and pasture, reforestation of erodible pasture and cropland, and practicing no-till on cropland.

Representatives from the VA DEQ, and other state and local agencies will be on hand to talk with landowners about what they can do to help clean up the impaired waterways. Participation from local residents in the implementation of this voluntary plan will be critical to cleaning up these streams. Many local landowners have been offered their input and ideas throughout the process of developing this plan. This meeting is another opportunity for landowners and other interested stakeholders to offer their feedback and get involved.

The public comment period on materials presented at this meeting will extend from October 28, 2014 through November 27, 2014. For additional information or to submit comments, contact Nesha McRae, at the Virginia Department of Environmental Quality, Valley Regional Office, P.O. Box 3000, Harrisonburg, VA, 22801, by phone (540) 574-7850 or by email nesha.mcrae@deq.virginia.gov.

Final Public Meeting Landowner Invitation

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
VALLEY REGIONAL OFFICE
4411 Early Road, P.O. Box 3000, Harrisonburg, Virginia 22801
(540) 574-7800 Fax (540) 574-7878
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

Amy Thatcher Owens
Regional Director

October 6, 2014

«Title» «First_Name» «Last_Name»
«Address_corrected»
«City_corrected», «State» «Zip»

Dear «Title» «Last_Name»,
Over the past five months, the Virginia Department of Environmental Quality and partners have been working with landowners in your community to develop a plan to restore Buffalo, Colliers, and Cedar Creeks and their tributaries. This draft plan will be presented at a community meeting on ***October 28th, 2014 at 6:00 p.m. at the Natural Bridge Park and Historic Hotel*** (15 Appledore Lane, Natural Bridge). The Upper James Resource Conservation and Development Council will be sponsoring a community supper at the meeting (so come hungry for a free meal!), and students from Maury River Middle School will be sharing information about the work that they have done to monitor water quality in the streams. Attendees will also hear from speakers about leasing of agricultural land in Virginia and septic system maintenance needs. Local partners in this effort will be setting up displays at the meeting, which will be a great chance to learn about the resources available to support restoration.

Buffalo, Colliers, and Cedar Creeks are on Virginia's list of impaired waters because they violate the state's water quality standard for bacteria. Levels of bacteria found in these streams could lead to an increased risk of illness or infection for people who come into direct contact with the water (*e.g.* water in the eyes, ears, mouth). Bacteria sources identified in the streams include failing septic systems and straight pipes, pets, and agricultural practices in the area. In addition, Colliers Creek is on the impaired waters list due to its failure to support a healthy and diverse population of aquatic life. Studies have determined that this is due to excessive sediment in the stream. This sediment covers the stream bottom and destroys critical habitat for aquatic life. Sediment is transported to the stream in runoff from the land.

Strong community participation in this effort helped to ensure that the final implementation plan was driven by local input. During the meeting on October 28th, the plan will be presented to the community, kicking off a 30-day comment period during which anyone can offer suggested changes or comments. As a landowner in the watershed, your participation in the implementation of this plan is absolutely critical. We hope that you will be able to join us for a good meal and a great information exchange! We are asking those who think they will attend to RSVP so that we can get a head count for supper.

Sincerely,

Nesha McRae, Non Point Source TMDL Coordinator, VADEQ
RSVP by phone or email: Phone: (540)574-7850 Email: nesha.mcrae@deq.virginia.gov

APPENDIX D: Public Comments

Response to Comments Document for Buffalo, Colliers and Cedar Creeks TMDL Implementation Plan Development

Introduction:

A final public meeting was held for the Buffalo, Colliers and Cedar Creeks TMDL Implementation Plan on October 28, 2014. This project included the development of a series of implementation scenarios to meet the *E.coli* bacteria TMDLs for Buffalo Creek and its tributaries (Colliers Creek, South Fork Buffalo Creek, and North Fork Buffalo Creek) and Cedar Creek, and the sediment TMDL for Colliers Creek, in addition to incremental water quality milestones. The draft implementation plan was presented at the meeting and made available on the Virginia Department of Environmental Quality (DEQ) website at that time. A 30-day public comment period on the draft plan was held from October 28 until November 27, 2014. During the public comment period, comments were received from Ms. Elise Sheffield, Education Director at Boxerwood Education Associate. The full text of the original comments and DEQ's responses to those comments are provided below.

Comments from Ms. Elise Sheffield (Received November 24, 2014):

Dear Nesha,

Boxerwood commends DEQ and the citizen task teams for creating this thoughtful and positive plan for improving water quality in the Colliers Creek, Cedar Creek, and Buffalo Creek watersheds. As some people at DEQ are aware, Boxerwood is a locally-focused education association primarily focused on helping people become better stewards of the earth. A major thrust of our outreach efforts are watershed education programs and water monitoring programs for public school students throughout the Rockbridge area.

While our help is indirect, we remind the task team that we have direct connections with many Rockbridge schools, classrooms, and teachers as well as partner organizations. It is possible, through some of these relationships, that we could support the work of this TMDL plan through public education efforts such as student-generated fliers or videos about the project, about septic clean-outs, or about BMPs. These projects would thus both educate students (and their families) who live in these watersheds, as well as the targeted general audience.

Coordination of these educational efforts, of course, requires investment in organizational time and some resources. Therefore, it would be ideal if there were a modest educational outreach component to the implementation package. We can also imagine some additional educational partnerships with DEQ that could engage focused groups of local high school students in more advanced monitoring, mapping, or public education. Finally, we note that the designated annual trout release site from a Trout in the Classroom program at Maury River Middle School is Colliers Creek at Effinger, an example of school interest and investment in ensuring healthier waters for all. In sum, we see educational opportunities arising within the TMDL project and would like that component and budgeting for it to be included within the final report.

Respectfully,

Elise Sheffield

Education Director

DEQ Response to Ms. Sheffield:

Dear Ms. Sheffield,

Thank you for your comments on the Buffalo, Colliers and Cedar Creek Water Quality Improvement Plan and your active engagement in the planning process. Boxerwood has been an excellent partner in this effort, and we look forward to collaborating with your organization in this next step of the process (implementation). Your comments will be incorporated into the final technical document for this project, which is available upon request. In addition, the education and outreach strategies that you have suggested have been incorporated into the "Education and Outreach" section of the public document.

The information that you have shared with us regarding Boxerwood Education Association's capacity to assist with education and outreach efforts in support of TMDL implementation in the watersheds was very helpful in better defining potential partner roles. Active engagement of local students in water quality monitoring as well as general outreach efforts regarding best management practices to improve the quality of these streams could play an important role in compelling landowners to implement these practices. Boxerwood's excellent working relationships with Rockbridge County schools could serve as a highly effective tool in facilitating this level of student involvement. While this outreach activity was detailed in the water quality improvement plan following receipt of your comments, an associated cost has not been assigned as DEQ does not typically budget for each recommended outreach strategy for these plans. However, a budget for staff time, travel, supplies etc. could be developed in support of funding proposals during the implementation phase of this project.

Your active participation in the development of this plan has been quite valuable to us in identifying tools for local engagement. We look forward to continuing to work with your organization as we move forward with implementation!

Very best,

Nesha McRae

Non Point Source TMDL Coordinator
DEQ Valley Regional Office