Beaver Creek and Little Creek Water Quality Implementation Plan

Washington County and City of Bristol, Virginia
(Bacteria and Sediment TMDLs)

Submitted to
The Stakeholders of
Beaver Creek and Little Creek Watersheds

Prepared by:
Virginia Department of Conservation and Recreation
in cooperation with the Virginia Department of Environmental Quality

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Also available for this project:
Total Maximum Daily Load Implementation Plan for Beaver Creek (Aquatic Life Use Benthic and *E. coli* TMDLs) and Little Creek (Fecal Coliform TMDL) Technical Report. *MapTech, Inc., Blacksburg, Virginia developed the Technical Report in cooperation with Virginia Department of Conservation and Recreation.

Acknowledgements:

Many representatives of various groups and private citizens contributed to the development of this plan. Representatives from the following agencies and groups played a critical role in this project:

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1.0 EXECUTIVE SUMMARY

Beaver Creek and Little Creek were listed as impaired on Virginia's *1998 303(d) Total Maximum Daily Load Priority List and Report* (VADEQ, 1998) due to violations of the State's water quality standards for fecal coliform. Neither stream supports primary contact recreation (*e.g.*, swimming, wading, and fishing). Beaver Creek also had violations of the General Standard (benthic), which means the stream does not adequately support aquatic life. As a result of the listings and court actions taken against the United States Environmental Protection Agency (EPA), total maximum daily load (TMDL) studies were completed (Beaver Creek Aquatic Life use and *E. coli* TMDL, George Mason University and Tetra Tech, Inc., April 2004 and Little Creek fecal coliform TMDL, The Louis Berger Group, Inc., June 2002) which established the reduction in loads needed to restore these waters. Virginia law requires a plan be developed to achieve fully supporting status for impaired waters. In fulfilling the state's requirement for the development of a TMDL Implementation Plan (IP), a framework was established for reducing fecal bacteria levels to achieve the water quality goals for the impaired streams.

Review of TMDL Development

Water quality modeling conducted in support of the TMDL studies considered fecal bacteria loads in runoff resulting from wildlife (*e.g.*, deer, raccoon, muskrat, beaver, turkey, goose, mallard, and wood duck), livestock (*e.g.*, beef, dairy, sheep, goat, and horse), residential (*e.g.*, failing septic systems, straight pipes, pets), and urban sources (Beaver Creek only). Direct loads to the stream (including direct deposition from cattle and wildlife), uncontrolled discharges (failing septic systems and straight pipes), and permitted sources were also modeled. The *E. coli* geometric mean standard (126 cfu/100 mL) and instantaneous standard (235 cfu/100 mL) were used as the water quality endpoints for the Beaver Creek fecal bacteria TMDL. The fecal coliform geometric mean standard (200 cfu/100 mL) with a 10 % Margin of Safety (MOS) was used as the water quality endpoint (190 cfu/100 mL) for the Little Creek fecal bacteria TMDL. The Beaver Creek TMDL determined the stressor causing the aquatic life impairment is sediment. Existing sediment loadings to the stream must be reduced by 55% to meet the sediment TMDL.

The TMDL results dictate all uncontrolled discharges must be identified and corrected, livestock must be excluded from streams, reductions will be required from urban/residential and agricultural land runoff (Beaver Creek only), and a majority of the direct deposition from wildlife must be reduced. Wildlife direct deposition will not be explicitly addressed by this implementation plan. All efforts will be directed at controlling anthropogenic (human induced) sources. Sediment loads must be reduced from pasture, cropland, residential and urban land uses in Beaver Creek.

Public Participation

The actions and commitments described in this document were drawn together through input from citizens of the watershed, Washington County and City of Bristol governments, Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Environmental Quality (VADEQ), Virginia Department of Health (VDH), Tennesse Valley Authority (TVA), Natural Resources Conservation Service (NRCS), the Holston River Soil and Water Conservation District (HRSWCD), MapTech, Inc, and other organizations. Every citizen and interested party in the watershed is encouraged to become involved in implementing the IP to help restore the health of the streams. Public meetings were conducted to distribute information, gain feedback, and solicit participation in smaller forums.

The working groups were comprised of stakeholders with similar concerns (*e.g.*, agricultural, residential, and governmental). Representatives from each working group participated in the Steering Committee. Input from the working groups was reviewed and decisions about the IP were made. Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), BMP specifications, locations of control measures, education, technical assistance, and funding.

Varied opinions were voiced throughout the public participation meetings regarding the IP process. Most members of the working groups agreed the cornerstone of an implementation plan is cultivating public involvement and education as well as encouraging commitment and partnerships between the citizens in the watershed and government agencies in order to attain the water quality goals.

Assessment of Implementation Action Needs

The quantity of control measures, or BMPs, required during implementation was determined through spatial analyses of land use, stream-network, and the United States Department of Agriculture (USDA) Common Land Unit (CLU) layer along with regionally appropriate data archived in the VADCR Agricultural BMP Database. Additionally, input from local agency representatives was used to verify the analyses. Overall, there is need for a twelve-year implementation period to implement the BMPs listed in Table ES.1 and to attain water quality standards.

Table ES.1 The types and quantities of BMPs recommended for Beaver Creek and Little Creek watersheds.

Control Measure (BMP)	Units	Beaver Creek	Little Creek
Residential BMPs (High and Low Intensity Residential):			
Septic System Pumpout	System	200	60
Total Failing Septic System Corrections:	System	383	34
Standard Septic System Repaired	*System*	*172*	*25*
New Standard Septic System Installed	*System*	*77*	*7*
New Alternative System Installed	*System*	*19*	*2*
Sewer Connection	*System*	*115*	*0*
Total Straight Pipe Corrections:	System	20	1
New Standard Septic System Installed	*System*	*10*	*1*
New Alternative System Installed	*System*	*4*	*0*
Sewer Connection	*System*	*6*	*0*
Residential Education Program	Program	1	0
Infiltration Trench	Acre-Treated	750	0
Rain Garden	Acre-Treated	138	0
Retention Ponds	Acre-Treated	747	0
Enhanced Erosion & Sediment Control	Acre-Treated	100	0
Vegetated Stream Buffer	Buffer Acre	173	0
Urban BMPs (Commercial and Urban Recreational):			
Bioretention Filter	Acre-Treated	600	0
Infiltration Trench	Acre-Treated	337	0
Rain Garden	Acre-Treated	350	0
Retention Ponds	Acre-Treated	335	0
Stormwater Collection System Retro-fits	Acre-Treated	15	0
Street Sweeping	Lane Miles/Year	7,200	0
Vegetated Stream Buffer	Buffer Acre	138	0
Agricultural BMPs (Pasture/Hay, Cropland, Barren/Trans):			
Livestock Exclusion:	System	242	*67*
SL-6	*System*	*235*	*66*
WP-2T	*System*	*7*	*1*
Hardened Crossing	*System*	*99*	*27*
Vegetative Cover:	Acre	211	0
Permanent Vegetative Cover on Cropland (SL-1)	*Acre*	*75*	*0*
Protective Cover for Specialty Cropland (SL-8)	*Acre*	*136*	*0*
Improved Pasture Management	Acre	8,505	0
Manure Incorporation	Acre	110	0
CREP / Vegetated Buffer	Buffer Acre	16	0

Cost/Benefit Analysis

Unit costs for control measures were determined through analysis of control measures previously installed through the Virginia Cost-Share Program by the HRSWCD, discussion with local agency representatives, and working groups. The cost of technical assistance was determined through discussion with working group members. The estimated total cost to install agricultural, residential, and urban control measures in the Beaver Creek watershed is $4.85 million, $9.2 million, and $11.2 million, respectively, excluding technical assistance. The estimated total cost to install agricultural and residential control measures in the Little Creek watershed is $1.2 million and $169,875, respectively, excluding technical assistance. The estimated total cost to provide technical assistance during implementation is expected to be $1.05 million. The total cost estimated is $27.6 million.

The primary benefit of implementation is the reduction of fecal bacteria in both streams and sediment in Beaver Creek. With the completion of this IP, the risk of fecal bacteria illness through swimming or drinking water from these streams will decrease and aquatic life in Beaver Creek can recover. The practices recommended in this document will provide economic benefits to the landowner in addition to the anticipated environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, and intensive pasture management will improve profitability of farms, while private sewage system installation and maintenance will ultimately save homeowners money by preventing expensive fees and repairs.

Measurable Goals and Milestones for Attaining Water Quality Standards

State and EPA guidance requires IPs to identify the BMPs necessary to meet the TMDL source allocations. EPA guidance also requires that there is a "reasonable assurance" that implementation will be completed. The requirement of "reasonable assurance" implies that a staged scenario be developed in the case that full implementation requirements are not practical or reasonable in current conditions, consequently, implementation is divided into stages. Implementation in the Little Creek and Beaver Creek watersheds is scheduled to occur in three main stages. The first stage involves implementation of the most cost-effective control measures.

Stage I for Little Creek will be obtained in three years wherein 45% of the agricultural and 40% of the residential BMPs are implemented. Stage I is expected to be 44% of the total cost of implementation for reaching 25% of the total bacteria load reduction necessary. Stage II is obtained by year five during which the remaining BMPs are completed and fence maintenance will be conducted. For the Beaver Creek implementation, Stage I will be completed in 5 years with the goal of 100% installation of all agricultural BMPs, 60% installation of all urban and residential BMPs, and the residential education program in place. Stage I is expected to be 68% of the total cost of implementation for reaching 99.6% and 80.4% of the bacteria and the sediment load reductions, respectively. Stage II will focus on completing the remaining 40% of the urban and residential BMPs and will include streamside fence maintenance. Finally, Stage III is an additional five-year period for assessment of stream conditions, in which the streams are expected to recover and attain the stated water quality goals.

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

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

The funding sources expected to play the largest role in implementation are the Federal Clean Water Act 319 Incremental Funds and the Virginia Agricultural BMP Cost-Share and Tax Credit Programs.

Stakeholders and Their Role in Implementation

Implementation progress success will be determined by monitoring conducted by VADEQ through the agency's monitoring program. The HRSWCD will be in charge of initiating contact with farmers and homeowners in the impaired watersheds to encourage the installation of agricultural and residential BMPs. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The HRSWCD staff plans to conduct a number of outreach activities in the watershed to promote participation and community support to obtain the implementation milestones and to improve community awareness of the TMDL requirements. Such activities will include information exchange through newsletters, mailings, field days, organizational meetings, etc. The HRSWCD staff will work with appropriate organizations (such as VDH) to educate the public.

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. The agencies regulating activities impacting water quality in Virginia includes VADEQ, VADCR, Virginia Department of Agriculture and Consumer Services (VDACS), and VDH.

Achieving the goals of this IP (*i.e.*, improving water quality and removing these waters from the Section 303(d) list) are dependent on stakeholder participation – not only the local citizens needing agricultural control measures or residential control measures, but all citizens living in the watershed. It must be acknowledged first that there is a water quality problem, and changes must be made as needed in operations, programs, and ordinances to address these pollutants.

2.0 INTRODUCTION

The Virginia Department of Environmental Quality (VADEQ) monitors water bodies throughout the state to determine if waters meet water quality standards and support their designated uses. The United States EPA, through Section 303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations, requires states to develop a Total Maximum Daily Load (TMDL) study for any water body found to be impaired, or exceeding a water quality standard. These TMDL studies identify the sources of impairment and reductions needed in those sources in order to bring the water body into compliance with water quality standards. § Section 62.1-44.19:7 of Virginia's 1997 Water Quality, Monitoring, Information and Restoration Act (WQMIRA) "requires the development of an implementation plan (IP) following the completion of a TMDL to achieve fully supporting status for impaired waters". A TMDL IP provides a detailed outline of suitable best management practices (BMPs) and strategies that may be implemented in order to meet water quality standards. BMP strategies are developed with input from the local community.

3.0 STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

Currently, TMDL implementation plans are not required in the Federal Code; however, Virginia State Code does incorporate the development of implementation plans for impaired streams. There are a number of state and federal requirements and recommendations for TMDL IPs. These requirements and recommendations serve to create a plan that outlines a clear, detailed and working solution to water quality impairments.

This implementation plan is designed to meet the requirements of Virginia's 1997 Water Quality Monitoring Information and Restoration Act (WQMIRA). It is also designed to meet the recommendations of an approvable IP in EPA's "Guidance for Water Quality-Based Decisions: The TMDL Process" (USEPA, 1999) along with EPA's requirements for Section 319 nonpoint source grants to States. These requirements and recommendations are discussed in greater detail in the technical report.

4.0 REVIEW OF TMDL DEVELOPMENT

Beaver Creek and Little Creek watersheds are located in Washington County and the City of Bristol, Virginia. Water from Beaver Creek and Little Creek flows into South Fork Holston River eventually flowing into the Tennessee River and the Gulf of Mexico.

Beaver Creek is impaired for approximately 13.46 miles from near its headwaters to the Virginia/Tennessee state line. The Virginia portion of Beaver Creek watershed is approximately 22,654 acres, which represents 32.3% of the entire watershed (70,074 acres in Tennessee and Virginia). Beaver Creek watershed is comprised of urban/residential (32%), agricultural (41%), and forest (27%) land uses.

As Little Creek flows through the City of Bristol it is a watershed comprised of rural and urban settings. Little Creek is impaired along a 13.69-mile stretch extending from its headwaters to the confluence with the Holston River. The Little Creek watershed is approximately 5,520 acres, dominated by forest (42%), agricultural (31%), and urban/residential (27%). A complete characterization of the watershed is presented in the technical report.

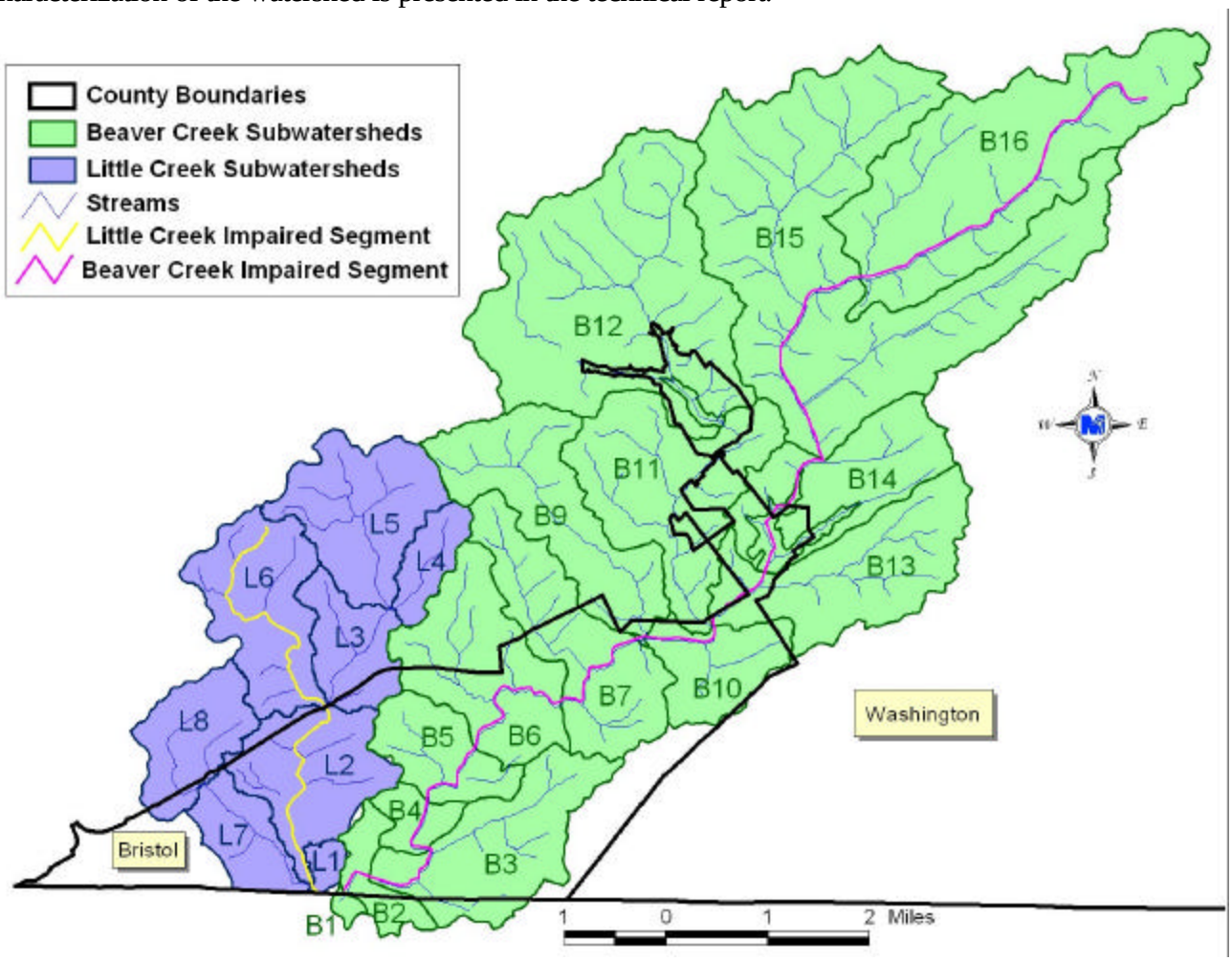

Figure 4.1 Subwatersheds in Beaver Creek and Little Creek Watersheds

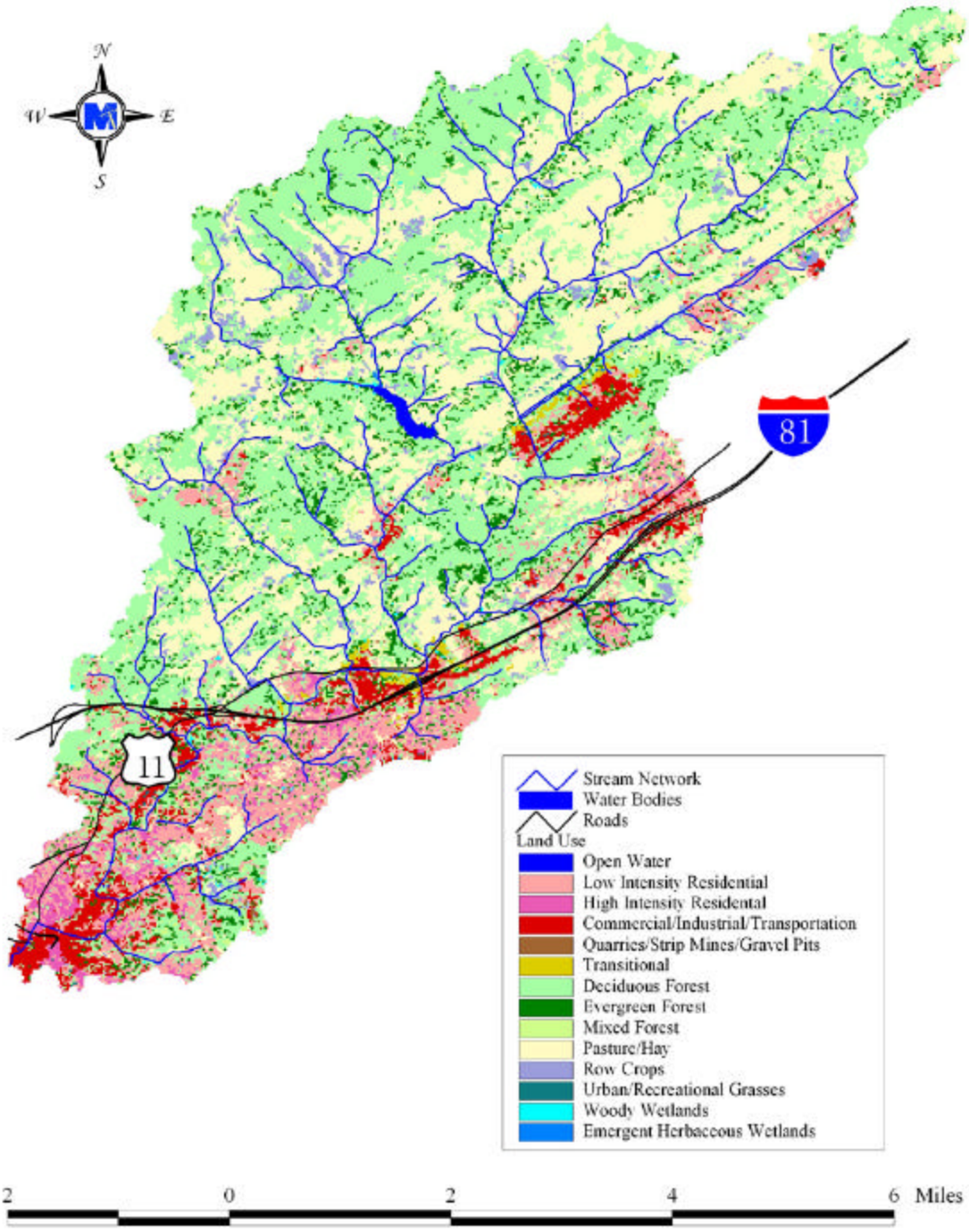

Figure 4.2 Land uses in the Beaver Creek watershed.

5.0 PUBLIC PARTICIPATION

The actions and commitments described in this document are drawn together through input from citizens of the watersheds, Washington County, City of Bristol, VADCR, VADEQ, VDH, VDOT, Natural Resources Conservation Service (NRCS), Holston River Soil and Water Conservation District (HRSWCD), Beaver Creek Alliance, Boone Watershed Partnership, Upper Tennessee River Roundtable, Tennessee Valley Authority, and others. Every citizen and interested party in these watersheds is encouraged to become involved in the implementation of this plan and contribute whatever resources available to help restore the health of these streams.

Public Meetings

Public participation in the IP development took place on three levels. First, a public meeting was held on September 22, 2005 to inform local stakeholders about the end goals of the project and solicit participation in smaller, more targeted working group meetings. The final public meeting was held on December 7, 2006 to discuss the proposed reductions in fecal bacteria and sediment needed and to present the draft implementation plan to the stakeholders. The public comment period for this phase of the IP development will end on January 12, 2007.

The second opportunity for public input was through the steering committee formed with representation from working groups, watershed citizens, agency representatives and local government representatives. The steering committee met on November 30, 2006 with 19 members present. The purpose of the steering committee is to assimilate the recommendations of the working groups into the IP and guide the overall development of the final IP document. This committee will also serve to evaluate the implementation progress and advise on any modifications to the plan in the future.

Thirdly, three working groups were formed from people with common interests and concerns regarding the implementation process. The agricultural, residential/urban and government working groups provide an arena for direct citizen and local agency input in the development of the IP. Each group met at least twice between January and October 2006. Over 270 man-hours were devoted to participating in the working groups.

Each working group discussed the type, location and cost of BMPs needed to meet the water quality goals set forth in the TMDLs and how to promote those practices. The following sections summarize the findings and recommendations of each working group. The full reports from each working group are available in the technical report available from VADCR.

Working Groups

Agricultural Working Group

Three agricultural working group (AWG) meetings were held for the Beaver Creek and Little Creek IP. The meetings were on the following dates: November 2, 2005, January 26, 2006 and July 13, 2006 with a total of 22 participants. The time for each meeting was from 7:00 p.m. until 9:00 p.m.
Topics Discussed:

- Best management practices
- Existing constraints
- Recommendations to increase participation
- Educational outreach
- Staffing needs

Recommendations:

Demonstration of a Mini CSP (Conservation Security Program): The AWG would like to develop a "Mini CSP" demonstration project in the Beaver Creek watershed.

Virginia-Tennessee Project

- Due to the number of citizens from the Tennessee side of the watershed, the AWG stated that a sub-committee of the government working group or Steering Committee should work with setting up projects on both sides of the state line.
- HRSWCD is willing to invite the Tennessee side of SWCDs and TDEC (Tennessee Department of Environmental Conservation) to determine how to address the water quality in Beaver Creek and Little Creek.
- Potential Partners: TVA, Tennessee SWCDs, TDEC, Beaver Creek Alliance, Boone Watershed Partnership and City of Bristol

Residential/Urban Working Group

Three working group meetings were held for the Beaver Creek and Little Creek IP. The meetings were on the following dates: November 10, 2005, January 26, 2006 and July 13, 2006 with a total of 19 participants. The time for each meeting was from 7:00 p.m. until 9:00 p.m. During the establishment of the Beaver Creek and Little Creek working group, the stakeholders felt comfortable with the suggestion to combine the residential and urban working groups into one group.
The following key topics and recommendations resulted from the RUWG meetings.

- Outreach and education: Develop short presentation for local radio stations, TV stations (WCYB) and newspapers
- Bulleted colored paper summarizing implementation plan as newspaper circular
- Sample septic tank pumpout and invite public and media
- Research local civic or community group to sponsor workshops that need to be part of the outreach program. The working group felt that rain barrel and rain gardens are excellent demonstration projects in Southwest Virginia.

Government Working Group

Two Government working group meetings were held for the Beaver Creek and Little Creek Implementation Plan. The meetings were on November 10, 2005 and April 25, 2006 with a total of 17 participants. The overall goal and responsibility of the Government Working Group (GWG) was to address the sources of bacteria and sediment from multiple land uses.

The following items were goals for the GWG:

- Identify funding sources
- Identify available technical resources
- Evaluate and develop monitoring component
- Identify regulatory controls currently in place
- Identify potential parties to be responsible for agricultural, residential, and urban implementation

Communication between Holston River SWCD and City of Bristol during implementation is vital. SWCD is not precluded to areas in their service areas such as the City of Bristol because they are a SWCD as well as a TMDL contractor that can assist anyone in the TMDL watershed IP area. The City of Bristol is very open to an opportunity to work with technical partners.

At the present time there is not a pet waste ordinance for the City of Bristol. Sugar Hollow Park was mentioned as a potential site for "Dooty Stations" and signage to address removing pet litter from public areas VDH stated there should be a monitoring process for identifying pet waste reductions.

GWG recommended the implementation plan should state that technical staff from the SWCD and/or Washington County need to work with the Virginia Department of Forestry to encourage increased logging inspections and BMPs on sites where needed.

Educational Outreach

The Three Creeks TMDL Project has had great success with minimizing distrust of governmental agencies in Washington County. The GWG suggested this effort should continue in a combined effort to get citizens to understand the Holston River SWCD is there to assist stakeholders and sell the Beaver Creek and Little Creek IP as a positive opportunity

Due to the history of the watershed, a Beaver Creek and Little Creek TMDL Implementation kick-off meeting should be scheduled with the intended audience being homeowners, developers, landowners and farmers. Educate homeowners on the types of wastewater systems; what they may have (septic, straight pipe, or public sewer), maintenance schedules; pumpouts and when they are applied. There is a need for a strong outreach campaign to educate the development community about the ESC and stormwater permitting process. In order to be successful, workshops need to target the right people. GWG suggested a LID (Low Impact Develop) workshop be held in conjunction with the TMDL IP kick off meeting. There is a strong real estate influence in the watersheds. The real estate agents are mainly interested in information for transactions, water supply, septic/sewer and radon. GWG recommended setting up an outreach effort to real estate agencies about straight pipes, failing septic systems, etc. because of their lack of knowledge of sewage issues.

Potential Project Site Locations and Outreach Ideas:

- Hiking/biking trails as an overlay with stream restoration in the downtown area as well as bringing funding and partnerships together.
- GWG recommended identifying sites for stabilization for the residential/urban land uses.

Wastewater

Wastewater was a heavily discussed topic of discussion. Two major areas that were identified by the VDH within the impaired watersheds that for large wastewater issues:

- Public sewage does not exist across the road from the VDH office on Lee Highway
- Commercial areas include a number of old hotels and a mobile home park. (Catalina Hotel/Apartments, Lowery Hills Tri-city Trailer Park) According to the VDH, it will be difficult to remove the wastewater problem in the mobile home park.

Bristol Virginia Utilities Board (BVUB) conducted a study in the late 1980's. Using that information, BVUB has been continually repairing sewer lines since then. Within the watersheds there is still a need for sewer line extensions but there is still a great emphasis on septic tanks and the cost of public sewer.

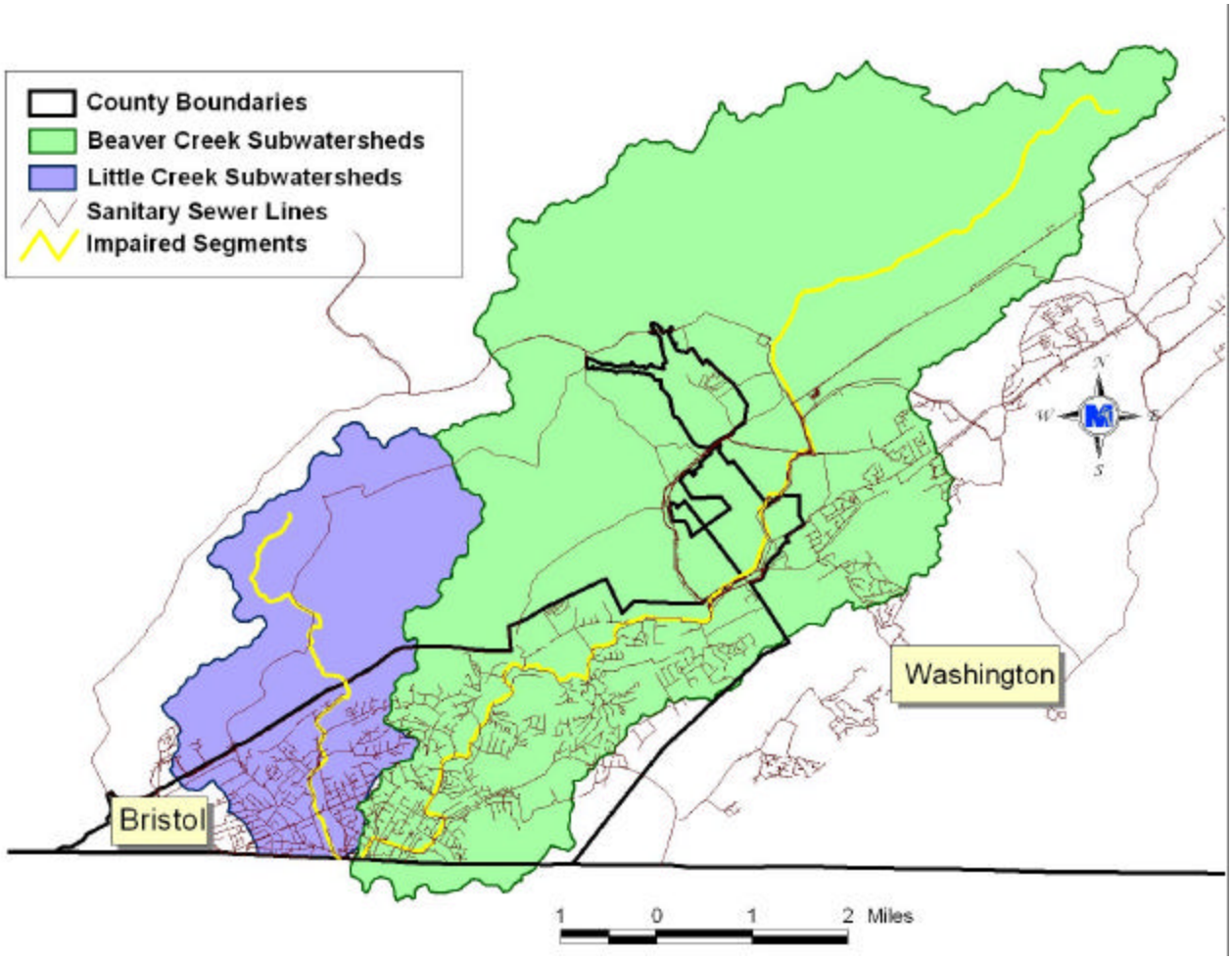

Figure 5. Present sanitary sewer lines in Washington County and City of Bristol

Wastewater Regulations

Sewage Handling and Disposal Regulations

Alternative systems and technology to address wastewater are being allowed in certain parts of the state based on performance, soils and geographic regions. There is more information from private industries on these types of systems. There is information on the monitoring of these systems from the VDH state-tracking program "Venus". The tracking system has been setup for four years and can be queried for home sewage systems, rabies, soils, and wells.

- GWG suggested the wastewater regulations for house purchase should be more stringent. Septic tank pump out is required when a house is transferred. (Inspection of systems, approved system, etc.) If it is an older house and is a straight purchase (no lending agency or real estate agency) pump out is not required. Certified Septic Inspections follow NEHA (National Environmental Health Association) any inspection can be completed from the streambank.
- GWG encouraged developing a local ordinance requiring a pump out before transaction of the property.

During a recent discussion with Washington County, there may not be an additional STP (Sewage Treatment Plant) or additional capacity to the Town of Abingdon STP to add 121 sewer lines connections in Beaver Creek Watershed.

Urban

In order to address the sediment and stormwater in the watershed, different types of BMPs (Best Management Practices) will need to be implemented. BMPs that address stormwater include rain gardens, vegetative buffers, and retention basins. In addition to BMPs, the City of Bristol has a street sweeper but there is a need for additional street sweepers to reduce pollution and minimize substances going into storm drains.

6.0 IMPLEMENTATION ACTIONS

A major element of the TMDL IP is the identification of implementation actions by local, state, and federal government agencies, business owners, and private citizens to attain the water quality goals. Information was obtained on the types of actions and program option available to achieve the goals practically and cost-effectively. This section outlines the methods used to identify practical and effective BMPs and quantify the BMPs needed to meet water quality goals.

Identification of Control Measures

Potential control measures, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from working groups, and literature review. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts. Measures that can be promoted through existing programs were identified, as well as those not currently supported by existing programs and their potential funding sources.

The assurance of implementation of specific control measures was assessed through discussion with the working groups and steering committee. Some control measures were indicated or implied by the TMDL allocations, while others were selected through a process of stakeholder review and analysis of effectiveness in these watersheds. These measures are discussed in greater detail in the technical report.

Control Measures Implied by the TMDL

The allocations determined during the TMDL development dictate some of the control measures that must be employed during implementation. In order to meet the 99-100% 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. The 100% reduction in loads from straight pipes, failing septic systems, sewer leaks, and sewer overflows is a pre-existing legal requirement as well as a result of this TMDL. This reduction indicates all illicit discharges (*i.e.*, straight pipes and cross-connections) in the watersheds should be corrected, and all existing onsite sewage treatment systems (OSTS) (*e.g.*, septic systems and alternative waste treatment systems) and sewer infrastructure must be maintained in proper working condition.

While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, it was determined any fencing installed through the use of cost-share programs should follow established NRCS (Natural Resource Conservation Service) Field Office Technical Guide (FOTG) specifications and be located 35-ft from the stream bank, at a minimum, as is specified in existing Virginia cost-share programs. Voluntary fencing will be encouraged as well, and implementation will be tracked and reported towards attaining implementation plan goals.

An alternative water source will typically be required where pasture is fenced off from streams. The main criterion is that the system be dependable. Water systems alone (*i.e.*, with no streamside fencing) have been shown to reduce the amount of time cattle spend in the stream by as much as 50 to 80%.

This is not a large enough reduction to meet the TMDL, however it has been recognized some farmers may be willing to install their own fence to their own specifications if cost-share money is available for the water system. It should be restated here the recommendation is that all fence, even that which is installed solely at the landowner's expense, be placed at least 35-ft from the stream. The inclusion of a buffer helps to reduce bacteria, as well as sediment, loads in runoff. The incorporation of effective buffers could reduce the need for more costly control measures. From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production could be contrary to that goal.

Additionally, intensive pasture management, which becomes possible with an alternative water source, has been shown to improve overall farm profitability and environmental impact. From a part-time farmer's perspective, the best management scenario is one that requires minimal input of time. This would seem to preclude intensive pasture management; however, those farmers who have adopted an intensive pasture-management system typically report that the additional management of the established system amounts to "opening a gate and getting out of the way" every couple of days. Furthermore, the efficient use of the pasture often means fewer supplemental feedings are necessary. Among both part-time and full-time farmers there are individuals who are hesitant to allow streamside vegetation to grow unrestricted because of aesthetic preferences or because they have spent a lifetime preventing this growth. However, given the reductions needed in pollutant (*i.e.*, fecal bacteria and sediment) delivery to the stream, a vegetated buffer will be needed. For planning purposes, it was assumed that a vegetated buffer would be established in conjunction with stream fencing. Correction of sewer overflows and leaks is an ongoing effort of the entities charged with the maintenance and operation of these systems. A more detailed description of these efforts can be found in the technical report. The options identified for correcting illicit discharges and failing septic systems included: repair of an existing septic system, installation of a septic system, and installation of an alternative waste treatment system. It is anticipated that some portion of straight pipes (that will be removed) 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.

Control Measures Selected through Stakeholder Review

In addition to the control measures that were directly indicated by the TMDL, a number of measures were needed to control fecal bacteria and sediment from land-based sources. Various scenarios were developed and presented to working groups. All scenarios began with implementation of the measures indicated by the TMDL. Next, specific sources of fecal bacteria were addressed where highly economic practices were identified. For instance, a residential education or pet-litter-control program was specified in the Beaver Creek watershed. Similarly, with regard to sediment, practices that specifically address this pollutant were identified. Additional control measures included street sweeping, erosion and sediment (E&S) controls on construction sites, and streambank stabilization.

Beyond this level of control for the pollutants of interest, practices that require the control or treatment of runoff are the primary tools available. These sorts of measures control bacteria and sediment. The resulting set of additional BMPs included; improved pasture management, conservation tillage, vegetated buffers, bioretention filters, rain gardens, infiltration trenches, and retention ponds. The final set of control measures identified and the efficiencies used in this study to estimate needs are listed in Table 6.1. The control measures listed in Table 6.1 are divided into categories based on the method of load reduction. “Direct Reductions” are those that reduce the load of pollutant from a specific source to the stream itself or to the land. “Buffer” practices control pollutants through both a land conversion and treatment of runoff from an upstream area. “Runoff Treatment” measures are those that either treat runoff from a given land area (*e.g.*, retention ponds) or treat runoff based on changing the runoff-producing characteristics of the land (*e.g.*, improved pasture management).

Table 6.1 Potential control measure efficiencies in removing bacteria and sediment.

	Efficiencies		
Control Measure	**Bacteria**	**Sediment**	**Reference**
Direct Reduction Efficiency			
Streamside Fencing	100%	0%	1
Corrected Straight-pipe	100%	100%	1, 2
Repaired Septic System	100%	100%	1, 2
Residential Education Program (pet waste)	75%	0%	3
Street Sweeping (Regenerative Air Sweeper)	550,000,000 colonies/yr	288 tons/yr	4, 6, 8
Streambank Restoration	N/A	2.55 lbs/ft/yr	2
*Buffer Efficiency**			
Vegetated Buffer	50%	50%	2
Runoff Treatment Efficiency			
Improved Pasture Management	50%	50%	2
Conservation Tillage	61%	61%	5, 7
E&S Controls	85%	85%	5, 7
Rain Gardens	85%	85%	2, 7
Bioretention Filters	85%	85%	2, 7
Retention Ponds	80%	80%	2, 7

*Buffer efficiencies shown here are applied to runoff from twice the buffer area upstream of the buffer.

1 Additional reductions result from the conversion of land from its existing condition to the buffer area.

2 Removal efficiency is defined by the practice.

3 Commonwealth of Virginia. 2005. Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy. www.naturalresources.virginia.gov/Initiatives/TributaryStrategies/

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

5 Local Measurements.

6 Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1992. Soils and Water Conservation Engineering, 4th Edition. Wiley.

7 Curtis, M.C. 2002. Street sweeping for pollutant removal. Department of Environmental Protection. Montgomery County, MD. 17pp.

8 Bacteria efficiency estimated based on sediment and nutrient efficiency.

9 Annual measurements of total solids collected in the City of Bristol.

Quantification of Control Measures

The quantity of control measures recommended during implementation was determined through spatial analyses, modeling alternative implementation scenarios, as well as requests from working group members. Spatial analyses included the processing of data that included land use, stream networks, and elevation, along with data archived from the VADCR Agricultural BMP Database and TMDL development documents. The map layers and archived data were combined to establish the number of control measures recommended overall, in each watershed, and in each subwatershed, where appropriate. Estimates of the amount of streamside fencing, number of full livestock exclusion systems, and number of hardened crossings were made through these analyses. The quantities of additional control measures were determined through modeling alternative scenarios and applying the related reduction efficiencies to their associated loads. Implicit in the TMDL is the need to avoid increased delivery of pollutants from sources that have not been identified as needing a reduction, and from sources that may develop over time, as implementation proceeds. One potential for additional sources of the pollutants identified is future residential and urban development. Care should be taken to monitor development and its impact on water quality. Where residential development occurs, there is potential for additional pollutant loads from pet waste, failing septic systems, sewer line overflows and leaks, and sediment delivered to streams by land disturbance.

Technical Assistance

It was determined by the working group members that it would require $50,000 to support the salary, benefits, travel, training, and incidentals for education of one technical FTE (Full Time Equivalent). With quantification analysis yielding a need for one agricultural and one residential technical FTE per year for the Beaver Creek watershed, the total potential cost to provide technical assistance during implementation is expected to be $700,000. For Little Creek with one FTE for 5 years the expected cost is $250,000. Implementation can begin with one agricultural FTE and one residential FTE; BMP installation progress would then be tracked in order to determine if another FTE needs to be hired.

Total Estimated Costs

The total estimated costs for the implementation of BMPs and technical assistance to work with landowners in the Beaver Creek and Little Creek watersheds is shown in Table 6.2.

Table 6.2 Total estimated costs to meet the Beaver Creek and Little Creek bacteria and sediment TMDLs.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Urban BMPs ($)	Technical Assistance ($)	Total Cost ($)
Beaver Creek	$4,835,085	$9,213,105	$11,153,525	$700,000	$25,901,715
Little Creek	$1,150,725	$169,875	$0	$350,000	$1,670,600
Total	$5,985,810	$9,382,980	$11,153,525	$1,050,000	$27,572,315

Cost Benefits/Analysis

The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal bacteria and sediment contamination in Beaver Creek and Little Creek will be reduced to meet water quality standards. It is hard to gage the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources through contact with surface waters should be reduced considerably

A cost benefit analysis for a mixed-use watershed is not an exact exercise. Therefore, cost benefit analyses are included for BMPs with physical installations to illustrate the relative cost advantages among these practices. Many of the costs included in these analyses for physical installations are also subject to change when site specific plans are developed during implementation. Analyses make the assumption that the actions proposed would accomplish the required reductions. Although the benefits of implementing BMPs consist of more than just sediment and bacteria load reductions, the cost/load reduced is calculated only on sediment in order to assess the relative advantage of individual BMPs for the primary targeted pollutant.

Economic Benefits The agricultural and residential practices recommended in this document will provide economic benefits to the landowner, as well as, the expected environmental benefits onsite and downstream. Specifically, alternative (clean) water sources, exclusion of cattle from streams, intensive pasture management, and private sewage system maintenance or upgrades will each provide economic benefits to individuals. 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 livestock stocking rates by 30 - 40%, and consequently, improve the profitability of the operation. With feed costs typically responsible for 70-80% of the cost of growing or maintaining an animal, and pastures providing feed at a cost of .01-.02 cents/lb of total digestible nutrients (TDN) compared to .04-.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VACES, 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. A side benefit is that cattle are more closely confined allowing for quicker checking and handling as well as increased animal health.

In terms of economic benefits to homeowners, an improved understanding of private sewage systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20-25 years or longer if properly maintained. Proper maintenance includes; knowing the location of the system components and protecting them by not driving or parking on top of them, and not planting trees where roots could damage the system, keeping hazardous chemicals (including water softening chemicals) out of the system, and pumping out the septic tank every 3 to 5 years.

The cost of proper maintenance is relatively inexpensive in comparison to repairing or replacing an entire system. Additionally, improvements to private waste treatment systems can enhance property values.

The economic benefits of the implementation of urban BMPs may be less obvious to an individual landowner or business, but the cumulative impacts can benefit the entire community. It is estimated that excessive erosion and sediment transport in waterways of the United States results in a $16 billion economic impact each year (Osterkamp et al., 1998). Bristol and Washington County have inevitably been economically affected by the impairments on Beaver Creek and Little Creek. In areas like Bristol and Washington County, a healthy waterway has the potential to attract local citizens and visitors for recreation as well as draw people to commercial areas adjacent to attractive, healthy streams.

Livestock Health Improvements A clean water source has been shown to improve weight gain and milk production in cattle. Healthy cattle consume close to 10% of their body weight during winter and 15% of their body weight in summer in water on a daily basis. Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VACES, 2000).

A clean water source can prevent illnesses that reduce production and incur the added expense of avoidable veterinary bills. In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing and well managed loafing areas exclude livestock from wet, swampy environments 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 VACES (1998) reports that mastitis currently 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 $1.7-2 billion annually or 11% of total U.S. milk production. Mastitis-causing bacteria can be harbored and spread in environments where cattle have access to wet and dirty areas.

Reduce Exposure to Human Pathogens 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 with it.

7.0 MEASURABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

Given the scope of work involved with implementing these TMDLs, full implementation is expected within five years in Little Creek and in seven years within Beaver Creek, with de-listing from the Virginia Section 305(b)/303(d) list within 10 to 12 years, respectively. Described in this section are funding sources, identification of milestones, timeline for implementation, targeting of control measures, and the roles of stakeholders during the process.

Milestones 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 10 to 12 years. Progress toward end goals will be assessed during implementation through tracking of control measure installations and continued water quality monitoring. Agricultural and residential control measures will be tracked through the Virginia Agricultural Cost-Share Program

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones establish the amount of control measures installed within certain timeframes, while water quality milestones establish the corresponding improvements in water quality that can be expected as the implementation milestones are met. The milestones described here are intended to achieve full implementation within five to seven years, leaving five years to assess water quality for de-listing. These goals are the basis for two of the milestones (*i.e*., full implementation at the five to seven-year mark, and de-listing at the 10 to 12-year mark). Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures first (Stage I). The stormwater BMPs are the most expensive components of the IP.

While these components are effective, large reductions in pollutant loads can be met through more cost-effective means. For instance, the bacteria source tracking results for Little Creek indicated that livestock are a significant source of fecal pollution in the stream. Concentrating on implementing livestock exclusion fencing may provide the highest return on water quality improvement with less cost to landowners. The Stage I goals for implementation in Beaver Creek will focus on installing 60% of all residential and urban BMPs, implementing a residential education program (for pet waste control), fencing cattle out of the stream, and implementing agricultural BMPs to reduce pollutant loadings from pasture and cropland. Stage II focuses on the completion of all recommended BMPs along with fence maintenance. Stage III is dedicated time for the streams to stabilize, vegetation to become established, and water quality monitoring to be continued.

Implementation is anticipated to begin in January 2007, after which two milestones will be sought over the next five to seven years. The first milestone will be three years for Little Creek and five years for Beaver Creek after implementation begins, whereby the more cost-efficient control measures will be installed, with significant reductions in bacteria and sediment (Beaver Creek) loads anticipated. Following Stage I implementation the steering committee should evaluate water quality improvements and determine how to proceed to complete implementation (Stage II). The timeline presented here proposes completing Stage II after five years in Little Creek and seven years in Beaver Creek from the start of implementation.

Tables 7.1 and 7.2 show the quantity of BMPs to be installed by each milestone. Table 7.3 shows the stage I, stage II and total costs to implement Beaver Creek and Little Creek.

Table 7.1 Stage I and Stage II implementation goals for Beaver Creek

Control Measure	Unit	Stage I completed by 2012	Stage II completed by 2014
Agricultural			
Grazing Land Protection System (SL-6)	System	235	0
Stream Protection System (WP-2T)	System	7	0
Hardened Crossing	System	99	0
Streamside Fence Maintenance	Foot	0	13,980
Improved Pasture Management	Acre	8505	0
Permanent Vegetative Cover on Cropland (SL-1)	Acre	75	0
Protective Cover for Specialty Cropland (SL-8)	Acre	136	0
Manure Incorporation	System	110	0
CREP / Vegetated Buffer	System	16	0
Residential			
Septic Systems Pump-out Program (RB-1)	System	120	80
Sewer Connection (RB-2)	System	73	48
Septic System Repair (RB-3)	System	103	69
Septic System Installation/Replacement (RB-4)	System	52	35
Alternative Waste Treatment System Installation (RB-5)	System	14	9
Residential Education Program	Program	0.5	ongoing
Infiltration Trench	Acre-Treated	450	300
Rain Garden	Acre-Treated	83	55
Retention Ponds	Acre-Treated	448	299
Erosion & Sediment Control	Acre-Treated	60	40
Vegetated Stream Buffer	Buffer Acre	104	69
Urban			
Bioretention Filter	Acre-Treated	360	240
Infiltration Trench	Acre-Treated	202	135
Rain Garden	Acre-Treated	210	140
Retention Ponds	Acre-Treated	201	134
Stormwater Collection System Retro-fits	Acre-Treated	9	6
Street Sweeping	Lane Miles/Year	4320	2,880
Vegetated Stream Buffer	Buffer Acre	83	55
Pollution Reductions			
Current Instantaneous EC Standard 235 cfu/100mL		31.09%	30.86%
Cumulative Progress Toward Sediment Endpoint		80.4%	100%

***Lowest violation obtainable without addressing wildlife loads**

Table 7.2 Stage I and Stage II implementation goals for Little Creek.

Control Measure	Unit	Stage I completed by 2010	Stage II completed by 2012
Agricultural			
Grazing Land Protection System (SL-6)	System	30	36
Stream Protection System (WP-2T)	System	0	1
Hardened Crossing	System	12	15
Streamside Fence Maintenance	Foot	0	3,750
Residential			
Septic Systems Pump-out Program (RB-1)	System	24	36
Septic System Repair (RB-3)	System	10	15
Septic System Installation/Replacement (RB-4)	System	3	5
Alternative Waste Treatment System Installation (RB-5)	System	1	1
Residential Education Program	Program	0.5	ongoing
Expected Bacteria Violations			
Current Instantaneous FC Standard 400 cfu/100mL		56.3%	22.8%

Table 7.3 Costs to implement Beaver Creek and Little Creek.

Stage I					
Impairment	**Agricultural BMPs ($)**	**Residential BMPs ($)**	**Urban BMPs ($)**	**Technical Assistance ($)**	**Total Cost ($)**
Beaver Creek	$4,786,155	$5,528,613	$6,692,115	$500,000	$17,506,883
Little Creek	$511,920	$69,075	$0	$150,000	$730,995
Total	$5,298,075	$5,597,688	$6,692,115	$650,000	$18,237,878
Stage II					
Impairment	**Agricultural BMPs ($)**	**Residential BMPs ($)**	**Urban BMPs ($)**	**Technical Assistance ($)**	**Total Cost ($)**
Beaver Creek	$48,930	$3,684,492	$4,461,410	$200,000	$8,394,832
Little Creek	$638,805	$100,800	$0	$100,000	$839,605
Total	$687,735	$3,785,292	$4,461,410	$300,000	$9,234,437
Total					
Impairment	**Agricultural BMPs ($)**	**Residential BMPs ($)**	**Urban BMPs ($)**	**Technical Assistance ($)**	**Total Cost ($)**
Beaver Creek	$4,835,085	$9,213,105	$11,153,525	$700,000	$25,901,715
Little Creek	$1,150,725	$169,875	$0	$250,000	$1,570,600
Total	$5,985,810	$9,382,980	$11,153,525	$950,000	$27,472,315

DEQ MONITORING

Virginia's 1997 Water Quality Monitoring, Information and Restoration Act requires that TMDL implementation plans include measurable goals and milestones for attaining water quality standards. Implicit in those milestones is the requirement of a method to measure progress. Implementation progress will be evaluated through water quality monitoring conducted by VADEQ and any citizen monitoring support that may develop as implementation progresses. VADEQ presently has 15 Beaver Creek and Little Creek monitoring locations that will be monitored continually or on a rotational schedule.

VADEQ will continually monitor two locations, State and 8th Street, in the Beaver Creek watershed and at Paty Lumber State Street in the Little Creek Watershed. The Beaver Creek Station is the most downstream station in the Virginia portion of the stream, 6CBEV015.27. Both stations will be sampled monthly beginning in January 2007 for the following twelve months. The following parameters will be collected at the 6CBEV015.27 monitoring station: *E.coli* bacteria, temperature, dissolved oxygen, pH, specific conductance, total nitrogen, total phosphorus, total solids, and total suspended solids. The following parameters will be monitored at the 6CLTL000.26 station: temperature, dissolved oxygen, pH, conductivity and *E. coli*. Benthic macroinvertebrate sampling will occur in the spring and fall at 6CBEV023.99.

At the time of the development of the Beaver Creek TMDL, fecal coliform was the indicator species for Virginia's bacteria water quality standard. In 2003, Virginia began the transition to an *E. coli* water quality standard. *E. coli* is a subset of fecal bacteria that has been shown to have a stronger correlation to gastrointestinal illness than fecal coliform. Assessment of implementation progress will rely on results of the *E. coli* sampling. At the end of 2007, a data review will determine whether monitoring will continue, the frequency adjusted, or postponed for a monitoring cycle.

In addition to DEQ's monitoring, there is interest from John S. Battle High School, Virginia Highlands Community College, and Emory and Henry College to assist in the water quality monitoring plan for Beaver Creek and Little Creek Watersheds. Citizen monitoring is a great screening tool for feedback on a stream and to determine if the stream is better or worse. There is a strong possibility for volunteer manpower for biological monitoring in Beaver Creek and Little Creek Watersheds. Funding will need to be acquired to fund monitoring equipment for citizens.

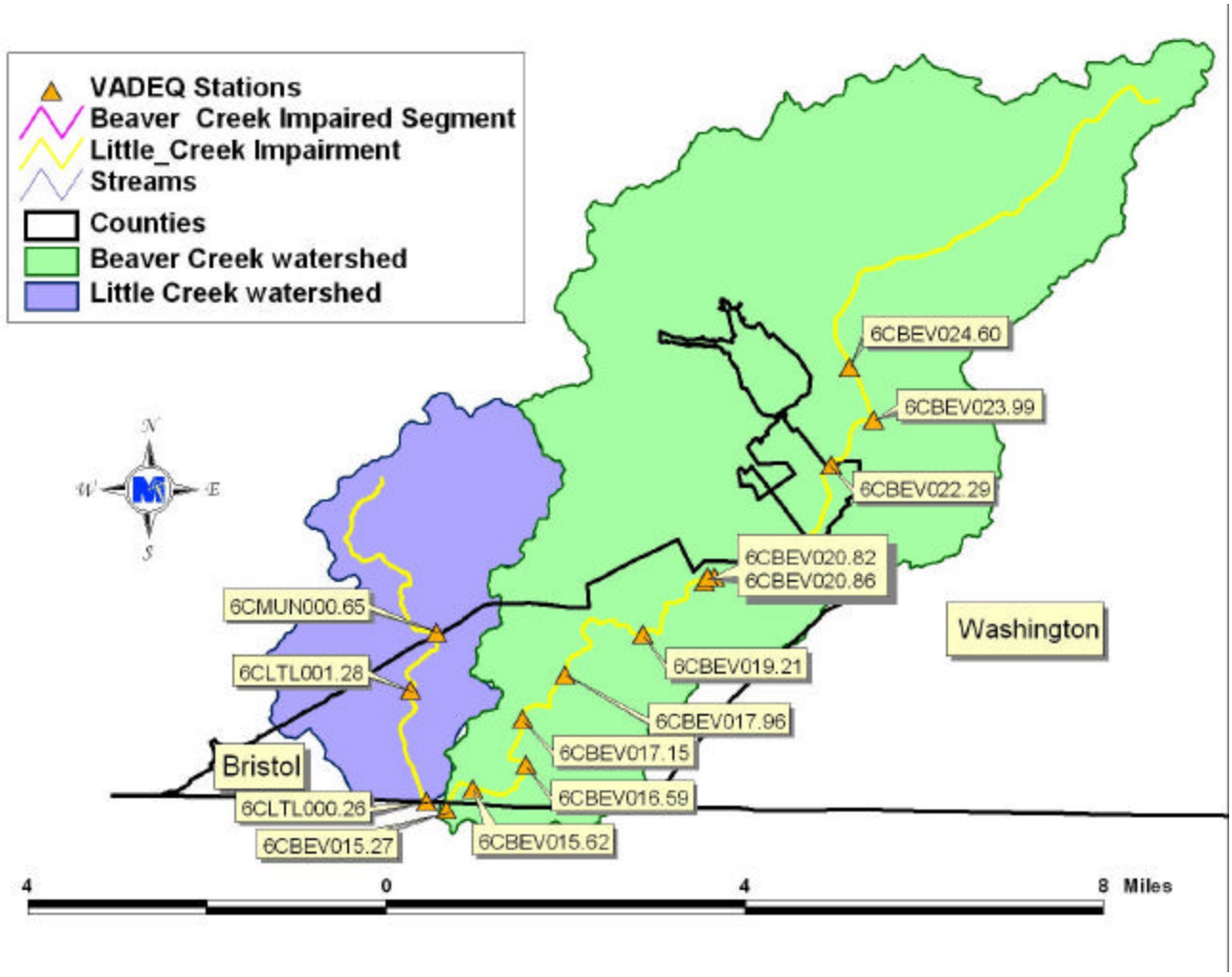

Figure 7. Present Virginia Department of Environmental Quality monitoring sites

8.0 STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Stakeholders include government agencies, businesses, citizens and special interest groups that live or have land management responsibilities in the watershed. Achieving the goals of this effort (i.e., improving water quality and removing these waters from the impaired waters list) relies on stakeholder participation. The purpose of this section is to identify and define the roles of some of the major stakeholders who will need to work together to implement this plan.

Federal Government

United States Environmental Protection Agency (USEPA)
The USEPA has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act (CWA). However, administration and enforcement of such programs falls largely to the states through state agencies.

Natural Resources Conservation Service (NRCS)
NRCS administers several funding programs identified in this plan including the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program (CREP). Locally, NRCS works closely with the HRSWCD to provide technical assistance to producers interested in conservation programs.

Tennessee Valley Authority (TVA)
TVA's Holston-Cherokee Douglas Watershed Team strives to protect and improve water quality in the northeastern portion of the Tennessee Valley. This is accomplished through targeted watershed initiatives in the region. The team helps local citizens, organizations, and agencies identify and quantify water quality problems, then work collaboratively to develop plans that target water quality improvement actions. In addition to TVA's technical expertise, the team provides support to leverage funds, build local partnerships/coalitions, and promote outreach efforts for water quality improvement.

State Government

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. State government has the authority to establish state laws that control delivery of pollutants to local waters. An example of this authority is a recent addition to the Virginia Code that allows localities to prohibit feeding of waterfowl that are found to exist in populations that threaten public health or the environment (§ 29.1-527.1). Another example is 2005 legislation (§ 10.1-104.1) that requires state lands, including universities (e.g., VI) that apply fertilizer to develop and implement a nutrient management plan. Currently, there are five state agencies responsible for regulating activities that impact water quality in Virginia. These agencies include: Virginia Department of Agriculture and Consumer Services, Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Forestry and Virginia Department of Health.

Virginia Department of Environmental Quality (VADEQ)
VADEQ has the responsibility for monitoring the waters to determine compliance with state standards, and for requiring permitted point source dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. In addition, DEQ has regulatory responsibility over animal waste from confined animal facilities in excess of 300 animal units of cattle and hogs and 200 animal units of poultry through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent groundwater contamination (ELI, 1999). DEQ will maintain monitoring stations described in this plan.

Virginia Department of Conservation and Recreation (VADCR)
VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution including nutrient management, erosion and sediment control, stormwater, and agricultural BMPs. Most VADCR programs dealing with agricultural NPS pollution historically have been through education and voluntary incentive programs.

VADCR also has regulatory authority over Virginia's National Pollution Discharge Elimination System (NPDES) permits for Municipal Separate Storm Sewer Systems (MS4). These permits require MS4 operators to develop, implement and enforce six minimum control measures to reduce pollutants entering surface waters through stormwater runoff. Current VADCR MS4 guidance expects the permittee in areas under a TMDL to specifically address the TMDL wasteload allocation for stormwater through the iterative implementation of programmatic BMPs. BMP effectiveness will be determined through permittee implementation of an individual control strategy that includes a monitoring program that is sufficient to determine BMP effectiveness. Ambient in-stream monitoring would not be an appropriate means of determining permit compliance, as it determines if the TMDL is being met by all contributing pollutant sources. If future monitoring indicates no improvement in the quality of the regulated discharge, the permit could require the MS4 to expand or better tailor its stormwater management program to achieve the TMDL wasteload allocation. However, only failing to implement the programmatic BMPs identified in the modified stormwater management program would be considered a violation of the permit. Any future changes to the TMDL resulting from water quality standards changes would be reflected in the permit. Currently, the City of Bristol and VDOT hold Phase II MS4 permits.

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

Virginia Department of Agriculture and Consumer Services (VDACS)
Through Virginia's Agricultural Stewardship Act, VDACS and 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 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. It is not the intention of this plan to actively use the Agricultural Stewardship Act to force producers into conservation measures.

Virginia Department of Health (VDH)
VDH is responsible for maintaining safe drinking water measured by standards set by the USEPA. Their duties also include septic system regulation and regulation of biosolids land application according to the Virginia Sewage Handling and Disposal Regulations. Like VDACS, VDH is complaint driven. In the scheme of these TMDLs, VDH has the responsibility of enforcing actions to correct or eliminate failed septic systems and straight pipes. In the implementation project, the VDH will write permits for new septic systems and refer customers needing assistance to HRSWCD.

Virginia Department of Transportation (VDOT)
VDOT is currently developing a protocol and prioritization for inspections of illicit discharges. The protocol will become an element of all routine emergencies, and requested maintenance activities on VDOT's drainage systems. Training on illicit discharge inspection will be developed in coordination with VDOT's hazardous materials spill response protocol. Following the development of the protocol and training, implementation will begin to inspect, detect and address non-stormwater discharges in 100% of regulated outfalls within the area addressed by VDOT's MS4 permit (I-81 corridor).

VDOT is currently developing an educational video on stormwater impacts and stormwater BMPs that will be distributed to local governments and citizens. A series of public service announcements related to stormwater issues are also planned. VDOT participates in regional stormwater planning and implementation meetings. They also participate in local government technical advisory groups and workshops to develop watershed plans including this implementation plan. VDOT also maintains an ongoing Adopt-A-Highway program that partners with community organizations and businesses to remove trash and debris from VDOT right-of-ways.

Local Government

Holston River Soil & Water Conservation District (HRSWCD)
The HRSWCD will provide technical and financial assistance to farmers and homeowners through the Virginia Agricultural BMP Cost-Share and Tax Credit programs. Their responsibilities will include promoting implementation goals, available funding and the benefits of BMPs and providing assistance in the survey, design, layout, and approval of agricultural and residential BMPs. The HRSWCD has filled a similar role in the Middle Fork Holston TMDL Implementation Project since 2001.

City of Bristol

In order to inform the public regarding the City's stormwater management program and general water quality issues, the City of Bristol is planning to produce multiple brochures and other forms of literature. The publications will include a brochure on Beaver Creek and Little Creek water quality. The City has been involved in several educational activities in the local school systems and through partnership with the local colleges.

The City of Bristol, Virginia is within the Beaver Creek and Little Creek watersheds. It compromises 25.8% of the two watersheds. The City maintains a number of programs that address water quality through the Public Works, Community Development, Public Utilities and Parks and Recreation Departments.

City government, through utilization of existing authorities and resources, works closely with state and federal agencies to support implementation of TMDL plans. Within its corporate boundaries, development and protection of the environment are protected through sound planning and design strategies and maintenance responsibilities. The City will promote education and outreach to its citizens to introduce the importance of the TMDL process.

Most notably, the Public Works Department administers the City's MS4 permit that addresses a series of water quality issues. The City of Bristol has several ordinances relating to maintaining or improving water quality including an ordinance prohibiting illicit discharge or cross connections into city sewer (Code Section 7-3-81). Additionally, the City has been involved throughout the development of this plan and is planning to submit a proposal through the Virginia WQIF to enhance its street sweeping in order to contribute to the implementation goals. City staff was involved in the government and urban/residential working groups. Through MS4 permits, existing regulatory controls, and existing programs and projects, the local community as a whole, local municipalities and community groups are currently maintaining practices that address bacteria and sediment. Additionally, alternative devices are being investigated for possible use within the City of Bristol. Through MS4 permits, existing regulatory controls, and existing programs and projects, the local community as a whole, local municipalities and community groups are currently maintaining practices that address bacteria and sediment. This section describes some of the existing MS4 permit activities and other existing and planned implementation actions pertinent to this implementation plan.

City of Bristol MS4

- **Public Education and Outreach** Distributing educational materials and performing outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality.
- **Public Participation/Involvement** Providing opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging citizen representatives on a stormwater management panel.
- **Illicit Discharge Detection and Elimination** Developing and implementing a plan to detect and eliminate illicit discharges to the storm sewer system (includes developing a system map and informing the community about hazards associated with illegal discharges and improper disposal of waste).

- **Construction Site Runoff Control** Developing, implementing, and enforcing an erosion and sediment control program for construction activities that disturb one or more acres of land (controls could include silt fences and temporary stormwater detention ponds).
- **Post-Construction Runoff Control** Developing, implementing, and enforcing a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventative actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs such as grassed swales or porous pavement.
- **Pollution Prevention/Good Housekeeping** Developing and implementing a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch-basin cleaning).

Virginia Erosion and Sediment Control Program (ESC)
In addition to the basic Virginia Erosion and Sediment Control laws, within the City of Bristol timbering is not exempt from Erosion and Sediment Control Laws, subdivisions are required to have the ESC Responsible Land Disturber Permit, and erosion and sediment control measures are required on disturbances more than 5,000 square feet.

Washington County
Washington County comprises approximately 75.5% of Beaver Creek Watershed and 69% of Little Creek watershed which both are addressed in this plan. County staff from the Planning Department was involved in the residential/urban and government working groups. The County maintains an erosion and sediment control program.

Community Organizations and Citizens

Beaver Creek Alliance
The Beaver Creek Watershed Alliance is a citizen-based organization operating under the umbrella of Keep Bristol Beautiful. The group's main focus is water quality in Beaver Creek and Little Creek. The group conducts annual cleanup events and provides educational materials to the community.

Boone Watershed Partnership (BWP)
The Boone Watershed Partnership is a nonprofit organization that works with local users, regional, state and federal entities, educators and others to identify and address water resource issues in the Boone Watershed, an area of about 686 square miles lying in Sullivan, Washington and Carter Counties of Tennessee and Washington County, Virginia. BWP shares information and provides a point of contact on water conditions and issues among partners, water users and the public, works to develop a consensus on priorities and actions needed to address regional issues, marshals resources to carry out needed actions and develop best management practices, and promotes awareness of the importance of water resources to the regional economy and to the quality of life in the watershed.

Upper Tennessee River Roundtable, Inc.
The mission of the Upper Tennessee River Roundtable, Inc. is to achieve clean water throughout the Clinch, Holston and Powell watersheds in Virginia with the involvement of citizens in planning, educating, coordinating, attracting funding and serving as an advocate for water resources.
The Upper Tennessee River Roundtable is a collaborative partnership representing interested citizens, communities, state and federal agencies, business and industry, watershed groups, and non-profit organizations. Through this partnership effort, the Roundtable implements a strategic plan that includes goals and objectives for mining, litter control and recycling, tourism, endangered species and toxics, forestry, agriculture, citizen action, education and urban. The Roundtable works on a numerous projects to involve citizens. One project is our stream-monitoring program that recruits and trains citizens in the Save Our Streams (S.O.S.) method. With S.O.S., citizens look for benthic macroinvertebrates that are indicators of stream health.

Emory & Henry College
Emory & Henry College's Environmental Studies Program is an academic program serving undergraduate students with an interest in careers or graduate school in either environmental science or policy. Students in this program perform chemical and biological water monitoring every semester, in several subwatersheds of the Holston River Basin.

9.0 INTEGRATION WITH OTHER WATERSHED PLANS

Current plans that should be integrated with the Beaver Creek and Little Creek Implementation Plan.

- Washington County sewer extension plan
- Washington County Comprehensive Plan
- City of Bristol Comprehensive Plan
- Upper Tennessee River Roundtable Strategic Plan
- Virginia 2025 Transportation Plan should be integrated with the implementation plan.

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include, but are not limited to Total Maximum Daily Loads, roundtables, WQMPs, sediment and erosion control regulations, stormwater management (SWM), local comprehensive plans, and much more. In some cases an IP may even address multiple TMDLs (e.g., bacteria and benthic) for the same impaired water body.

Continuing Planning Process

Continuing the planning process (CPP) established by Section 303(e) of the Clean Water Act provides a good framework for implementing TMDLs, especially the NPS load allocations. Under the Section 303(e) process, states develop and update statewide plans that include TMDL development and adequate implementation of new and revised water quality standards, among other components. The water quality management regulations at 40 CFR 130.6 require states to maintain WQMPs (Water Quality Management Planning) that are used to direct implementation of key elements of the continuing planning process, including TMDLs, effluent limitations, and NPS management controls. These state WQMPs are another way for states to describe how they will achieve TMDL load allocations for NPSs.

The CPP in Virginia is implemented in various state programs, all aimed toward achieving and maintaining the state water quality standards. Virginia Code Sections 62.1-44.15(10) & (13), 62.1-44.17:3, and 62.1-44.19:7 give the Virginia State Water Control Board (Board) the duty and authority to conduct the CPP in Virginia. Under the authority of Virginia Code Section 10.1-1183, DEQ serves as the administration arm of the Board.

10.0 POTENTIAL FUNDING SOURCES

As mentioned previously, some of the control measures outlined in this plan will be implemented as part of existing programs including the MS4 permits. Potential funding sources available for remaining implementation activities were identified during plan development. More detailed descriptions of each source are included in the technical document and can also be obtained from organizations and agencies listed below. Potential funding sources include:

Federal Clean Water Act Section 319 Incremental Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement nonpoint source programs. VADCR administers the money to fund watershed projects, demonstration and educational programs, nonpoint source pollution control program development, and technical and program staff including TMDL Implementation. During implementation in the Beaver Creek and Little Creek watersheds, standards, specifications, cost-share, and tax credits for practices under the Virginia Agricultural BMP Cost-share Program will be followed for funding eligibility. This project has been placed in the plan of work for DCR's 2005 319 grant. Section 319 funds should be available at the completion of the IP, and in subsequent years, given reasonable progress toward implementation goals.

Conservation Reserve Enhancement Program (CREP) CREP is a cost-share program administered by NRCS that assists farmers to protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water. The program offers cost-share, rental payments and an incentive payment to protect riparian areas including exclusion fencing, alternative watering systems and riparian easements. Information is available at www.dcr.virginia.gov/sw/crep.htm.

Virginia Agricultural Best Management Practices Cost-Share and Tax Credit Programs The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on their land to better control sediment, nutrient loss, and transportation of pollutants into our waters. Cost-share is typically 75% of the actual cost, not to exceed $50,000. Each practice under the cost-share program has specifications and a lifetime during which the practice must be maintained. For all taxable years, a farmer can also take a 25% state tax credit on the first $70,000 spent on agricultural BMPs. Information is available at www.dcr.virginia.gov/sw/costshar.htm.

VADEQ Agricultural Best Management Practices Loan Program
The DEQ Agricultural Best Management Practices Loan Program provides Virginia agricultural producers with low interest financing alternative for costs associated with the implementation of specified practices (BMPs) which relate to water quality improvement in the Commonwealth.

Virginia Water Quality Improvement Fund (WQIF)
The fund is administered by VADCR. This is a permanent fund established by the Commonwealth of Virginia in order to assist local stakeholders in reducing point and nonpoint source pollutant loads to Virginia's waters. Eligible organizations include local governments, SWCDs and individuals. Grants for point sources are administered through VADEQ and grants for nonpoint sources are administered through VADCR. Most WQIF grants provide matching funds on a 50/50 cost-share basis. A request for proposals is distributed annually. Information is available at www.dcr.virginia.gov/sw/wqia.htm.

Virginia Department of Housing and Community Development: Water/Sewer Programs
The Department of Housing and Community Development offers several programs that provide water and wastewater systems to low-income communities in Virginia.
The Virginia Appalachian Regional Commission program was formed to provide water and sewer citizens and improve the quality of life in the Appalachian region of Southwest Virginia.
The Community Development Block Grant Program provides funding to eligible local governments for projects that address crucial community needs including housing, infrastructure, and economic development. Each project that utilizes CDBG funding must meet one or more national objectives.
The Indoor Plumbing Rehabilitation Program provides zero interest, forgivable loans for the installation of indoor plumbing where it does not exist, or where the existing water delivery or waste disposal systems have failed for the owners of substandard housing.
The Self-Help Virginia Program works in conjunction with local residents on water and wastewater projects in small communities, with the majority of labor being provided by volunteers.

Southeast Rural Community Assistance Project
Southeast RCAP's Loan Fund provides low-interest loans to low-income rural communities for predevelopment costs, system upgrades and new construction of water and wastewater services and facilities. Loans are also available for housing and community development.

Virginia Department of Game and Inland Fish - Virginia's Landowner Incentive Program
To protect and restore biological diversity, the Virginia Department of Game and Inland Fisheries (VDGIF) is providing financial and technical assistance to private landowners through the Landowner Incentive Program (LIP). LIP is a federal grant program funded by US Fish and Wildlife Service and administered by VDGIF. It can provide cost-share of 75% of conservation project costs to landowners willing to install and maintain stream restoration and riparian buffer projects on their property for a minimum of 10 years. These LIP projects are undertaken to improve degrading lands, reduce sediment in streams, and improve critical habitats for at risk species. A complete list of species ranked according to their need for conservation in Virginia, can be found in the Virginia Wildlife Action Plan, which is available at http://bewildvirginia.org/

Tennessee Valley Authority -TVA's Holston-Cherokee Douglas Watershed Team strives to protect and improve water quality through their technical expertise. The team helps local citizens, organizations, and agencies identify and quantify water quality problems, then work collaboratively to develop plans that target water quality improvement actions. TVA provides funding for five targeted areas related to improving water quality:

- Stream restoration
- Watershed assessment
- Partnerships and capacity building
- Implementation and planning
- Education and outreach

GLOSSARY

Alternative waste treatment system—Any system for treatment of residential wastewater for return to the environment, other than a standard onsite septic system.
Bacterial Source Tracking (BST) — A collection of scientific methods used to track sources of fecal contamination.
Benthic— Refers to material, especially sediment, at the bottom of an aquatic ecosystem. It can be used to describe the organisms that live on, or in, the bottom of a water body.
Best Management Practices (BMPs) — Methods, measures or practices determined to be reasonable and cost-effective means for a landowner to meet certain, generally nonpoint source, pollution control needs. BMPs include structural and nonstructural controls and operation and maintenance procedures.
Cost-share program — A program that allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The remaining costs are paid by the producer(s).
Discharge — Flow of surface water in a stream or canal or the outflow of groundwater from a flowing artesian well, ditch or spring; can also apply to discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting systems.
Effluent — Municipal sewage or industrial liquid waste (untreated, partially treated, or completely treated) that flows out of a treatment plant, septic system, pipe, *etc*.
Fecal coliform — Indicator organisms (organisms indicating presence of pathogens) associated with the digestive tract of warm-blooded animals.
Fixed-frequency water quality monitoring — Collecting water samples from a fixed location over time at regular intervals (*e.g.*, bi-monthly, monthly, annually.)
Full time equivalent (FTE) — FTE is calculated by dividing the total number of paid hours by the number of hours in a time period.
GIS (Geographic Information System) — Computer programs linking features commonly seen on maps (such as roads, town boundaries, water bodies) with related information not usually presented on maps, such as type of road surface, population, type of agriculture, type of vegetation, or water quality information. A GIS is a unique information system in which individual observations can be spatially referenced to each other.
Hardened crossing — A stabilized area (*e.g.*, concrete or wooden bridge) that provides access to and/or across a stream for livestock and/or farm machinery.
Load allocation (LA) — The portion of receiving water's loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.
Loading capacity (LC) — The greatest amount of loading a water body can receive without violating water quality standards.

Modeling – A system of mathematical expressions that describe the spatial and temporal distribution of water quality constituents resulting from fluid transport and the one or more individual processes and interactions within some prototype aquatic ecosystem.

Monitoring – Periodic or continuous surveillance to determine the pollutant levels in water bodies.

Municipal Separate Storm Sewer System (MS4) – A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

> Owned and operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States; Designed or used for collecting or conveying stormwater; which is not a combined sewer; and which is not part of a publicly owned treatment works (POTW).

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

Nutrient — Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

Pathogens – Microorganisms (*e.g.*, bacteria, viruses or parasites) that can cause disease in humans, animals, and plants.

Point source — Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial treatment facilities or any conveyance such as a ditch, tunnel, conduit or pipe from which pollutants are discharged. Point sources have a single point of entry with a direct path to a water body. Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river.

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

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

SL6 Grazing Land Protection Systems — A structural and/or management practice that will enhance or protect vegetative cover to reduce runoff of sediment and nutrients from existing pastureland, and reduce NPS pollution associated with grazing livestock.

Stakeholder — Any person with a vested interest in the TMDL development, *e.g.*, farmer, landowner, resident, business owner, or special interest group.

Storm-event water quality monitoring — Collecting water samples from a location during and/or immediately following a rainstorm.

Straight pipe — Delivers wastewater directly from a building (*e.g.*, house or milking parlor) to a stream, pond, lake or river.

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

Waste load allocation (WLA) — Portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40CFR 130.2(h)).

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