A Total Maximum Daily Load Implementation Plan for Knox Creek and Pawpaw Creek

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Virginia Department of Environmental Quality
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Virginia Department of Forestry, Abingdon Regional Office (VADOF)

Big Sandy Soil and Water Conservation District (BSSWCD)

New River-Highlands RC&D

Kentucky Department of Environmental Protection (KDEP)

Local citizens and stakeholders in the Knox Creek and Pawpaw Creek watersheds

EXECUTIVE SUMMARY

When a stream fails to meet standards, it is listed as impaired on the Clean Water Act's (CWA) Section 303(d) list. Knox Creek was first listed as impaired on the *1996 303(d) TMDL Priority List*, due to violations of the State of Virginia's General Standard (benthic). It was listed again on the 1998 and 2002 lists. In the *2004 305(b)/303(d) Water Quality Assessment Integrated Report*, Knox Creek was listed for General Standard (benthic), *E. coli* (a specific type of fecal coliform), and fish tissue – PCBs (Polychlorinated biphenyls). The PCB impairment will not be addressed in this report. Pawpaw Creek, a tributary to Knox Creek, was first listed as impaired in 1994 for violations of the General Standard (benthic). Pawpaw Creek remained on the 1998, 2002, and 2004 lists.

As a result of the listings and court actions taken against the United States Environmental Protection Agency (EPA), total maximum daily load (TMDL) reports were developed (*Fecal Bacteria and General Standard Total Maximum Daily Load Development for Knox Creek and Pawpaw Creek*, MapTech, Inc., April 2006) which established the reduction in loads needed to restore these waters. Virginia law requires that a plan be developed to achieve fully supporting status for impaired waters. In fulfilling the state's requirement for the development of a TMDL Implementation Plan (IP), a framework was established for reducing fecal bacteria levels to achieve the water quality goals for the impaired streams.

Review of TMDL Development

The greatest portion of the Knox Creek and Pawpaw Creek watersheds is located in Buchanan County, Virginia with a small portion in Pike County, Kentucky. In 2004, the estimated human population within the Knox Creek and Pawpaw Creek watersheds was 3,878. The major land use is forest.

MapTech, Inc. conducted Bacterial Source Tracking (BST) in the Knox Creek watershed. BST is intended to aid in identifying sources (*i.e.*, human, pets, livestock, or wildlife) of fecal contamination in water bodies. The BST results provided insight into the likely sources of fecal contamination, aided in distributing fecal loads from different sources

during model calibration, and will improve the chances for success in implementing solutions. The BST results for Knox Creek indicate that human waste is the dominant source of fecal bacteria in the stream. The correction of straight pipes and failing septic systems are a requirement of the *E. coli* TMDL and will benefit the General Standard (benthic) TMDLs by reducing TDS and solids from entering the streams. The final scenario for reducing *E. coli* loads is shown in table ES.1. Reductions to wildlife fecal bacteria loads will not be addressed in this project.

Table ES.1 Load reductions allocated during bacteria TMDL development.

	Percent Reduction in Loading from Existing Conditions					
Simulation	**Direct Wildlife Loads**	**NPS Forest / Wetland**	**Direct Livestock Loads**	**NPS Agricultural Land**	**Direct Human Loads**	**NPS Residential Land**
Stage I	0	0	89	98	100	98
Final	87	94	89	99.5	100	99.5

The sources of TDS and sediment (Pawpaw Creek only) come from erosion from land areas, straight pipes, and point sources. Land uses used in the analyses are Abandoned Mined Land (AML), Active Mined Land, Cropland, Forest, Disturbed Forest, Pasture, Reclaimed Mine Land, Residential, Roads, and Water from both Virginia and Kentucky. The final TDS loads required in the Knox Creek watershed and in the Pawpaw Creek watershed are shown in Tables ES.2 and ES.3, respectively. The sediment reductions recommended in the Pawpaw Creek watershed are shown in Table ES.4. The Waste Load Allocation includes all permited sources of TDS, including active surface and deep mining areas. The Load Allocation is the remaining sources of TDS, including all other land uses and straight pipes.

Table ES.2 Average annual TDS loads (kg/yr) modeled after TMDL allocation in the Knox Creek impairment.

Allocation	TDS (kg/year)
Waste Load Allocation	**1.11E+06**
Load Allocation	**6.85E+06**
TMDL	**7.97E+06**

Table ES.3 Average annual TDS loads (kg/yr) modeled after TMDL allocation in the Pawpaw Creek impairment.

Allocation	TDS (kg/year)
Waste Load Allocation	**1.52E+05**
Load Allocation	**2.56E+06**
TMDL	**2.71E+06**

Table ES.4 Final TMDL allocation scenario for the Pawpaw Creek watershed.

Sediment Source	Pawpaw Existing Loads t/yr	Final Reductions (%)	Allocated Loads t/yr
Virginia Area:			
AML	4,289	59	1,758
Active Mine	0.60	0	0.60
Cropland	1,211	57	520.5
Forest	1,257	0	1,257
Forest Disturbed	2,799	58	1,176
Pasture	17.06	0	17.06
Reclaimed	0.65	0	0.65
Residential	0.14	0	0.14
Water	0.00	0	0.00
Roads	3.06	0	3.06
Residential	0.06	0	0.06
Kentucky Area:	620.47	0	620.47
Streambank Erosion (VA & KY)	81.44	13	70.85
Straight pipes (VA only)	2.94	100	0.00
Point Sources (VA only)	4.99	0	4.99
Watershed Total	10,287	47.2	5,430

Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watershed, Buchanan County governments, Virginia Department of Environmental Quality (VADEQ), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Health (VDH), Virginia Department of Forestry (VDOF), Department of Mines, Minerals, and Energy (DMME), Virginia Cooperative Extension (VCE), Natural Resources Conservation Service (NRCS), the Big

Sandy Soil and Water Conservation District (BSSWCD), coal company representatives, Kentucky Department of Environmental Protection (DEP), 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 the smaller forums. The working groups were comprised of stakeholders with similar concerns (*e.g.*, industrial, residential, and governmental). Representatives from each working group participated in the Steering Committee, where input from the working groups was reviewed and decisions about the IP were made. Throughout the public participation process, 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 meetings regarding the IP process. Most members of the working groups agreed that a cornerstone of the implementation plan is cultivating public involvement and education and encouraging commitment and partnerships between the citizens in the watershed and government agencies in order to reduce fecal bacteria pollution. Two letters of comments were received after the final 30-day comment period. These were address and the draft document was updated accordingly.

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, the needs to meet the TMDL for the fifteen-year implementation period were identified and are shown in Table ES.5.

Table ES.5 Agricultural and residential BMPs needed in the Knox Creek and Pawpaw Creek watersheds.

Control Measure	Unit	Knox Creek	Pawpaw Creek
Agricultural			
Grazing Land Protection System (SL-6)	System	13	0
Stream Protection System (WP-2T)	System	1	0
Improved Pasture Management	Acre	117.3	13
Waste Storage Facilities (WP-4) - Horses	System	14	1
Manure Incorporation	System	377.3	0
Vegetated Stream Buffer	Buffer Acres	40	1
Residential			
Septic System Pump-out Program (RB-1)	System	158	100
Septic System Repair (RB-3)	System	80	30
Septic System Installation/Replacement (RB-4)	System	374	105
Alternative Waste Treatment System Installation (RB-5)	System	24	15
Infiltration Trench	Acre Treated	12	0
Erosion and Sediment Control	Acre Treated	20	3
Vegetated Stream Buffer	Buffer Acres	37	6.6
Streambank Stabilization	Feet	0	7,470
Residential Education Program	Program	1 Program for both watersheds	
Industrial			
Reclamation of Abandoned Mine Land	Acre	1,583.2	502
Dirt Road Stabilization	Acre	37.3	1.8
Forest Harvesting BMPs	Acre	126	68

Cost/Benefit Analysis

Unit costs for control measures were determined through analysis of control measures previously installed through the Virginia Cost-Share Program in Buchanan County, discussion with local agency representatives, and working groups. The cost of technical assistance was determined through discussion with working group members. The estimated total costs to install industrial, agricultural and residential control measures in the Knox Creek and Pawpaw Creek watersheds are $20.9 million and $9.67 million, respectively, excluding technical assistance. The estimated total cost to provide technical assistance during implementation is expected to be $1.5 million. The total cost estimated for ten years of implementation is $32 million.

The primary benefit of implementation is the reduction of fecal bacteria in these two streams. With the completion of this IP, the risk of fecal bacteria illness through swimming in or drinking water from this stream will decrease. Streambank protection, provided through exclusion of livestock from streams, will also lead to improved aquatic habitat. The practices recommended in this document will provide economic benefits to 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

Potential funding sources available during implementation were identified during plan development. Sources may include:

- 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)
- Southeast Rural Community Assistance Project (SE/R-CAP)
- Virginia Water Quality Improvement Fund

The potential funding sources that should be sought first are the Federal Clean Water Act 319 Incremental Funds, the Virginia Agricultural BMP Cost-Share and Tax Credit Programs, and Southeast Rural Community Assistance Project (SE/R-CAP).

Implementation is scheduled to occur in three main stages. The first stage involves implementation of the most cost-effective control measures. Stage II describes the remainder of the control measures required to achieve the targeted pollutant load reductions, if the water quality goals are not achieved during Stage I. Finally, the third stage is a five-year period for assessment of stream conditions, in which the streams are expected to recover and attain the stated water quality goals.

Targeting of critical areas for agricultural BMP installation was accomplished through analysis of land use, farm boundaries, stream network Geographic Information Systems (GIS) layers, and monitoring results. The subwatersheds were ranked by the ratio of animals per length of fence needed and by the combined failing septic systems and straight pipes loads estimated in each subwatershed.

Stakeholders and Their Role in Implementation

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

The BSSWCD will be in charge of initiating contact with home and land owners 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 BSSWCD staff should conduct a number of outreach activities in the watershed to promote participation and community support to obtain the implementation milestones and to make the community aware of the TMDL requirements. Such activities will include information exchange through newsletters, mailings, field days, organizational meetings, etc. The BSSWCD staff will work with appropriate organizations to educate the public.

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. The agencies regulating activities that impact water quality in Virginia include VADEQ, VADCR, VDOF, DMME, 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) is dependent on stakeholder participation – not only the local citizens needing agricultural control measures or residential waste treatment facilities, but also all citizens living in the watershed. It must be acknowledged first that there is a water quality problem, and changes must be made as needed in operations, programs, and legislation to address these pollutants.

1. INTRODUCTION

1.1 Background

Clean water is essential to all forms of life: human, plant, and animal. In cases where water has been impacted by fecal bacteria, sediment and TDS, the adverse effects must be noted and counteracted.

The detrimental effects of bacteria in food and water supplies have been documented repeatedly. On August 8, 1994, the Virginia Department of Health (VDH) was notified that campers and counselors at a Shenandoah Valley summer camp developed severe gastrointestinal illness. It was confirmed that *E. coli* 0157:H7, a type of fecal coliform bacteria commonly found in the intestines of humans and animals, was the causative agent (CDC, 1995). In Franklin County, Virginia, a 1997 outbreak of illnesses involving three children was attributed to *E. coli* (0157:H7) in Smith Mountain Lake. The children came in contact with the bacteria while swimming in the lake, and a two-year-old child almost died as a result of the exposure (Roanoke Times, 1997a, 1997b, 1998b). In August 1998, seven children and two adults at a day-care center in rural Floyd County were infected with *E. coli* (0157:H7). Upon investigation, two of the property's wells tested positive for total coliform (Roanoke Times, 1998a, 1998c). On June 6, 2000, Crystal Spring, (Roanoke, Virginia's second largest water source) was shut down by the VDH for *E. coli* contamination (Roanoke Times, 2000).

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

The General Standard is meant to protect the health of aquatic life, and also to serve as a fallback monitoring program to identify problems that are not detected by the ambient monitoring system (*e.g.*, pollutant discharges that are intermittent in occurrence, isolated incidents of pollutant discharge, and discharge of pollutants that are not normally measured through the ambient monitoring system). The health of the aquatic life is measured through assessment of the benthic macroinvertebrate (benthic) community, which is integral to the food chain that supports higher-level organisms. An unhealthy aquatic community will impact local and downstream fisheries. Additionally, an aquatic community that is already impacted will not be a good indicator of pollutant problems in the stream.

As for the specific pollutants being addressed for these General Standard TMDLs (Total Dissolved Solids – TDS - in Knox Creek; sediment and TDS in Pawpaw Creek), they have relevance for downstream water bodies as well as for Pawpaw Creek and Knox Creek. Specifically, Pawpaw Creek is a tributary of Knox Creek, which then flows into Tug Fork. Tug Fork also has a benthic impairment and any progress toward preventing pollutants from traveling to Knox and Pawpaw Creeks will also benefit the health of Tug Fork.

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

When streams fail to meet standards, the stream is listed as impaired on the CWA's Section 303(d) list. Knox Creek was first listed as impaired on the *1996 303(d) TMDL Priority List*, due to violations of the State's General Standard (benthic). The biological monitoring station at 6AKOX011.08 showed that aquatic life is partially supporting. It was listed again on the *1998 303(d) Total Maximum Daily Load Priority List and Report* with regard to the General Standard (benthic). The Knox Creek segment was

recalculated as 16.94 miles in the *2002 303(d) Report on Impaired Waters*. In addition to the General Standard (benthic) violation, this report lists Knox Creek for fecal coliform and fish tissue – PCBs. In the *2004 305(b)/303(d) Water Quality Assessment Integrated Report*, Knox Creek was listed for General Standard (benthic), *E. coli* (a specific type of fecal coliform), and fish tissue – PCBs (Figure 1.1). A benthic survey previously completed rated the stream as moderately impaired. The PCB impairment will not be addressed in the report.

Pawpaw Creek was first listed as impaired in 1994. It appeared again on the *1996 303(d) TMDL Priority List* for violations of the General Standard (benthic) based on monitoring at VADEQ biological station 6APPW000.60. The stream was determined to be non-supporting of aquatic life at this station. Pawpaw Creek remained on the *1998 303(d) Total Maximum Daily Load Priority List and Report*, the *2002 303(d) Report on Impaired Waters* and the *2004 305(b)/303(d) Water Quality Assessment Integrated Report* for violations of the General Standard (benthic) (Figure 1.1). It continued to be rated as severely impaired overall.

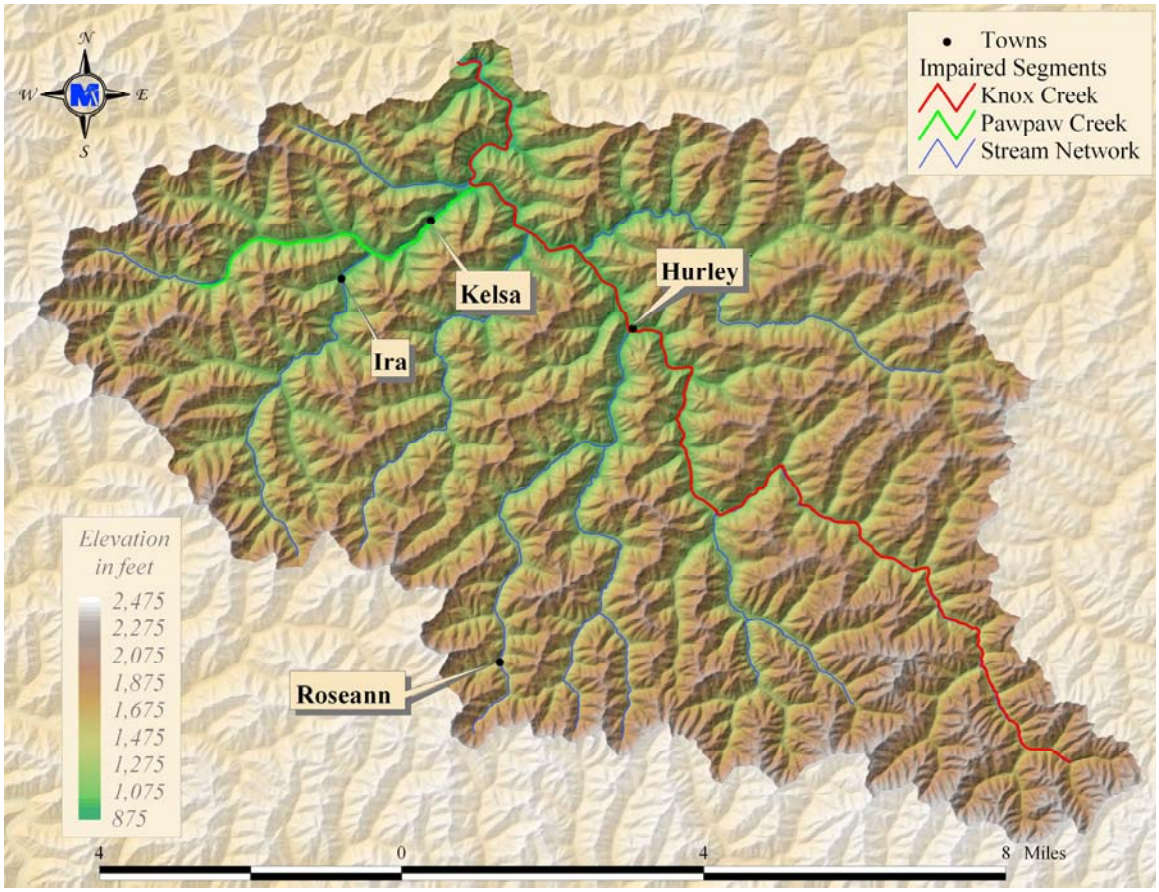

Figure 1.1 The impaired segments of Knox Creek and Pawpaw Creek (2004).

The majority of the Knox Creek and Pawpaw Creek watersheds (contained in USGS Hydrologic Unit Code 05070201) are located in Buchanan County, Virginia with a small portion in Pike County, Kentucky. Pawpaw Creek flows into Knox Creek near Kelsa, VA. This watershed is a part of the Tennessee/Big Sandy River basin, which drains via the Mississippi River to the Gulf of Mexico (Figure 1.2).

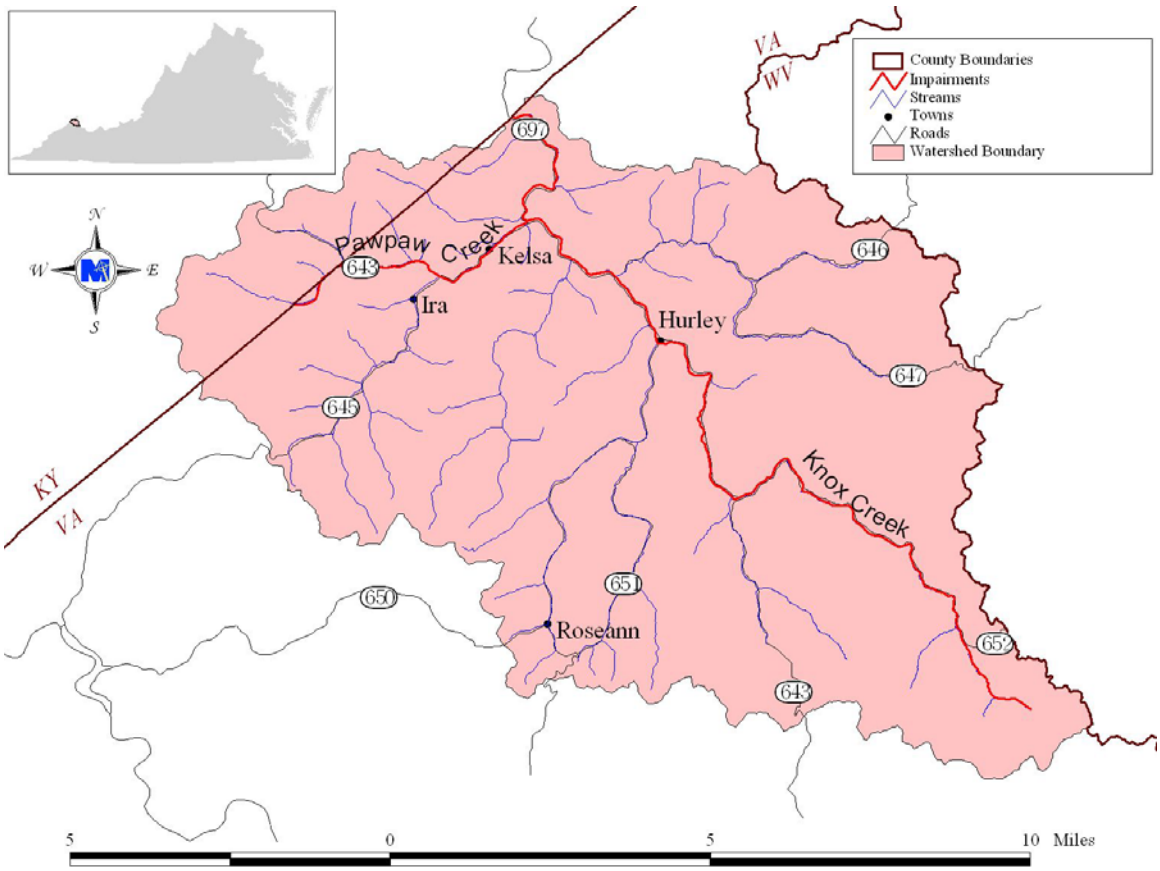

Figure 1.2 Location of the Knox Creek and Pawpaw Creek watersheds.

The land area of the Knox Creek watershed is approximately 56,125 acres, with forest as the primary land use. The Pawpaw Creek watershed is approximately 11,711 acres comprised of abandoned mine land (4.4%), active mine land (1.1%), reclaimed mine land (0.7%), residential (0.3%), pasture/hay and cropland (0.4%), water (0.9%), and forest (92.2%) land uses. The Knox Creek watershed, including the Pawpaw Creek area, is comprised of abandoned mine land (3.8%), active mine land (2.1%), reclaimed mine land (0.7%), residential (0.4%), pasture/hay and cropland (1.1%), water (1.1%), and forest (90.8%) land uses (Figure 1.3 and Table 1.1).

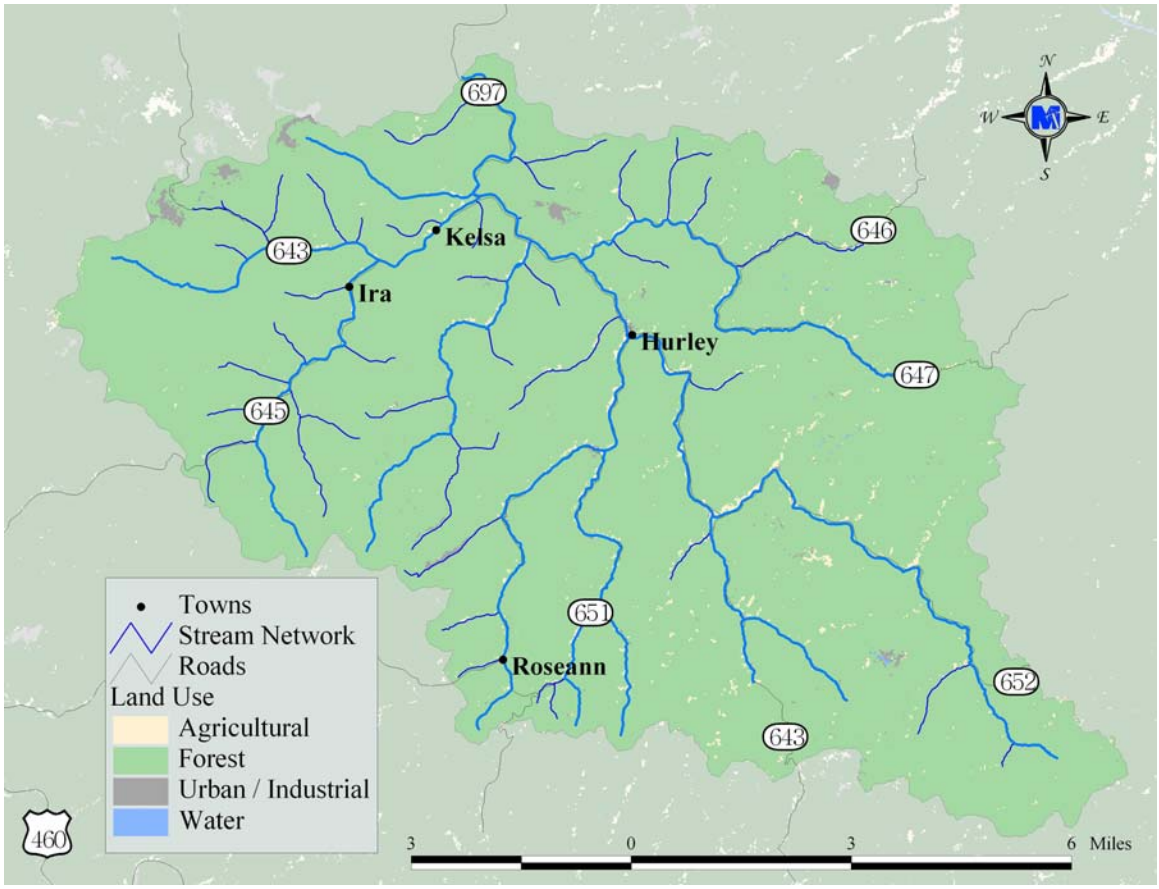

Figure 1.3 Land uses in the Knox Creek watershed.

Buchanan County is home to 329 species of wildlife including 50 types of mammals (*e.g.*, beaver, raccoon, and white - tailed deer) and 146 types of birds (*e.g.*, wood duck, wild turkey) (VDGIF, 2005).

Table 1.1 Contributing land use area for the entire Knox Creek watershed.

Land use	Knox Creek watershed (acres)
Virginia:	
Active Mining	787
Abandoned Mine Land	2,085
Cropland	432
Forest	47,450
Livestock Access	16
Pasture	149
Reclaimed	399
Residential	54
Roads – Salt applied	191
Water	598
Kentucky:	
Active Mining	371
Abandoned Mine Land	38
Cropland	0
Forest	3,490
Pasture	7
Reclaimed	30
Roads – Salt applied	0
Water	28
Total	**56,125**

For the period 1955 to 2004, the Knox and Pawpaw watersheds received average annual precipitation of approximately 44.58 inches, with 53% of the precipitation occurring during the May through October growing season (SERCC, 2005). Average annual snowfall is 17.3 inches with the highest snowfall occurring during January (SERCC, 2005). The average annual daily temperature is 55.6 ºF. The highest average daily temperature of 87.1 ºF occurs in July, while the lowest average daily temperature of 23.3 ºF occurs in January (SERCC, 2005). The estimated human population within the Knox Creek drainage area is currently 3,878.

1.2 Applicable Water Quality Regulations

Section 303(d) of the CWA and the U.S. Environmental Protection Agency's (EPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require that states develop a Total Maximum Daily Load (TMDL) for each pollutant. A TMDL is a "pollution budget" for a stream. That is, it sets limits on the amount of pollution that a

stream can tolerate and still maintain water quality standards. In order to develop a TMDL, background concentrations, point source loadings, and non-point source loadings are considered. A TMDL accounts for seasonal variations and must include a margin of safety (MOS). Through the TMDL process, states establish water-quality based controls to reduce pollution and meet water quality standards.

Once a TMDL is developed and approved by the State Water Control Board (SWCB) and the EPA, measures must be taken to reduce pollution levels in the stream. The approved TMDL for Knox and Pawpaw Creeks can be found on the VADEQ website (http://gisweb.deq.virginia.gov/tmdlapp/tmdl_report_search.cfm). Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". The TMDL Implementation Plan (IP) describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process.

In developing this IP, elements from both state and federal guidance were incorporated and the recommendations from Virginia's *Guidance Manual for Total Maximum Daily Load Implementation Plans* (VADCR and VADEQ, 2003) were followed. (Specific state and federal requirements of an IP are described in chapter 2 of this document.) Virginia's 1997 WQMIRA determined that an IP shall include the date of expected achievement of water quality objectives, measurable goals, necessary control measures, and the associated costs, benefits, and environmental impacts of addressing the impairments. The EPA outlines the minimum elements of an approvable IP in its 1999 proposal, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA, 1999). These elements include implementation actions/management measures, timeline, legal or regulatory controls, time required to attain water quality standards, monitoring plan, and milestones for attaining water quality standards. The process of incorporating these state and federal guidelines into an IP consisted of three major components: 1) public participation, 2) identification and assessment of potential control measures, and 3) assessment of progress toward end goals.

Once developed, the Virginia Department of Environmental Quality (VADEQ) will take the TMDL implementation plan to the State Water Control Board (SWCB) for approval as the plan for implementing the pollutant allocations and reductions contained in the TMDL. Also, VADEQ will request SWCB authorization to incorporate the TMDL IP into the appropriate Water Quality Management Plan (WQMP) in accordance with the CWA's Section 303(e). In response to a Memorandum of Understanding (MOU) between EPA and VADEQ, VADEQ also submitted a draft Continuous Planning Process to EPA in which VADEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

In fulfilling the state's requirement for the development of a TMDL IP, a framework has been established for reducing *E. coli* levels, TDS levels, and sediment levels (in Pawpaw Creek) and achieving the water quality goals for the Knox Creek and Pawpaw Creek impaired segments for which TMDL allocations were developed.

1.2.1 Designated Uses of Virginia's Waterbodies

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 fecal coliform bacteria standard is described in 9 VAC 25-260-170 (below). This standard is to be met during all stream flow levels and was established to protect bathers from ingestion of potentially harmful bacteria. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

Recognizing that all waters in the Commonwealth are not used extensively for swimming, Virginia has approved a process for re-designation of the 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). The 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 the EPA will have an opportunity to comment on these special studies.

As stated in Virginia state law 9 VAC 25-260-10 (Designation of uses),

> *A. All state waters, including wetlands, are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish.*
>
> ♦
>
> *D. At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under §§301(b) and 306 of the Clean Water Act and cost-effective and reasonable best management practices for nonpoint source control.*

The applicable water quality criteria for fecal bacteria impairments in the Knox Creek watershed are covered in Section 9 VAC 25-260-170.

1.2.2 Indicator Species for Fecal Impairment

EPA recommended that all states adopt an *E. coli* or *enterococci* standard for fresh water and *enterococci* criteria for marine waters by 2003. EPA is pursuing the states' adoption of these standards because there is a stronger correlation between the concentration of these organisms (*E. coli* and *enterococci*) and the incidence of gastrointestinal illness than with fecal bacteria. *E. coli* and *enterococci* are both bacteriological organisms that can be found in the intestinal tract of warm-blooded animals. Like fecal bacteria, these organisms indicate the presence of fecal contamination. The adoption of the *E. coli* and e*nterococci* standard went into effect in Virginia on January 15, 2003.

The new criteria, used in developing the bacteria TMDL in this study, is outlined in 9 VAC 25-260-170 and reads as follows:

A. In surface waters, except shellfish waters and certain waters identified in subsection B of this section, the following criteria shall apply to protect primary contact recreational uses:

1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water. This criterion shall not apply for a sampling station after the bacterial indicators described in subdivision 2 of this subsection have a minimum of 12 data points or after June 30, 2008, whichever comes first.

2. E. coli and Enterococci bacteria per 100 ml of water shall not exceed the following:

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

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

1.2.3 Addressing Wildlife Contributions

In some streams for which bacteria TMDLs have been developed, water quality modeling indicates that, even after removal of all bacteria sources (other than wildlife), the stream will not attain standards under all flow regimes at all times. As is the case for the Knox Creek and Pawpaw Creek watersheds, these streams may not be able to attain standards without some reduction in wildlife load. **Virginia and EPA are not proposing the reduction of wildlife to allow for the attainment of water quality standards.**

To address this issue, Virginia proposed during its triennial water quality standards review a new "secondary contact" category for protecting the recreational use in state waters. On March 25, 2003, the Virginia SWCB adopted criteria for "secondary contact

recreation" which means "a water-based form of recreation, the practice of which has a low probability for total body immersion or ingestion of waters (examples include but are not limited to wading, boating and fishing)". These new criteria will become effective pending EPA approval and can be found at http://www.deq.virginia.gov/wqs/rule.html.

In order for the new criteria to apply to a specific stream segment, the primary contact recreational use must be removed. To remove a designated use, the state must demonstrate that 1) the use is not an existing use, 2) downstream uses are protected, and 3) the source of bacterial contamination is natural and uncontrollable by effluent limitations and by implementing cost-effective and reasonable best management practices (BMPs) for nonpoint source control (9 VAC 25-260-10). This, and other, information is collected through the UAA study. 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.

Based on the above, EPA and Virginia have developed a process to address the wildlife issue. First in this process is the development of a Stage I scenario. The pollutant reductions in the Stage I scenario are targeted only at the controllable, anthropogenic bacteria sources identified in the TMDL, setting aside control strategies for wildlife except for cases of over-populations. During the implementation of the Stage I scenario, all controllable sources would be reduced to the maximum extent practicable using the iterative approach described in Section 6.1. The VADEQ will re-assess water quality in the stream during and subsequent to the implementation of the Stage I scenario to determine if the water quality standard is attained. This effort will also evaluate if the modeling assumptions were correct. If water quality standards are not being met, a UAA may be initiated to reflect the presence of naturally high bacteria levels due to uncontrollable sources. In some cases, the effort may never have to go to the UAA phase because the water quality standard exceedances attributed to wildlife in the model may have been very small and infrequent and within the margin of error.

1.2.4 Applicable Criterion for Benthic Impairment

The General Standard**,** as defined in Virginia state law 9 VAC 25-260-20, states:

> 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 inimical or harmful to human, animal, plant, or aquatic life.*

The General Standard is implemented by VADEQ through application of the modified Rapid Bioassessment Protocol II (RBP II). Using the modified RBP II, the health of the benthic macroinvertebrate community is typically assessed through measurement of eight biometrics (Table 1.2) which evaluate different aspects of the community's overall health. Surveys of the benthic macroinvertebrate community performed by the VADEQ are assessed at the family taxonomic level (Barbour, 1999).

Each biometric measured at a target station is compared to the same biometric measured at a reference (not impaired) station to determine each biometric score. These scores are then summed and used to determine the overall bioassessment (*e.g.*, not impaired, slightly impaired, moderately impaired, or severely impaired).

Table 1.2 Components of the modified RBP II assessment.

Biometric	Benthic Health [1]
Taxa Richness	↑
Modified Family Biotic Index (MFBI)	↓
Scraper to Filtering Collector Ratio (SC/CF)	↑
EPT / Chironomid Ratio (EPT/CHI ABUND)	↑
% Contribution of Dominant Family (% DOM)	↓
EPT Index	↑
Community Loss Index (COMM. LOSS INDEX)	↓
Shredder to Total Ratio (SH/TOT)	↑

[1] An upward arrow indicates a positive response in benthic health when the associated biometric increases.

1.3 Project Methodology

The overall goal of this project was to begin the process of restoring water quality to the impaired stream segments in Knox Creek and Pawpaw Creek.

The key components of the staged IP are discussed in detail in the following sections: State and Federal Requirements for Implementation Plans, Review of TMDL Development, Public Participation, Assessment of Implementation Action Needs,

Measurable Goals and Milestones for Attaining Water Quality Standards, and Stakeholders and Their Role in Implementation.

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

2. STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

The goal of this chapter is to clearly define the state and federal requirements and recommendations for TMDL IPs. This chapter has three sections that discuss the following: the requirements outlined by the WQMIRA that must be met in order to produce an IP that is acceptable and approvable by the Commonwealth, the EPA-recommended elements of IPs, and the required components of an IP in accordance with Section 319 guidance. The IP is intended to include both the required and recommended elements described in this chapter.

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. The WQMIRA directs VADEQ 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 the WQMIRA. WQMIRA requires that IPs include the following:

- Date of expected achievement of water quality objectives,
- Measurable goals,
- Corrective actions necessary,
- Associated costs, benefits, and environmental impacts of addressing the impairment, and
- Expeditious development and implementation of TMDLs when appropriate.

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 "Guidance for Water Quality-Based Decisions: The TMDL Process" (EPA, 1999). The listed elements include:

- a description of the implementation actions and management measures,
- a timeline 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. While Section 319 funds are not guaranteed to areas with approved implementation plans, the guidelines set forth by the Section 319 program are useful for ensuring a complete and thorough plan. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine processes that must be reflected in the IP in order to meet the 319 requirements:

1. Identify the causes and sources of 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 nonpoint (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 progress is being made towards attaining water quality standards and, if not, the criteria for determining if the watershed-based plan needs to be revised.
9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

3. REVIEW OF TMDL DEVELOPMENT

MapTech, Inc. was contracted by the VADEQ to develop TMDLs for the Knox Creek and Pawpaw Creek watersheds in Virginia. The EPA-approved TMDL document can be obtained at http://gisweb.deq.virginia.gov/tmdlapp/tmdl_draft_reports.cfm. Once the SWCB issues its approval, the document will be accessible through http://gisweb.deq.virginia.gov/tmdlapp/tmdl_report_search.cfm. Water quality monitoring, water quality modeling, and allocated reductions were reviewed to determine the implications of TMDL and modeling procedures for IP development.

3.1 TMDL Water Quality Monitoring Results

TMDL development typically relies on monitored data collected prior to the TMDL study; however, supplemental data is often collected during the TMDL study. In the case of the fecal coliform TMDL for Knox Creek, MapTech, Inc. was contracted to perform an analysis of fecal bacteria and *E. coli* concentrations as well as Bacterial Source Tracking (BST). BST is intended to aid in identifying sources (*i.e.*, human, pets, livestock, or wildlife) of fecal contamination in water bodies. Data collected provided insight into the likely sources of fecal contamination, aided in distributing fecal loads from different sources during model calibration, and will improve the chances for success in implementing solutions. For the General Standard TMDLs, benthic surveys and ambient water quality data were collected. As a review, the benthic survey results are shown in this report. The quantity of ambient water quality data is great and can be found in the TMDL document.

3.1.1 Data Collected to Support the Fecal Coliform TMDL

The TMDL document reports fecal coliform violation rates of 57% and 25% at Knox Creek VADEQ stations 6AKOX006.52 AND 6AKOX014.17, respectively. These results are based on data collected from February 1980 to June 2004 by VADEQ, and the current instantaneous fecal coliform standard (400 cfu/100 mL). Similarly, an *E. coli* violation rate of 63% was reported at VADEQ station 6AKOX006.52 for data collected from November 2003 to June 2004 (the *E. coli* instantaneous standard is 235 cfu/100 mL).

Several procedures are currently under study for use in BST. Virginia has adopted the Antibiotic Resistance Analysis (ARA) methodology implemented by MapTech's Environmental Diagnostics Laboratory (EDL). This method was selected because it has been demonstrated to be a reliable procedure for confirming the presence or absence of human, pet, livestock, and wildlife sources in watersheds in Virginia. The results were reported as the percentage of isolates acquired from the sample that were identified as originating from either humans, pets, livestock, or wildlife.

The BST results of water samples collected at one ambient station in the Knox Creek watershed are reported in Table 3.1. The *E. coli* enumerations are given to indicate the bacteria concentrations at the time of sampling. The proportions reported are formatted to indicate statistical significance (*i.e.*, **BOLD** numbers indicate a statistically significant result). The statistical significance was determined through two tests. The first was based on the sample size. A z-test was used to determine if the proportion was significantly different from zero (alpha = 0.10). Second, the rate of false positives was calculated for each source category in each library, and a proportion was not considered significantly different from zero unless it was greater than the false-positive rate plus three standard deviations. Table 3.2 summarizes the results for each station with load-weighted average proportions of bacteria originating from the four source categories. The load-weighted average considers the level of flow in the stream at the time of sampling, the concentration of *E. coli* measured, and the number of bacterial isolates analyzed in the BST analysis.

Table 3.1 Bacterial source tracking results from water samples collected in the Knox Creek impairment (6AKOX006.52).

Station	Date	*E. coli* (cfu/100 ml)	Percent Isolates classified as[1]:			
			Wildlife	Human	Livestock	Pets
6AKOX006.52	7/14/03	310	0%	4%	**42%**	**54%**
	8/11/03	700	0%	8%	**80%**	**12%**
	9/16/03	580	0%	8%	**88%**	4%
	10/14/03	140	7%	**27%**	13%	**53%**
	11/19/03	1800	**38%**	**41%**	4%	**17%**
	12/8/03	124	4%	**59%**	**12%**	**25%**
	1/6/04	280	4%	**29%**	8%	**59%**
	2/18/04	10	12%	12%	25%	51%
	3/15/04	10	0%	83%	17%	0%
	4/26/04	2500	8%	**33%**	**26%**	**33%**
	5/11/04	350	8%	**63%**	0%	**29%**
	6/22/04	500	**38%**	**42%**	8%	**12%**

[1]**BOLD** type indicates a statistically significant value.

Table 3.2 Load-weighted average proportions of fecal bacteria originating from wildlife, human, livestock, and pet sources.

Station ID	Stream	Wildlife	Human	Livestock	Pet
6AKOX006.52	Knox Creek	28%	38%	11%	23%

3.1.2 Data Collected to Support the General Standard TMDLs

Modified RBP II benthic monitoring was conducted by the VADEQ on Knox Creek. The results are shown in Table 3.3. All sampling results indicated that Knox Creek is impaired.

Table 3.3 Modified RBP II biological monitoring results for VADEQ station 6AKOX008.51 on Knox Creek.

Date	Assessment	Reference Station
12/4/1992	Moderately Impaired	6ADIS002.80
12/13/1993	Moderately Impaired	6ADIS002.80
5/3/2005	Slightly Impaired	6ADIS002.80

An alternative method to the modified RBP II is the Virginia Stream Condition Index (VASCI). The VASCI is being developed, and data is being collected to calibrate and further validate the VASCI method. Eight biometrics are obtained, with higher scores

indicating a healthier benthic community. The advantage of the VASCI is that the score does not depend upon values from a reference station. The VASCI has an impairment threshold of 61.3; a stream with a score above this value has a non-impaired assessment for that survey. On July 31, 2002, the Kentucky Department of Environmental Protection (DEP) performed a benthic survey on Knox Creek at the Virginia/Kentucky state line (station 6AKOX006.52). The VASCI results are shown in Table 3.4. On December 22, 2004, Gress Engineering performed benthic surveys at two sites on Knox Creek under contract with Virginia Department of Mines, Minerals, and Energy (DMME).

Table 3.4 VASCI benthic monitoring data for stations on Knox Creek.

Station	River Mile	Location	Date	VASCI Score	Assessment
6AKOX006.52	6.52	VA/KY state line	7/31/2002	63.25	Non-impaired
KC-1	6.23	Near State Line	12/22/2004	45.76	Impaired
KC-2	11.96	At Hurley, VA	12/22/2004	45.26	Impaired

Modified RBP II benthic surveys were performed by VADEQ at 6APPW000.60 in 1992 and on May 3, 2005. Table 3.5 shows the results of the May 2005 survey; the results from 1992 are not available. On December 22, 2004, Gress Engineering performed benthic surveys at two sites on Pawpaw Creek under contract with DMME. The VASCI results are shown in Table 3.6.

Table 3.5 Modified RBP II biological monitoring results for VADEQ station 6APPW000.49 on Pawpaw Creek.

Date	Assessment	Reference Station
5/3/2005	Slightly Impaired	6ADIS002.80

Table 3.6 VASCI benthic monitoring data for stations on Pawpaw Creek.

Station	River Mile	Location	Date	VASCI Score	Assessment
PP-1	0.31	Near Mouth	12/22/2004	38.33	Impaired
PP-2	1.86	Above Left Fork Pawpaw Creek	12/22/2004	34.56	Impaired

3.2 Water Quality Modeling

In order to understand the implications of the load allocations determined during TMDL development, it is important to understand the modeling methods used in the analysis. Different modeling approaches were used for the fecal bacteria and aquatic life TMDLs. These approaches are presented here in the "Fecal Bacteria Modeling" section (section 3.2.1) and the "Sediment Modeling" section (section 3.2.3).

3.2.1 Fecal Bacteria Modeling

The USGS Hydrologic Simulation Program - Fortran (HSPF) water quality model was used as the modeling framework to simulate hydrology and the transport of fecal coliform for the bacteria TMDL allocation. Seasonal variations in hydrology, climatic conditions, and watershed activities can be explicitly accounted for in the HSPF model. The water quality endpoint used for determining the necessary reduction to *E. coli* loads was the 30-day *E. coli* geometric mean standard (126 cfu/100 mL) and the instantaneous *E. coli* standard (235 cfu/100 mL).

3.2.1.1 Fecal Coliform Sources

Potential sources of FC considered in the development included both point source and nonpoint source contributions. Permitted point sources are shown in Table 3.7. Nine non-mining point sources are permitted in the Knox Creek watershed through the Virginia Pollutant Discharge Elimination System (VPDES). Permitted point discharges that may contain pathogens associated with fecal matter are required to maintain a fecal bacteria concentration below 200 cfu/100 ml. Currently, these permitted discharges are expected not to exceed the 126 cfu/100ml *E. coli* standard.

Table 3.7 Summary of VPDES permitted point sources in the Knox Creek and Pawpaw Creek watersheds.

Facility Name	Permit No	Recorded Flow (MGD)[1]	Design Flow (MGD)	Permitted For Fecal Control	Active During Modeling Time Periods[2]	Receiving Stream
Buchanan County Hurley High School	VA0026972	0.007	0.008	YES	YES	Straight Fork (until 1999); Right Fork (currently)
Buchanan County Hurley Middle School	VA0067521	0.0057	0.017	YES	YES	Right Fork
Domestic discharge	VAG400180	0.001	0.001	YES	YES	Straight Fork
Domestic discharge	VAG400391	0.001	0.001	YES	YES	Knox Creek
Hurley Heights I	VAG400502	0.001	0.001	YES	YES	Lester Fork
Hurley Heights II	VAG400503	0.001	0.001	YES	YES	Lester Fork
Rebel Den Dine & Shine	VAG750011	0.005	0.005	NO	YES	Knox Creek
Pit Stop - Wolford	VAG750123	0.005	0.005	NO	YES	Right Fork
VDOT Lebanon	VAR101849	NA	NA	NO	YES	Laurel Fork

[1]NA = Not applicable
[2]Modeling time periods = HSPF Hydrology Calibration, HSPF FC Calibration, HSPF TDS Calibration, GWLF Modeling

Both urban and rural nonpoint sources of fecal bacteria were considered. Sources included residential sewage treatment systems, land application of waste (livestock), livestock, wildlife, and domestic pets. It is important to understand the types of sources modeled, their delivery mechanisms, and temporal variations. Table 3.8 gives a summary of nonpoint loads. Loads were represented either as land-based loads, where they were deposited on land and available for wash-off during a rainfall event, or as direct loads, where they were directly deposited to the stream. Land-based nonpoint sources are represented as an accumulation of pollutants on land, where some portion is available for transport in runoff. The amount of accumulation and availability for transport vary with land use type and season. The model allows a maximum accumulation to be specified. The maximum accumulation was adjusted seasonally to account for changes in die-off rates, which are dependent on temperature and moisture conditions. Some nonpoint sources, rather than being land-based, are represented as being deposited directly to the stream (*e.g.*, animal defecation in stream, houses that utilize straight pipes to discharge waste). These sources are modeled similarly to point sources, as they do not require a runoff event for delivery to the stream. These sources are primarily due to animal

activity, which varies with the time of day. Direct depositions by nocturnal animals were modeled as being deposited from 6:00 PM to 6:00 AM, and direct depositions by diurnal animals were modeled as being deposited from 6:00 AM to 6:00 PM. Once in-stream, die-off is represented by a first-order exponential equation.

Table 3.8 Fecal bacteria sources modeled during TMDL development.

Source	Delivery Mechanism(s)	Variation
Wildlife		
Raccoon	Land-Based & Direct	Temporal and Spatial
Muskrat	Land-Based & Direct	Temporal and Spatial
Beaver	Direct	Temporal and Spatial
Deer	Land-Based & Direct	Temporal and Spatial
Turkey	Land-Based & Direct	Temporal and Spatial
Goose	Land-Based & Direct	Temporal and Spatial
Duck	Land-Based & Direct	Temporal and Spatial
Agricultural		
Dairy Cattle	Land-Based & Direct	Temporal and Spatial
Beef Cattle	Land-Based & Direct	Temporal and Spatial
Horse	Land-Based	Spatial
Swine	Land-Based	Spatial
Sheep	Land-Based	Spatial
Residential		
Failing Septic Systems	Land-Based	Temporal and Spatial
Uncontrolled Discharges	Direct	Spatial
Dogs & Cats	Land-based	Spatial

3.2.1.2 E. coli Model Allocation

Several model runs were made investigating scenarios that would meet the current water quality standards. The final load allocations are shown in Table 3.9. The TMDL goal is 89% reduction in fecal bacteria from direct livestock, 99.5% reduction from NPS agricultural loads, 99.5% from NPS residential loads, 100% reduction of direct human loads (straight pipes), 87% reduction from direct wildlife loads, and a 94% reduction from NPS forest/wetland loads. The Stage I scenario gives reductions of anthropogenic sources, which yields instantaneous standard violations near 10%. This is a typical goal to accomplish during implementation.

Table 3.9 Load reductions allocated during bacteria TMDL development.

	Percent Reduction in Loading from Existing Conditions					
Simulation	**Direct Wildlife Loads**	**NPS Forest / Wetland**	**Direct Livestock Loads**	**NPS Agricultural Land**	**Direct Human Loads**	**NPS Residential Land**
Stage I	0	0	89	98	100	98
Final	87	94	89	99.5	100	99.5

3.2.2 Total Dissolved Solids Modeling

The HSPF water quality model was used as the modeling framework to simulate hydrology and the transport of TDS to both of the streams. Seasonal variations in hydrology, climatic conditions, and watershed activities can be explicitly accounted for in the HSPF model. Since there is no state standard for TDS, a reference watershed approach was used to establish the water quality endpoint for TMDL allocations. Using this approach, a similar, but non-impaired, watershed is selected and modeled to determine the acceptable load of the pollutant in question. The reference watershed for Knox Creek was Dismal Creek in Buchanan County, Virginia. The reference watershed for Pawpaw Creek was Middle Creek in Tazewell County, Virginia.

3.2.2.1 Total Dissolved Solids Model Allocation

The TDS allocation scenario was modeled using HSPF. The TMDL developed for Pawpaw Creek was based on the 90th percentile TDS concentration (334 mg/L) sampled in Middle Creek. The 90th percentile TDS concentration of 369 mg/L measured in Dismal Creek was used as the TDS TMDL endpoint for Knox Creek. Existing conditions were adjusted until the TMDL endpoint was attained. An explicit MOS was used in the development of the TDS TMDLs. By adopting an MOS in estimating the loads in the watershed, it is ensured that the recommended reductions will, in fact, succeed in meeting the water quality standard.

Pollutant concentrations were modeled over the entire duration of a representative modeling period, and pollutant loads were adjusted until the endpoint was met. The development of the allocation scenario was an iterative process that required numerous runs with each followed by an assessment of source reductions against the water quality

target. The final allocated TDS loads are shown in Table 3.10 for Knox Creek and Table 3.11 for Pawpaw Creek.

Table 3.10 Source loads used in Knox Creek model runs.

Source	Total Annual Loading for Existing Run (kg/yr)	Total Annual Loading for Allocation Run (kg/yr)
Land-based	1.83E+07	7.97E+06
Direct	2.0E+04	1.0E+04

Table 3.11 Source loads used in Pawpaw Creek model runs.

Source	Total Annual Loading for Existing Run (kg/yr)	Total Annual Loading for Allocation Run (kg/yr)
Land-based	3.33E+06	2.71E+06
Direct	2.0E+04	0.0

3.2.3 Sediment Modeling

Excessive sedimentation is considered to be a primary cause of the listed benthic impairments in Pawpaw Creek. This is based on the persistent and extremely high Total Suspended Solids (TSS) concentrations and the marginal habitat score for pool sediment. Sedimentation has impacted the benthic community in these streams due to increases caused by agricultural and urban runoff, streambank de-stabilization, the loss of riparian buffers, and other processes.

The Generalized Watershed Loading Function (GWLF) model (Haith et al., 1992) was used to model sediment for Pawpaw Creek. Since there is no state standard for sediment, a reference watershed approach was used to establish the water quality endpoint for TMDL allocations. Using this approach, a similar, but non-impaired, watershed is selected and modeled to determine the acceptable load of the pollutant in question. The reference watershed for Pawpaw Creek was Middle Creek in Tazewell County, Virginia.

3.2.3.1 Sediment Allocations

The target TMDL load for Pawpaw Creek is the average annual load in metric tons per year (t/yr) from the area-adjusted Middle Creek watershed under existing conditions. To

reach the TMDL goal (5,430 t/yr) several scenarios were simulated with GWLF. The final scenario is shown in Table 3.12. Sediment loads from straight pipes were reduced 100% due to health implications and the recommendations of the fecal bacteria TMDL. Table 3.12 shows similar reductions to sediment loads from abandoned mine land (59%), disturbed forest (58%), and high tillage cropland (57%), and a 13% reduction to streambank erosion.

Although the streambank erosion load is the combined load from the Virginia and Kentucky portions of the stream, the required 13% reduction can be implemented in the Virginia portion of the watershed only. Since only 35% of the main stem of the stream network is in the Kentucky portion of the watershed, it is reasonable to estimate the 13% sediment reduction recommended can be obtained from BMPs implemented in the Virginia portion of the watershed.

Table 3.12 Final Sediment TMDL allocation scenario for Pawpaw Creek.

Sediment Source	Pawpaw Existing Loads t/yr	Reductions (Final) (%)	Allocated Loads t/yr
Pervious VA Area:			
AML	4,289	59	1,758
Active Mine	0.60	0	0.60
Cropland	1,211	57	520.5
Forest	1,257	0	1,257
Forest Disturbed	2,799	58	1,176
Pasture	17.06	0	17.06
Reclaimed	0.65	0	0.65
Residential	0.14	0	0.14
Water	0.00	0	0.00
Impervious VA Area:			
Salted Roads	3.06	0	3.06
Residential	0.06	0	0.06
Pervious KY Area	620.47	0	620.47
Impervious KY Area	0.00	0	0.00
Streambank Erosion (VA & KY)	81.44	13	70.85
Straight pipes (VA only)	2.94	100	0.00
Point Sources (VA only)	4.99	0	4.99
Watershed Total	**10,287**	**47.2**	**5,430**

3.3 Implications of TMDL and Modeling Procedure on Implementation Plan Development

The major implication in the development of these TMDLs is that extreme reductions are required to achieve the water quality standard, particularly in the case of the bacteria TMDL. All uncontrolled discharges and failing septic systems must be identified and corrected and most livestock must be excluded from streams. Additionally, residential and rural nonpoint sources of fecal bacteria, TDS, and sediment must be reduced.

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. Although reductions to the fecal bacteria load from wildlife are indicated, these reductions will not be explicitly addressed by this implementation plan. Wildlife control measures that are already intended by local authorities will be considered in terms of anticipated reductions to the fecal bacteria load; implementation efforts will be directed at controlling anthropogenic sources. See Section 1.2.3 in this report for a discussion of regulatory issues regarding wildlife.

In terms of livestock access to streams, only cattle were modeled explicitly as supplying direct inputs to the stream (Table 3.8). Implicit in the modeling scheme was that other livestock do not have access to the stream. The HSPF model is calibrated to measure levels of fecal bacteria regardless of source, so the modeled load of fecal bacteria directly deposited by cattle is representative of direct loads from all forms of livestock. Therefore, all livestock with stream access will be considered in order to reach the reduction in direct depositions that has been deemed necessary (*i.e.*, 89%).

4. PUBLIC PARTICIPATION

Public participation was an integral part of the TMDL Implementation Plan development in the Knox Creek and Pawpaw Creek watersheds, and it is also critical to promote reasonable assurances that the implementation activities will occur. Public participation took place on three levels.

First, public meetings were held to provide an opportunity for informing the public as to the end goals and status of the project as well as for soliciting participation in the smaller, more-targeted meetings. Second, working groups (WG) were assembled from communities of people with common concerns regarding the TMDL process, and were the primary arena for seeking public input. Working groups for industrial, residential, and governmental issues were formed. A representative from the Virginia Department of Conservation and Recreation (VADCR) attended each working group meeting in order to facilitate the process and integrate information collected from the various communities. Third, a Steering Committee was formed with representation from VADEQ, VADCR, VDH, DMME, Big Sandy Soil and Water Conservation District (BSSWCD), Kentucky DEP, representatives from the working groups, and MapTech. Minutes from each of the Working Group and Steering Committee meetings are included in Appendix A.

The overall goal of the Working Groups was to identify obstacles to implementation in their respective communities and recommend workable solutions that will overcome these obstacles. In addition, the Working Groups were expected to: identify funding/partnering opportunities that would help to overcome obstacles to implementation, review the IP from an environmental perspective, identify the regulatory authority in the specific areas related to implementation, identify existing programs and resources that might be relevant to the situation, and propose additional programs that would support implementation. The Steering Committee had the express purpose of formulating the TMDL IP. In addition, this committee had the responsibility for identifying control measures that are founded in practicality, establishing a timeline to ensure expeditious implementation, and setting measurable goals and milestones for attaining water quality standards.

Attendance at public meetings is critical to the public participation effort, and was encouraged through announcements in the *Virginia Register*, advertisements in local newspapers, direct mailings and contact with community groups and local SWCDs.

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

Table 4.1 Meetings held for TMDL IP development in the Knox Creek and Pawpaw Creek watersheds.

Date	Meeting Type	Location	Attendance
11/28/2005	First Public	Hurley Elementary and Middle School Hurley, VA	16
2/6/2006	1st Industrial WG	Hurley Elementary and Middle School Hurley, VA	9
2/6/2006	1st Residential WG	Hurley Elementary and Middle School Hurley, VA	8
2/6/2006	1st Government WG	Hurley Elementary and Middle School Hurley, VA	5
4/20/2006	1st Steering Committee	Hurley Community Center, Hurley, VA	9
5/19/2006	2nd Steering Committee	Hurley Park, Hurley, VA	14
7/10/2006	2nd Industrial WG	Hurley Elementary and Middle School Hurley, VA	11
7/10/2006	2nd Residential WG	Hurley Elementary and Middle School Hurley, VA	6
7/10/2006	2nd Government WG	Hurley Elementary and Middle School Hurley, VA	9
8/10/2006	3rd Industrial WG	Appalachian School of Law Grundy, VA	8
8/14/2006	3rd Steering Committee	SWCD office Hurley, VA	8
7/19/2007	Final Public	Hurley Elementary and Middle School Hurley, VA	14

4.1 Public Meetings

The first public meeting for the Knox Creek and Pawpaw Creek watersheds was held at the Hurley Elementary and Middle School in Hurley, Virginia on November 28, 2005. Information delivered to the public at the meeting included: a general description of the

IP development process, a review of the impairments and status of the TMDL and a solicitation for participation in working groups. There were 16 people in attendance.

The final public meeting was on July 19, 2007 in Hurley, VA with attendees from the community, industry, government agencies, and MapTech. The primary purpose of this meeting was to present the full draft TMDL implementation plan. A presentation was given describing the implementation plan using major components as an outline: Review of TMDL development, public participation, assessment of needs, cost/benefit analysis, and implementation. Maps with land use, topographic features, and analysis results were displayed and discussed after the presentation. Many comments were made, resulting in a need for a ground-truth survey of the streamside fence estimates. The BSSWCD volunteered to locate each area estimated to need streamside fencing and take notes on the actual land use (if not pasture) and estimate an amount of fencing needed if the actual land use was pasture. The results of this survey were incorporated into Chapter 5 and is shown as Appendix B.

During the 30-day public comment period after the final public meeting, two letters with comments were received. These outlined the need for the ground-truth survey of the streamside fence estimates and the results of this survey.

4.1.1 Industrial Working Group

The first meeting of the Knox and Pawpaw Creeks Industrial Working Group (IWG) occurred on February 6, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia. Participants included representatives from VADEQ, BSSWCD, DMME, MapTech, and local industry. Due to the lack of attendance by agricultural producers, the group concentrated on mining and forestry issues.

The primary responsibilities of the IWG, as presented at the meeting, are:

- Identify outreach methods for reaching agricultural producers
- Review implementation strategies from an agricultural perspective
- Identify potential constraints to implementation of BMPs
- Identify BMP options and costs
- Identify outreach tools for public participation
- Identify funding sources/partnerships that will promote implementation

- Identify timeline and measurable goals for meeting implementation goals and
- Report findings to the Steering Committee.

Other topics discussed at this meeting were BMPs that will bring down TDS and sediment loadings, restrictions related to new coal mining permits, livestock (*i.e.*, horses and cows) in the watershed, the need for educating the landowners, the potential impact from deep mines in other watersheds, road surfaces, and possible credits for abandoned mined land (AML) cleanup.

The second meeting of the IWG occurred on July 10, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia; there were 11 people in attendance. Topics of discussion included: possible composting of horse waste, future mining permits, logging activities, gas wells, reduction of acres of AML, erosion and sediment control, and stream mitigation funding. It was determined that a third meeting of the IWG would be needed.

The IWG met for the third time on August 10, 2006 at the Appalachian School of Law in Grundy, Virginia; eight members were in attendance. Topics of discussion were requirements of gas well development, forestry BMPs, DMME mitigation credit for AML reclamation, and BMP installation milestones.

4.1.2 Residential Working Group

The first meeting of the Residential Working Group (RWG) occurred on February 6, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia. Among the eight participants were several local residents as well as representatives from VADEQ, BSSWCD, and MapTech.

The primary responsibilities of the RWG, as presented at the meeting, are:

- Identify technical and financial resources to carry out implementation plan,
- Identify legal or regulatory controls,
- Recommend how to deliver residential implementation,
- Find ways to identify and eliminate straight pipes,
- Identify funding means for corrections of these sources,
- Identify difficulties faced by landowners in correcting these problems,
- Determine educational and outreach tools, and
- Report findings to the Steering Committee.

The TMDL study was reviewed for the committee and issues relating to the residential component of the IP were discussed: *e.g.*, obstacles to correcting septic systems, methods to combat those obstacles, septic system costs, and release of sediment and water after ponds are bulldozed. A representative was chosen for the Steering Committee.

The second meeting of the RWG took place on July 10, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia; there were six people in attendance. Topics of discussion included: sampling the water quality in the headwaters where watershed citizens remove drinking water, the need for funding sources for septic system installation and repairs, targeting for repairs based on bacteria counts, and partnering with Virginia Department of Transportation (VDOT) for streambank stabilization.

4.1.3 Government Working Group

The first meeting of the Knox and Pawpaw Creeks Government Working Group (GWG) occurred on February 6, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia. Participants included representatives from VADEQ, VADCR, VDOT, DMME, BSSWCD, and MapTech.

The primary responsibilities of the GWG, as presented at the meeting, are:

- Identify technical and financial resources to carry out implementation plan,
- Identify legal or regulatory controls,
- Recommend how to deliver agriculture and residential implementation, and
- Report findings to the Steering Committee.

The group discussed the installation of septic systems, financial resources and lack thereof, the Kentucky PRIDE program, legal and regulatory controls, constraints to implementation, and ways to encourage more participation. A comment was made that there are so many agencies that work with water quality, that there should be a way to coordinate and work together.

The second meeting of the GWG took place on July 10, 2006 at the Hurley Elementary and Middle School in Hurley, Virginia; there were nine people in attendance. Among the topics discussed were horse manure and the requirements of land application of waste,

the high cost figure attached to streambank restoration, concern over the accuracy of the numbers of septic systems, costs of new septic systems, and acreage estimates for active and abandoned mine lands. Comments were also made regarding the livestock exclusions (83 on 432 acres), bacteria numbers since the 2002 flood, and that the IP timeframe with regard to the hired staff should be defined within the IP.

4.1.4 Steering Committee

The first Steering Committee meeting took place on April 20, 2006 at the Hurley Community Center in Hurley, Virginia. The committee consisted of nine members with representatives from the local community, the Industrial, Residential, and Government working groups, VADEQ, VDH, BSSWCD, MapTech, and Virginia's Division of Mined Land Reclamation, (DMLR). Minutes from each of the first meetings of the working groups were distributed to all in attendance.

Committee members discussed the need for more monitoring in the headwaters, a review of mining permits to determine what corrective actions are already in place, the possibility of involving a citizens' group to conduct bug collections and counts, and the potential for pairing DMLR funding with other funding for water quality projects. Some committee members felt that AMLs are a major source of sedimentation, and permit sediment ponds were also discussed. Agencies or organizations that might be available to provide oversight for grant funds were also identified; these included BSSWCD and the Big Sandy River Basin Coalition. The Hurley Community Center and the coal companies were mentioned as possible outlets for passing on information.

The second meeting of the Steering Committee took place on May 19, 2006; 14 people attended. The committee was informed that the TMDL report had been revised with changes to the TDS loads in the TMDL tables. (This was due to a transcription error, not an error with the modeling results.) Four tables of data were presented to the committee for discussion; one with scenarios for addressing all TMDL reductions, one with scenarios for Knox Creek to meet the bacteria and TDS reductions, one demonstrating the difference between targeting and not targeting reductions, and one showing the numbers of corrective actions per year.

The committee also discussed active gas wells in the watershed, highway cleanup, education of children, and a cleanup conducted by the Knox Hunt Club that removed tons of litter from the headwaters.

The third meeting of the Steering Committee took place on August 14, 2006 at the SWCD office in Hurley. The following points were made: the public should be informed that each land use has sedimentation reduction practices in place, BMP expectations for each industry should be included in an appendix of the IP, there is a need for education of loggers in the watershed, and there is a movement to look at AML reclamation in terms of stream mitigation credits (an option that would make reclamation much more attractive to coal companies in the watershed). Possible final scenarios and milestones were also discussed.

4.1.5 Summary

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

5. ASSESSMENT OF IMPLEMENTATION ACTION NEEDS

An important element of the TMDL IP is the encouragement of voluntary compliance with implementation actions by local, state, and federal government agencies, business owners, and private citizens. In order to encourage voluntary implementation, information was obtained on the types of actions and program options that can achieve the goals practically and cost-effectively. This section outlines the methods used to identify practical and effective BMPs, or control measures, and quantify the BMPs needed to meet water quality goals.

5.1 Identification of Control Measures (BMPs)

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 indicated; those that are not currently supported by existing programs (along with their potential funding sources) were identified. The assurance of implementation of specific control measures was assessed through discussion with the Working Groups and the 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 sections 5.1.1 and 5.1.2, respectively.

It should be noted that, although only Knox Creek is impaired for fecal bacteria, BMPs to reduce bacteria will also be required in the Pawpaw Creek watershed since Pawpaw Creek drains to Knox Creek.

5.1.1 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 89% 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 landowners will want to minimize the cost of fencing and the amount of pasture lost, it was determined that any fencing installed through the use of cost-share programs should follow established Natural Resources Conservation Service (NRCS) specifications and be located 35-ft from the stream bank, at a minimum, as is specified in existing Virginia cost-share programs. Local topography and the generally small farm size were identified as deterrents to establishing large buffers in agricultural settings in these watersheds.

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 that some farmers may be willing to install their own fencing to their own specifications if cost-share money is available for the water system. It should be restated here that it is recommended 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 sediment, TDS, and bacteria loads in runoff. The incorporation of effective buffers could reduce the need for more costly control measures.

From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life.

From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production is contrary to that goal. However, a clean water source has been shown to improve milk production and weight gain. Clean water will also improve the health of animals (*e.g.*, cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. Additionally, intensive pasture management,

which becomes possible with an alternative water source, has been shown to improve overall farm profitability and environmental impact.

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

The 100% reduction in loads from straight pipes and failing septic systems is a pre-existing legal requirement as well as a result of the Knox Creek bacteria TMDL. This reduction indicates that all illicit discharges (*i.e.*, straight pipes) in the watershed should be corrected, and that all onsite sewage treatment systems (OSTS) (*e.g.*, septic systems and alternative waste treatment systems) must be maintained in proper working condition. The options identified for correcting illicit discharges and failing septic systems included: installation of a septic system, repair of an existing septic system, and installation of an alternative waste treatment system. It is anticipated that some 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. These may be designed to accommodate multiple houses so cost and maintenance responsibilities are shared.

Also implied by the Knox Creek and Pawpaw Creek TDS TMDLs is the need for reclamation of AML areas in the watersheds. Reclamation of all AML area is estimated to decrease the total annual amount of TDS that reaches Knox Creek by 48% and

Pawpaw Creek by 63%, and reduce the sediment traveling to Pawpaw Creek by 38%. These reductions alone do not meet the TMDLs, but they are significant.

5.1.2 Control Measures Selected through Stakeholder Review

In addition to the control measures that were directly indicated or implied by the TMDLs, a number of additional measures are needed to control fecal bacteria from land-based sources, sediment, and TDS. Various scenarios were developed and presented to the 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 example, a residential education program was specified for the entire Knox Creek watershed to educate citizens on how to properly dispose of pet waste. Additionally, the storage and possible composting of horse manure was addressed through inclusion of waste storage facilities. Similarly, with regard to sediment and TDS, practices that specifically address these pollutants were identified. Control measures included forest-harvesting BMPs, gas well dirt road stabilization, erosion and sediment (E&S) controls on construction sites, and streambank restoration.

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, sediment, and TDS. The resulting set of additional BMPs included: improved pasture management, manure incorporation, vegetated buffers, and infiltration trenches. Along with the infrastructure provided by a grazing land management system (SL-6), improve pasture management includes:

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

The final set of control measures identified and the efficiencies used in this study to estimate needs are listed in Table 5.1. The control measures listed in this table 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 5.1 Potential control measure costs and efficiencies in removing FC.

	Efficiencies			
Control Measure	**Bacteria**	**Sediment**	**TDS**	**Reference**
Direct Reduction Efficiency				
Streamside Fencing	100%	0%	0%	1
Corrected Straight-pipe	100%	100%	100%	1, 2
Repaired Septic System	100%	100%	100%	1, 2
Residential Education Program	75%	0%	0%	3
Manure Storage	75%	75%	N/A	2, 5
Streambank Restoration	N/A	2.55 lbs/ft/yr	0.0035 lbs/ft/yr	2
*Buffer Efficiency**				
Vegetated Buffer	50%	50%	50%	2
Runoff Treatment Efficiency				
Improved Pasture Management	50%	50%	50%	2
Manure Incorporation	90%	0%	90%	5, 7
Erosion and Sediment Controls	85%	85%	72%	4, 5, 6
Infiltration Trenches	90%	90%	70%	2, 5

* Buffer efficiencies shown here are applied to runoff from twice the buffer area upstream of the buffer. Additional reductions result from the conversion of land from its existing condition to the buffer area.

1 Removal efficiency is defined by the practice.

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

3 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.

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

5 Bacteria efficiency estimated based on sediment and nutrient efficiency.

6 Phosphorus reductions based on sediment-associated phosphorus modeled in the watershed.

7 Walter, M.F., T.L. Richard, P.D. Robillard and R. Muck. 1987. Manure management with conservation tillage. In *Effects of Conservation Tillage on Groundwater Quality: Nitrates and Pesticides*, ed., T.J. Logan et al., 253-270. Chelsea, MI: Lewis Publishers, Inc.

5.2 Quantification of Control Measures

The quantity of control measures required during implementation was determined through spatial analyses, modeling alternative implementation scenarios, and working group member requests. Spatial analyses included the processing of data that included

land use, census data, 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 required overall, in each watershed, and in each subwatershed, where appropriate. Estimates of the amount of on-site treatment systems, 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 are future increases in coal mining, forest harvesting and gas well installation. Care should be taken to monitor land changes and its impacts on water quality.

5.2.1 Agricultural Control Measures

5.2.1.1 Agricultural Control Measures: Livestock Exclusion

To estimate fencing requirements, the stream network was overlaid with land use. Stream segments that flowed through or adjacent to land use areas that had a potential for supporting cattle (*e.g.*, pasture) were identified. If the stream segment flowed through the land use area, it was assumed that fencing was required on both sides of the stream; if a stream segment flowed adjacent to the land use area, it was assumed that fencing was required on only one side of the stream. These assumptions were further refined to examine taxable land use criteria, size of resultant pasture, zoning, and existing BMPs. Both perennial and intermittent streams were included in this process. Not every land use area identified as pasture has livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access. A map of the original streamside fencing estimates and the needs found by a field survey are shown in Figure 5.1.

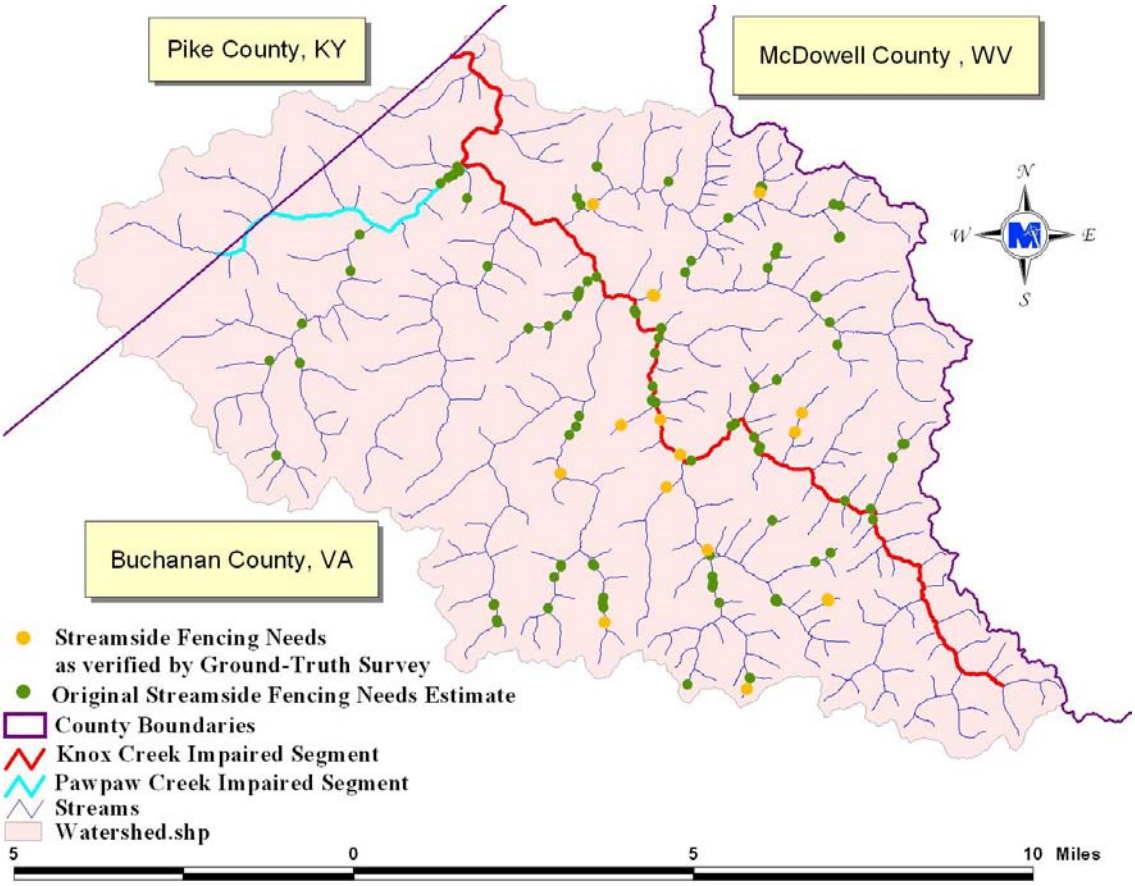

Figure 5.1 Original streamside fencing estimates and verified streamside fencing needs in the Knox Creek and Pawpaw Creek watersheds.

The VADCR Agricultural BMP Database was utilized to determine typical characteristics (*e.g.,* streamside fencing length per practice) of full livestock exclusion systems leading to the quantification of the number of required systems. The database was queried for information on Grazing Land Protection Systems (SL-6) and Stream Protection Systems (WP-2 and WP-2T) installed in the Big Sandy River basin. The SL-6 system includes streamside fencing, cross fencing, alternative watering system, and a 35-ft buffer from the stream. The WP-2 and WP-2T systems include streamside fencing, hardened crossings, and a 35-ft buffer from the stream. In TMDL implementation areas, the WP-2T practice is eligible and, in cases where a watering system already exists, a WP-2T system is a more appropriate choice. Before 1999, the number of acres benefited from installing the system was recorded while, after 1999, the average streamside fencing

length was recorded. Twenty-two systems have been installed with 14 systems characterized by streamside fencing length, and eight systems characterized with acres benefited. The average streamside fencing length was 452 feet with 17 acres benefited per installation.

To establish the total number of full livestock exclusion systems necessary to achieve full implementation, systems were calculated by dividing the potential pasture streamside fencing required by the average streamside fencing length per system. The breakdown of number of exclusions systems that are expected to be SL-6 or WP-2T systems is based on historical use of these practices in the Big Sandy River basin. The number of hardened crossings was calculated by intersecting the streams that required potential fencing on both sides with property boundaries. The resulting parcels were then analyzed for land use and resultant pasture size; parcels which were at least one acre of grazable land were identified as sufficient for livestock, and were included in the count of hardened water crossings. This IP focuses on fencing along both perennial and intermittent streams because the TMDL requires stringent reductions of fecal bacteria from direct livestock and agricultural nonpoint sources. It was determined that 85 total livestock exclusion systems (SL-6 and WP-2T) and six hardened water crossings could be installed in the Knox Creek watershed. However, the TMDL only requires an 89% reduction from direct cattle fecal bacteria. An estimated 78 SL-6 and 1 WP-2T system were originally estimated with the processes described above (Table 5.2). Due to the strict land-based fecal reductions, the remaining length of stream through and adjacent to pasture will require a 35 ft stream buffer but entire livestock exclusion practices are not required (Section 5.2.1.2).

Table 5.2 Original estimation of streamside fencing, number of full exclusion systems, and number of hardened stream crossings required in the Knox Creek and Pawpaw Creek watersheds.

Impairment	Subwatershed	Estimated Potential Fence (ft)	Estimated Required Fence (ft)	SL-6 Systems	WP-2T Systems	Hardened Crossings
Knox Creek	1	0.51	0	0	0	0
	2	539	539	2	0	0
	3	9,356	9,356	20	1	0
	4	2,665	2,665	6	0	1
	5	2,850	2,850	7	0	1
	6	0	0	0	0	0
	7	0	0	0	0	0
	8	951	951	3	0	0
	9	4,195	4,195	10	0	1
	10	353	353	1	0	0
	11	1,813	1,813	5	0	1
	12	540	540	2	0	0
	13	3,317	2,200	5	0	0
	14	1,963	0	0	0	0
	15	0	0	0	0	0
	16	0	0	0	0	0
	17	4,953	4,953	11	0	1
	18	0	0	0	0	0
	19	14	14	1	0	0
	24	897	0	0	0	0
Impairment Total		*34,408*	*30,430*	*73*	*1*	*5*
Pawpaw Creek	20	0	0	0	0	0
	21	1,294	1,152	3	0	0
	22	327	291	1	0	0
	23	131	116	1	0	0
Impairment Total		*1,752*	*1,559*	*5*	*0*	*0*
Total		**36,160**	**31,989**	**78**	**1**	**5**

After presenting the results in Table 5.2 at the final public meeting on July 19, 2007, many people were concerned that the estimated number of cattle exclusion systems and the amount of streamside fencing were too large. The Big Sandy SWCD agreed to ground truth where streamside fencing needs were estimated. Of the 117 potential fencing points given to the BSSWCD staff, 9 were verified as pasture where fencing would be required and 7 were noted as potential pasture because they could not be

reached safely. The areas not verified were assumed to need fence according to the original estimate. The survey results yielded an estimated 3,950 feet of streamside fencing that would be required. Of the areas not verified during the survey, an additional 156 feet were included in the project. The majority of the areas were identified as residential land or woodlot. These results are shown in Appendix B Table B.1. This data was used to refine the original estimations of cattle exclusion systems. Table 5.3 shows the updated estimates used for the final scenario for this IP.

Table 5.3 Final estimations of streamside fencing, number of full exclusion systems, and number of hardened stream crossings required in the Knox Creek and Pawpaw Creek watersheds.

Impairment	Ground-Truth Fence Estimate (ft)	SL-6 Systems	WP-2T Systems	Hardened Crossings
Knox Creek	4,106	13	1	2
Pawpaw Creek	0	0	0	0
Total	4,106	13	1	2

5.2.1.2 Agricultural Control Measures: Land-Based

The Knox Creek fecal bacteria TMDL requires large reductions to land-based agricultural loads. In order to meet these strict requirements, the BMPs in Table 5.3 must be implemented; however, a staged approach to implementation is described in Chapter 6 of this document, whereby much of the needed reductions can be achieved without overly intensive actions. One category of practices that is expected to have a substantial impact on water quality improvement is improved pasture management. Improved pasture management, or rotational grazing, consists of cross fencing, which allows farmers to move cattle around pastureland more efficiently. Less trampling and less overgrazing keep vegetation on the ground, which hold soil, nutrients, and manure in place.

Table 5.4 Agricultural land-based BMPs required to meet the Knox Creek and Pawpaw Creek TMDLs.

Control Measure	Unit	Knox Creek	Pawpaw Creek	Total
Improved Pasture Management	Acre	117.3	13	130.3
Manure Incorporation	Acres	377.3	0	377.3
Vegetated Buffer	System	40	1	41
Waste Storage Facilities (WP-4) - Horse	System	14	1	15

The other agricultural practices that should be introduced to the watersheds are waste storage sheds, manure incorporation and vegetated buffers. Stakeholders in the IWG stated that some horse owners in the watershed shovel the manure to the streambank. If storage sheds are encouraged, the owners can haul the manure to the shed instead of allowing it to wash into the creek. Manure incorporation is a practice in which farmers spread manure and then disk the land. The disking mixes manure with soil and has shown to keep manure and nutrients on the land longer. A vegetated buffer is an area next to a stream where cattle and horses are not allowed and vegetation is established. The area filters bacteria from runoff from adjacent land. The Knox Creek watershed has some vegetated buffer area associated with pasture due to the streamside fencing requirements. When cattle are fenced out of streams, the area between the fence and stream becomes a vegetated buffer over time, as plants establish themselves.

5.2.2 Residential Control Measures

5.2.2.1 BMPs to Correct Failing Septic Systems and Straight Pipes

All straight pipes and failing septic systems must be identified and corrected during implementation since a 100% load reduction from these sources was deemed necessary to meet the fecal bacteria and TDS TMDL goals. The number and location of failing septic systems and straight pipes were based on analysis of census data and review by the RWG. Table 5.4 shows the number of failing septic systems and straight pipes for each subwatershed.

The RWG identified the following BMPs to correct failing septic systems and straight pipes: septic system repairs, septic systems, and alternative waste treatment systems. The RWG estimated that approximately 5% of the failing septic systems would need new

alternative treatment systems installed. Of the remaining failing septic systems, 75% would be corrected with conventional septic systems and 25% would be septic repairs. It was also decided that 95% of straight pipe corrections would be new standard septic systems and the remainder would be new alternative systems. A total need of 619 new waste treatment systems or repairs were estimated for these watersheds (Table 5.4). However, the BSSWCD has been working with the communities to install new residential treatment systems and repair systems damaged by a flood that occurred in 2002. They have implemented 28 septic repairs and eight straight pipe corrections in the entire Knox Creek watershed, which are not taken into account in Table 5.4. Subtracting the corrected systems from the estimates yields 338 failing septic systems and 140 straight pipes in the Knox Creek portion and 83 failing septic systems and 22 straight pipes in the Pawpaw Creek portion of the watershed. The final needs for residential waste treatment are shown in Table 5.5.

Table 5.5 Estimated failing septic systems and straight pipes in the Knox Creek and Pawpaw Creek subwatersheds.

Impaired Segment	Subwatershed	Sewer	Septic Systems	Failing Septic Systems	Straight Pipes
Knox Creek	1	0	73	16	7
	2	0	87	19	9
	3	0	61	18	9
	4	0	192	46	19
	5	0	37	15	5
	6	0	22	6	2
	7	0	13	4	1
	8	0	60	14	6
	9	0	70	17	8
	10	0	76	25	11
	11	0	53	9	3
	12	0	65	13	4
	13	0	75	14	5
	14	0	92	19	7
	15	0	43	14	4
	16	0	27	12	3
	17	0	245	70	34
	18	0	7	7	1
	19	0	63	16	6
	24	0	26	6	2
Impairment Total		*0*	*1,387*	*360*	*146*
Pawpaw Creek	20	0	62	25	8
	21	0	44	10	3
	22	0	190	41	9
	23	0	38	13	4
Impairment Total		*0*	*334*	*89*	*24*
Watershed Total		**0**	**1721**	**449**	**170**

Table 5.6 Estimated residential waste control measures needed in the Knox Creek and Pawpaw Creek watersheds.

Control Measure	VA Cost-Share Practice Number	Knox Creek Existing BMPs	Knox Creek Units Needed	Pawpaw Creek Existing BMPs	Pawpaw Creek Units Needed	Total Units Needed
Septic System Pump-out Program	RB-1	2	158	1	42	200
Sewer Connection	RB-2	0	0	0	0	0
Septic System Repair	RB-3	22	80	6	20	100
Septic System Installation/Replacement	RB-4	6	374	2	82	456
Alternative Waste Treatment System	RB-5	0	24	0	6	30

5.2.2.2 Residential Control Measures: Land-Based

The Knox Creek and Pawpaw Creek TMDLs require large reductions to land-based residential loads. In order to meet these strict requirements, the BMPs in Table 5.6 must be implemented; however, a staged approach to implementation is described in Chapter 6 of this document, whereby much of the needed reductions can be achieved without overly intensive actions. In addition to these control measures, it was recognized that educational efforts would be vital to the successful implementation of these TMDLs. This education includes information on how pet waste should be disposed of, a septic tank pump-out program addressing 200 systems within the entire watershed, information on septic maintenance, and other water quality tips. It is recognized that space for stormwater runoff treatment is limited; therefore, the infiltration trenches are considered the “last chance” BMPs. These are used after the easier and less expensive BMPs are implemented and the reductions have not been met.

Table 5.7 Residential land-based BMPs required to meet the Knox Creek and Pawpaw Creek TMDLs.

Control Measure	Knox Creek	Pawpaw Creek	Total
Residential Education Program (#)	1 program for both watersheds		1
Infiltration Trench (ac - treated)	12	0	12
Erosion and Sediment Control (ac - treated)	20	3	23
Streambank Stabilization (ft-stream)	0	7,470	7,470
Vegetated Stream Buffer (ft-streambank)	37	6.6	43.6

5.2.3 Industrial Control Measures

5.2.3.1 Industrial Control Measures: Regulations Overview

Resource extraction (coal mining and gas well drilling) companies in the Knox Creek watershed are regulated by the DMME. They are required to follow environmental and safety regulations in order to prevent negative impacts on the environment and human health. One such regulation is the placement of retention ponds to collect all runoff water from active surface mining sites. These ponds must be designed to hold runoff from a 10 year 24 hour storm. Depending on the permit, there are regulations for flow, pH, and concentrations for iron (Fe), manganese (Mn), total suspended solids (TSS), and chloride in the outfalls and/or nearby streams. Mining sites are inspected regularly. More information can be found at http://www.mme.state.va.us/Dmm/default.htm. The company must pay a bond up front for each permit, which is held until the active site is sufficiently reclaimed. If not, the money is forfeited over to DMME and they reclaim the land. Reclaimed land in the Knox Creek watershed has been used for grazing pasture for livestock and for residential purposes.

The gas well drilling companies are required to install sumps or ponds to collect runoff from gas well areas. The roads leading to the wells must be maintained and must have water bars to divert water from the roadway. Construction typically lasts 60 days and grass is planted on and along the road and around the well site. Gas well companies also must pay bonds for reclamation that can be forfeited if reclamation is not adequate. More information can be found at http://www.dmme.virginia.gov/Dgo/default.htm; Section 25-150-260 contains the erosion, sediment control and reclamation regulations and Section 25-150-270 deals with stormwater management.

The Virginia Department of Forestry (VDOF) is in charge of regulating any logging operations of commercial or private entities. A logging company must call the VDOF to report that they are going to harvest an area within 3 days of starting. A VDOF representative inspects the site before, during (typically every 30 days), and after harvesting. There is a zero tolerance for sedimentation in nearby streams; if the VDOF thinks there is sedimentation possible, the loggers must have measures in place to prevent

sediment travel within 10 days of a citation. Some BMPs recommended on logging areas are not harvesting trees near streams (leaving a vegetated stream buffer), water bars, hardened stream crossings (*i.e.*, culverts, bridges), and seeding and mulching bare areas upon completion. More information of logging BMPs can be found at http://www.dof.virginia.gov/wq/index-bmp-guide.shtml. If BMPs are not in place, special orders are handed to the company; fines are then assessed based on the extent of the disturbance and any prior citations. This money is channeled into an education fund used to train loggers in environmental practices. More information on regulations of resource extraction and logging operations is detailed in Chapter 7.

5.2.3.2 Industrial Control Measures: Land-Based

The Knox Creek and Pawpaw Creek TMDLs require large reductions to bacteria and TDS land-based loads as well as reductions to sediment loads in Pawpaw Creek. In order to meet these strict requirements, the BMPs in Table 5.7 must be implemented. A staged approach to implementation is described in Chapter 6 of this document.

Table 5.8 Urban land-based BMPs required to meet the Knox Creek and Pawpaw Creek TMDLs.

Control Measure	Knox Creek	Pawpaw Creek	Total
Reclamation of Abandoned Mine Land (ac)	1,583.2	502.0	2,085.2
Dirt Road Stabilization (ac)	37.3	1.8	39.1
Forest Harvesting BMPs	126.0	17.0	143.0

5.3 Technical Assistance and Education

Members of the Working Groups and the Steering Committee agree that technical assistance and education are critical for getting people involved in implementation. There must be a proactive approach to contact farmers and residents to articulate exactly what the TMDL means to them and what practices will help meet the goal of improved water quality. Several education/outreach techniques will be utilized during implementation. Articles describing the TMDL process, the reasons why high levels of the pollutants are a problem, the methods through which the problem can be corrected, the assistance that is currently available for landowners to deal with the problem, and the potential ramifications of not dealing with the problem should be made available to the

public through as many channels as possible (*e.g.*, Farm Service Agency (FSA) newsletters, VDOF handouts, and targeted mailings). Workshops and demonstrations should be organized to show landowners the extent of the problem, the effectiveness of control measures, and the process involved in obtaining technical and financial assistance.

For the agricultural community, field days, pasture walks, and presentations offered through local farm groups are recommended. The emphasis should be with local farmers discussing their experiences with cost-share programs, demonstrating the advantages of a clean water source and pasture management, and presenting monitoring results to demonstrate the problem. It is generally accepted that farmers will be more persuaded by discussion with local technical personnel or fellow farmers who have implemented the suggested control measures than through presentations made by state-agency representatives.

For residential issues, public outreach should focus on increasing awareness of private residential sewage treatment systems, control of pet waste, programs to describe the importance of erosion and sediment (E&S) controls to developers, and control of storm runoff. This outreach effort will provide useful information to residents and increase the likelihood of identifying straight pipes and failing septic systems in the impaired watersheds. Small community meetings similar to the small workshops proposed for the agricultural community can be organized for educating homeowners about residential issues. Information about the TMDL can be presented using media outlets and direct mailings, as well as through direct contact with potential corporate partners and residents, and presentations to community groups. An educational packet about septic system issues should be disseminated to new homeowners. Additionally, educational tools (*e.g.*, a model septic system used to demonstrate functioning and failing septic systems, a video of septic maintenance and repair) would be useful in communicating the problem to the public. The technical assistance and educational outreach tasks needed in the residential community during implementation were identified during plan development.

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

Agricultural Programs

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

Residential Programs

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

Industrial Programs

1. Develop educational materials & programs. Some suggestions include:
    a. An erosion and sediment control workshop, focusing on educating the public and key stakeholders along each watershed on E&S law and regulations.
    b. A brochure/mailing, explaining specific practices that individuals and small groups can and should use to reduce pollution (particularly bacteria, sediment and phosphorus) from reaching these streams.
2. Organize educational programs.
3. Distribute educational materials.
4. Correspond with DMME, VDOF, and Division of Gas and Oil (DGO) to encourage and track BMP installation.
5. Assess progress toward implementation goals.

Table 5.8 shows the amount of agricultural and residential full time equivalent (FTE) technical assistance estimated and recommended. One FTE is equal to one full-time staff member.

The BSSWCD has preliminarily agreed to manage the agricultural and residential programs. In this capacity, they will be in charge of funds for the associated FTEs, either to pay existing staff or hire new employees to carry out the implementation of BMPs. Historical work records of the BSSWCD were utilized to determine the level of agricultural and residential technical assistance needed to complete implementation. Based on these analyses, it was determined that approximately 1.5 FTEs would be needed in the first 5 years to achieve full implementation of the agricultural control measures. To achieve implementation of the residential control measures, 3.0 FTEs would be needed during the first five years of implementation. In the last 5 years (year 6-10), 1.5 combined agricultural and residential FTEs will be required to complete the remaining BMP installations (Table 5.9).

Table 5.9 Recommended technical assistance needs for implementation in the Knox Creek and Pawpaw Creek watersheds.

	Years 1-5				Years 6-10		
Impairment	**Estimated Agricultural FTE**	**Recommended Agricultural FTE**	**Estimated Residential FTE**	**Recommended Residential FTE**	**Estimated Agricultural FTE**	**Estimated Residential FTE**	**Recommended Agricultural /Residential FTE**
Knox Creek	1.22	1	2.32	2.5	1.22	0.13	1
Pawpaw Creek	0.41	0.5	0.54	0.5	0.41	0.02	0.5
Total	1.63	1.5	2.86	3.0	1.63	0.15	1.5

5.4 Cost Analysis

5.4.1 Agricultural Control Measures

Streamside fencing through or adjacent to pasture with potential livestock access was translated and quantified into full livestock exclusion systems as described in Section 5.2.1.1. An average cost estimate of livestock exclusion needs was calculated through assuming a mix of Grazing Land Protection Systems (SL-6, typical full livestock exclusion system), and Stream Protection Systems (WP-2T, livestock exclusion system without installation of a water system, plus a fence maintenance incentive payment). The cost for one SL-6 and one WP-2T system were estimated from systems already in place in the Big Sandy River basin. The cost of an SL-6 system was estimated as $4,000. The cost of a hardened crossing was assumed to be included in the SL-6 cost. The cost of a WP-2 system was $2,000; the cost of a WP-2T system is expected to be the same.

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

The remaining costs outlined in Table 5.9 were determined through literature review, analysis of the Virginia Agricultural BMP Database, and discussion with stakeholders. The estimated cost of implementing all agricultural practices is estimated as $495,296.

Table 5.10 Agricultural control measure costs and needs.

Control Measure	Unit	Unit Cost	Knox Creek	Knox Cost	Pawpaw Creek	Pawpaw Cost
Grazing Land Protection Systems (SL-6)	System	$4,000	13	$52,000	0	$0
Stream Protection Systems (WP-2T)	System	$2,000	1	$2,000	0	$0
Improved Pasture Management*	Acres		117.3		13	
Waste Storage Facilities (WP-4) - Horses	System	$27,000	14	$378,000	1	$27,000
Manure Incorporation	Acres	$20	377.3	$7,546	0	$0
Vegetated Stream Buffer	Acres	$700	40	$28,000	1	$700

*Included in the cost of an SL-6 system

5.4.2 Residential Control Measures

Following recommendations from the RWG, it was assumed that approximately 10% of failing septic system corrections and straight pipe corrections would require new alternative treatment systems ($11,400). The majority of these corrections would be septic system repairs ($3,000) and new standard septic systems ($6,000).

The remaining costs outlined in Table 5.10 were determined through literature review and discussion with stakeholders. The estimated cost of implementing all residential practices is estimated as $7.1 million.

Table 5.11 Residential control measure costs and needs.

Residential Control Measure	Unit	Unit Cost	Knox Units	Knox Cost	Pawpaw Units	Pawpaw Cost
Septic Systems Pump-out Program (RB-1)	System	$250	158	$39,500	100	$25,000
Septic System Repair (RB-3)	System	$3,000	80	$240,000	30	$90,000
Septic System Installation/Replacement (RB-4)	System	$6,000	374	$2,244,000	105	$630,000
Alternative Waste Treatment System Installation (RB-5)	System	$11,400	24	$273,600	15	$171,000
Residential Education Program	Program	$3,750	0.75	$2,813	0.25	$938
Infiltration Trench	Acre-Treated	$5,285	12	$63,420	0	$0
Erosion and Sediment Control	Acre-Treated	$2,000	20	$40,000	3	$6,000
Vegetated Stream Buffer	Acres	$700	37	$25,900	6.6	$4,620

5.4.3 Industrial Control Measures

The costs outlined in Table 5.11 were determined through discussion with stakeholders. The estimated cost of implementing all industrial BMPs in both watersheds is $23.18 million. Coal companies, logging operators, and the gas well companies will most likely cover this amount of money as they continue operations in the watershed.

Table 5.12 Industrial control measure costs and needs.

Control Measure	Unit	Unit Cost	Knox Creek	Knox Cost	Pawpaw Creek	Pawpaw Cost
Reclamation of Abandoned Mine Land	Acre	$10,000	1,583.2	$15,832,200	502.0	$5,020,000
Dirt Road Stabilization	Acre	$10,000	37.3	$373,000	1.8	$18,000
Forest Harvesting BMPs	Acre	$10,000	126.0	$1,260,000	68.0	$680,000

5.4.4 Streambank Stabilization

Streambank stabilization BMPs can be implemented on any section of stream within the Pawpaw Creek watershed in order to prevent erosion into the creek. Since this practice is not specific to any land use, it is a separate category in the total cost (Table 5.12). The estimated cost of streambank stabilization is $440 pre foot; Pawpaw Creek requires an estimated 7,470 feet of stabilization, therefore it will cost approximately $3,286,800.

5.4.5 Technical Assistance

It was determined by the Working Group and Steering Committee members that it would require $50,000 to support the salary, benefits, travel, training, and incidentals for education of one technical FTE. With quantification analysis yielding a need for 4.5 technical FTEs per year for the first 5 years and 1.5 FTEs for the remaining 5 years, the total potential cost to provide technical assistance during implementation is expected to be $1.5 million total for 10 years.

5.4.6 Total Estimated Costs

The total estimated costs for the implementation of BMPs in the Knox Creek and Pawpaw Creek watersheds is shown in Table 5.12. The technical assistance cost assumes a need of 4.5 FTEs for the first 5 years and 1.5 for the second 5 years. The total cost to

implement the BMPs needed in this watershed is estimated at $32 million. However, $23 million, or 72%, of the total cost is estimated for the industrial BMPs, which will largely be covered by these industries.

Table 5.13 Total estimated costs to meet the Knox Creek and Pawpaw Creek TMDLs.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Industrial BMPs ($)	Streambank Stabilization ($)	Tech. Assist. ($)	Total ($)
Knox Creek	$467,556	$2,929,240	$17,465,200	$0	$1,125,000	$21,986,995
Pawpaw Creek	$27,700	$642,458	$5,718,000	$3,286,800	$375,000	$10,049,958
Total	$495,256	$3,571,698	$23,183,200	$3,286,800	$1,500,000	$32,036,953

5.5 Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal contamination in Knox Creek and Pawpaw Creek will be reduced to meet water quality standards, and the aquatic community in these streams will be restored. Table 5.13 indicates the cost efficiencies of the various practices being proposed in this IP. It is hard to gauge the impact that reducing fecal contamination will have on public health as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources through contact with surface waters should be reduced considerably. In addition to allowing the aquatic community to thrive, the control measures that will be implemented to control sediment and TDS will also serve to reduce delivery of other pollutants to the stream from upland locations. Many of the BMPs intended to reduce soil and TDS losses should increase infiltration of precipitation, decreasing peak flows downstream.

Table 5.14 Cost efficiencies of control measures in units removed per $1,000.

Control Measure	Bacteria (colonies)	Sediment [1] (kg)	TDS (kg)
Agricultural			
Grazing Land Protection Systems (SL-6)	8.57E+11	1.66	4.35E+05
Stream Protection Systems (WP-2T)	2.80E+11	NA	1.52E+05
Improved Pasture Management	5.66E+12	0.61	2.89E+06
Waste Storage Facilities (WP-4) - Horses	2.83E+11	0.00	0.00
Manure Incorporation	1.30E+12	0.00	3.63E+07
Vegetated Stream Buffer	2.88E+11	7.27	3.12E+06
Residential			
Septic System Repair (RB-3)	7.54E+11	0.00	0.00
Septic System Installation/Replacement (RB-4)	2.68E+11	0.001	18.48
Alternative Waste Treatment System Installation (RB-5)	1.19E+11	0.0006	8.04
Residential Education Program	1.61E+13	0.00	0.00
Infiltration Trench	2.70E+12	0.00	0.00
Erosion and Sediment Control	1.17E+13	0.004	0.00
Vegetated Stream Buffer	5.87E+12	0.00	0.00
Industrial			
Reclamation of Abandoned Mine Land	1.60E+08	0.17	4.71E+04
Dirt Road Stabilization	2.98E+08	0.07	554.16
Forest Harvesting BMPs	2.89E+08	0.17	746.00
Streambank Stabilization	0.00	4.35	0.00

[1] Calculated for Pawpaw Creek BMPs only.

An important objective of the implementation plan is to foster continued economic vitality and strength. This objective is based on the recognition that healthy waters improve economic opportunities for Virginians and a healthy economic base provides the resources and funding necessary to pursue restoration and enhancement activities. The agricultural, residential, and urban 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. Implementation of the recommended control measures in urban areas will have the added benefits of enhancing a recreational resource and beautifying the downtown area. Additionally, money spent by landowners and state agencies in the process of implementing this plan will stimulate the local economy.

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

In addition to reducing the likelihood of animals contracting waterborne illnesses by providing a clean water supply, streamside fencing excludes livestock from wet, swampy environments as are often found next to streams where cattle have regular access. Keeping cattle in clean, dry areas has been shown to reduce the occurrence of mastitis and foot rot. The Virginia Cooperative Extension (VCE) reports that mastitis costs producers $100 per cow in reduced quantity and quality of milk produced (VCE, 1998a). 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 instigate 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.

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 three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system. 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 Section 6.1, a portion of the funding for implementation can be expected to come from state and federal sources. This portion of funding represents money that is new to the area and will stimulate the local economy. In general, implementation will provide not only environmental benefits to the community, but economic benefits as well, which, in turn, will allow for individual landowners to participate in implementation.

6. MEASURABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

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

6.1 Milestones Identification

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

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 10 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 10-year mark, and de-listing at the 15-year mark).

Following the idea of a staged implementation approach, resources and finances will be concentrated on the most cost-efficient control measures first. As described in Chapter 5, infiltration trenches are the most expensive components of the residential portion of the plan. While these components are effective, large reductions in pollutant loads can be met through more cost-effective means. The BST results showed that human wastes were the most predominant source of fecal coliform in Knox Creek. Concentrating on implementing residential waste treatment facilities within the first year may provide the highest return on water quality improvement with less cost to landowners.

Implementation is anticipated to begin in September 2007; two five-year implementation stages will be followed by five years of water quality monitoring. The Stage I goals will focus on the more cost-efficient control measures, *i.e.,* correcting straight pipes and failing septic systems, and implementing a residential education program. Fifty per cent of the remaining residential BMPs, 50% of the agricultural BMPs, and 25% of the industrial BMPs are also scheduled for implementation during Stage I. Following Stage I implementation, the Steering Committee should evaluate water quality improvements and determine how to proceed to complete implementation during Stage II.

In Stage II, the remainder of the residential BMPs, 50% of the agricultural BMPs, and 75% of the industrial BMPs are scheduled for implementation. Three years are allowed for resources extraction permitting, and 10 to 15% of each of the BMPs are scheduled for each year. The proposed timeline points to completing Stage II ten years after the start of implementation. Stage III, during which the effects of the BMPs are monitored, will be completed five years after the completion of Stage II.

Table 6.1 shows the types and quantities of BMPs to be installed for each impairment during each stage. It is anticipated that the de-listing of the impaired segments from the Section 303(d) list will occur by 2022.

Table 6.1 Stage I and Stage II implementation goals for Knox Creek and Pawpaw Creek.

Control Measure	Unit	Knox Creek		Pawpaw Creek	
		Stage I	Stage II	Stage I	Stage II
Agricultural					
Grazing Land Protection Systems (SL-6)	System	6.5	6.5	0	0
Stream Protection Systems (WP-2T)	System	0.5	0.5	0	0
Improved Pasture Management	Acres	58.6	58.6	6.5	6.5
Waste Storage Facilities (WP-4) - Horses	System	7.0	7.0	0.5	0.5
Manure Incorporation	Acre	188.6	188.6	0	0
Vegetated Stream Buffer	Buffer Acres	20.0	20.0	0.5	0.5
Residential					
Septic Systems Pump-out Program (RB-1)	System	158	0	42	0
Septic System Repair (RB-3)	System	80	0	20	0
Septic System Installation/Replacement (RB-4)	System	374	0	82	0
Alternative Waste Treatment System Installation (RB-5)	System	24	0	6	0
Residential Education Program	Program	0.75	0	0.25	0
Infiltration Trench	Acre-Treated	0	12.0	0	0
Erosion and Sediment Control	Acre-Treated	0	20.0	0	3.0
Vegetated Stream Buffer	Acre	18.5	18.5	3.3	3.3
Industrial					
Reclamation of Abandoned Mine Land (ac)	Acre	395.8	1187.4	125.5	376.5
Dirt Road Stabilization (ac)	Acre	9.3	28.0	0.45	1.35
Forest Harvesting BMPs	Acre	31.5	94.5	17.0	51.0
Streambank Stabilization	Feet	0	0	3,735	3,735

6.2 Timeline

Ten-year implementation plan timelines were formulated for the Knox Creek and Pawpaw Creek watersheds (Figures 6.1 and 6.2, Tables 6.2 - 6.5). The timelines describe the needs for implementation in terms of completion of the agricultural, residential and industrial control measures. Tables 6.6 and 6.7 show the projected staged implementation costs for agricultural and residential control measures, including technical assistance.

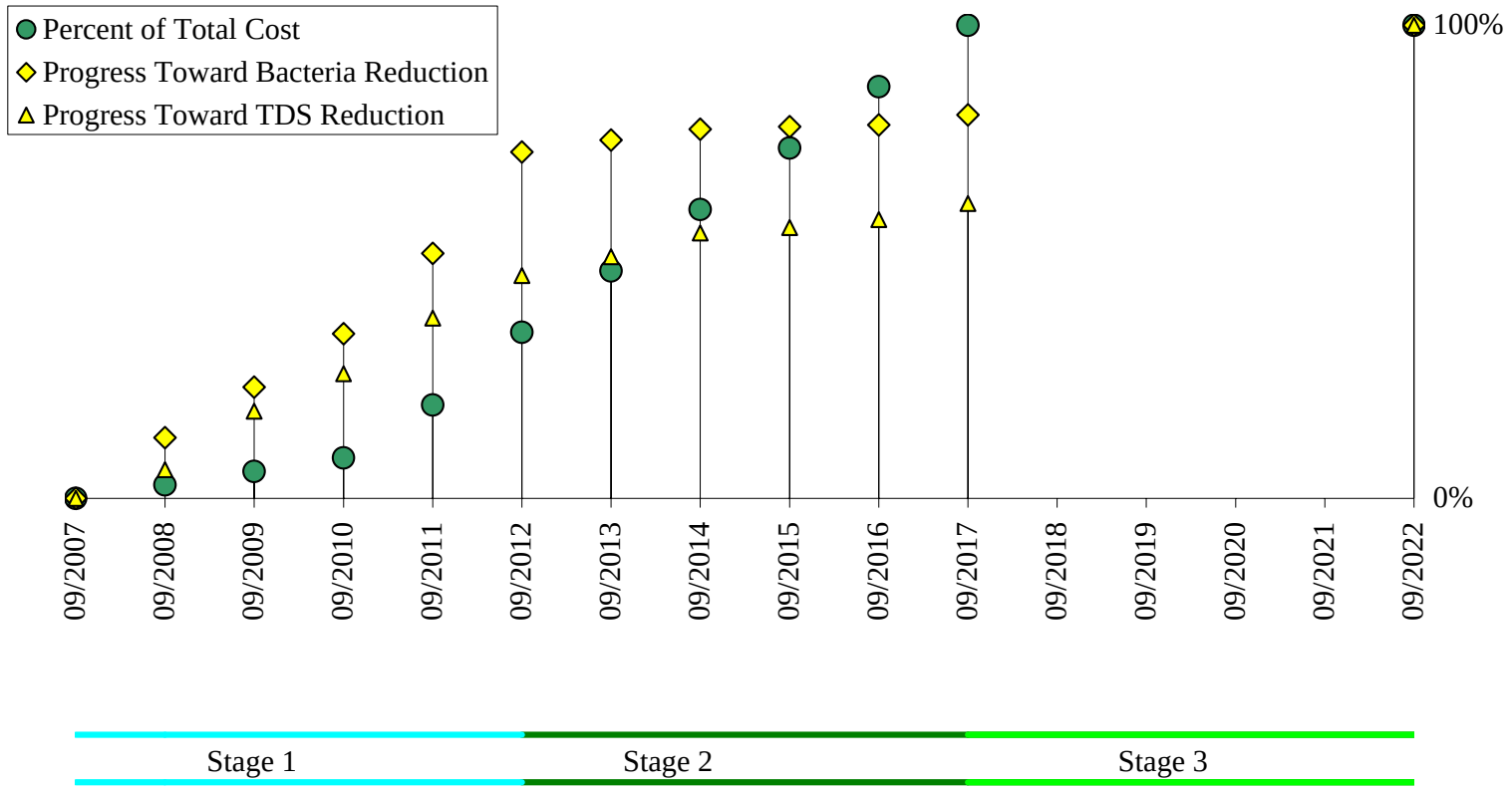

Figure 6.1 Timeline for implementation in the Knox Creek watershed.

Table 6.2 Timeline for implementation in the Knox Creek watershed – Stage I.

Knox Creek Implementation Milestones	Existing	Year 1	Year 2	Year 3	Year 4	Year 5
Cumulative Progress Toward BMP Installation						
***Agricultural*:**						
Grazing Land Protection System (SL-6)	0%	10%	20%	30%	40%	50%
Stream Protection System (WP-2T)	0%	10%	20%	30%	40%	50%
Improved Pasture Management	0%	10%	20%	30%	40%	50%
Waste Storage Facilities (WP-4) - Horses	0%	10%	20%	30%	40%	50%
Manure Incorporation	0%	10%	20%	30%	40%	50%
Vegetated Stream Buffer	0%	10%	20%	30%	40%	50%
***Residential*:**						
Septic Systems Pump-out Program (RB-1)	0%	20%	40%	60%	80%	100%
Septic System Repair (RB-3)	0%	20%	40%	60%	80%	100%
Septic System Installation/Replacement (RB-4)	0%	20%	40%	60%	80%	100%
Alternative Waste Treatment System Installation (RB-5)	0%	20%	40%	60%	80%	100%
Residential Education Program	0%	20%	40%	60%	80%	100%
Infiltration Trench	0%	0%	0%	0%	0%	0%
Erosion and Sediment Control	0%	0%	0%	0%	0%	0%
Vegetated Stream Buffer	0%	10%	20%	30%	40%	50%
***Industrial*:**						
Reclamation of Abandoned Mine Land	0%	0%	0%	0%	10%	25%
Dirt Road Stabilization	0%	0%	0%	0%	10%	25%
Forest Harvesting BMPs	0%	0%	0%	0%	10%	25%
Exceedance of Endpoints (%)						
Instantaneous EC Standard (235 cfu/100mL)	47.8%	41.7%	36.6%	31.2%	23.0%	12.8%
Geometric Mean EC Standard (126 cfu/100mL)	91.7%	86.1%	83.3%	63.9%	47.2%	25.0%
TDS Endpoint (369 mg/L)	16.2%	15.3%	13.2%	12.0%	10.0%	8.6%
Cost (% of Total)	0%	3.0%	6.0%	9.0%	20.3%	35.7%

Table 6.3 Timeline for implementation in the Knox Creek watershed – Stages II and III.

Knox Creek Implementation Milestones	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15
Cumulative Progress Toward BMP Installation						
***Agricultural*:**						
Grazing Land Protection System (SL-6)	60%	70%	80%	90%	100%	100%
Stream Protection System (WP-2T)	60%	70%	80%	90%	100%	100%
Improved Pasture Management	60%	70%	80%	90%	100%	100%
Waste Storage Facilities (WP-4) - Horses	60%	70%	80%	90%	100%	100%
Manure Incorporation	60%	70%	80%	90%	100%	100%
Vegetated Stream Buffer	60%	70%	80%	90%	100%	100%
***Residential*:**						
Septic Systems Pump-out Program (RB-1)	100%	100%	100%	100%	100%	100%
Septic System Repair (RB-3)	100%	100%	100%	100%	100%	100%
Septic System Installation/Replacement (RB-4)	100%	100%	100%	100%	100%	100%
Alternative Waste Treatment System Installation (RB-5)	100%	100%	100%	100%	100%	100%
Residential Education Program	100%	100%	100%	100%	100%	100%
Infiltration Trench	20%	40%	60%	80%	100%	100%
Erosion and Sediment Control	20%	40%	60%	80%	100%	100%
Vegetated Stream Buffer	60%	70%	80%	90%	100%	100%
***Industrial*:**						
Reclamation of Abandoned Mine Land	40%	55%	70%	85%	100%	100%
Dirt Road Stabilization	40%	55%	70%	85%	100%	100%
Forest Harvesting BMPs	40%	55%	70%	85%	100%	100%
Exceedance of Endpoints (%)						
Instantaneous EC Standard (235 cfu/100mL)	11.6%	10.5%	10.2%	10.1%	9.1%	0%
Geometric Mean EC Standard (126 cfu/100mL)	25.0%	25.0%	25.0%	25.0%	22.2%	0%
TDS Endpoint (369 mg/L)	7.9%	7.1%	6.9%	6.7%	6.1%	Healthy Aquatic Life
Cost (% of Total)	48.6%	61.4%	74.3%	87.1%	100.0%	100%

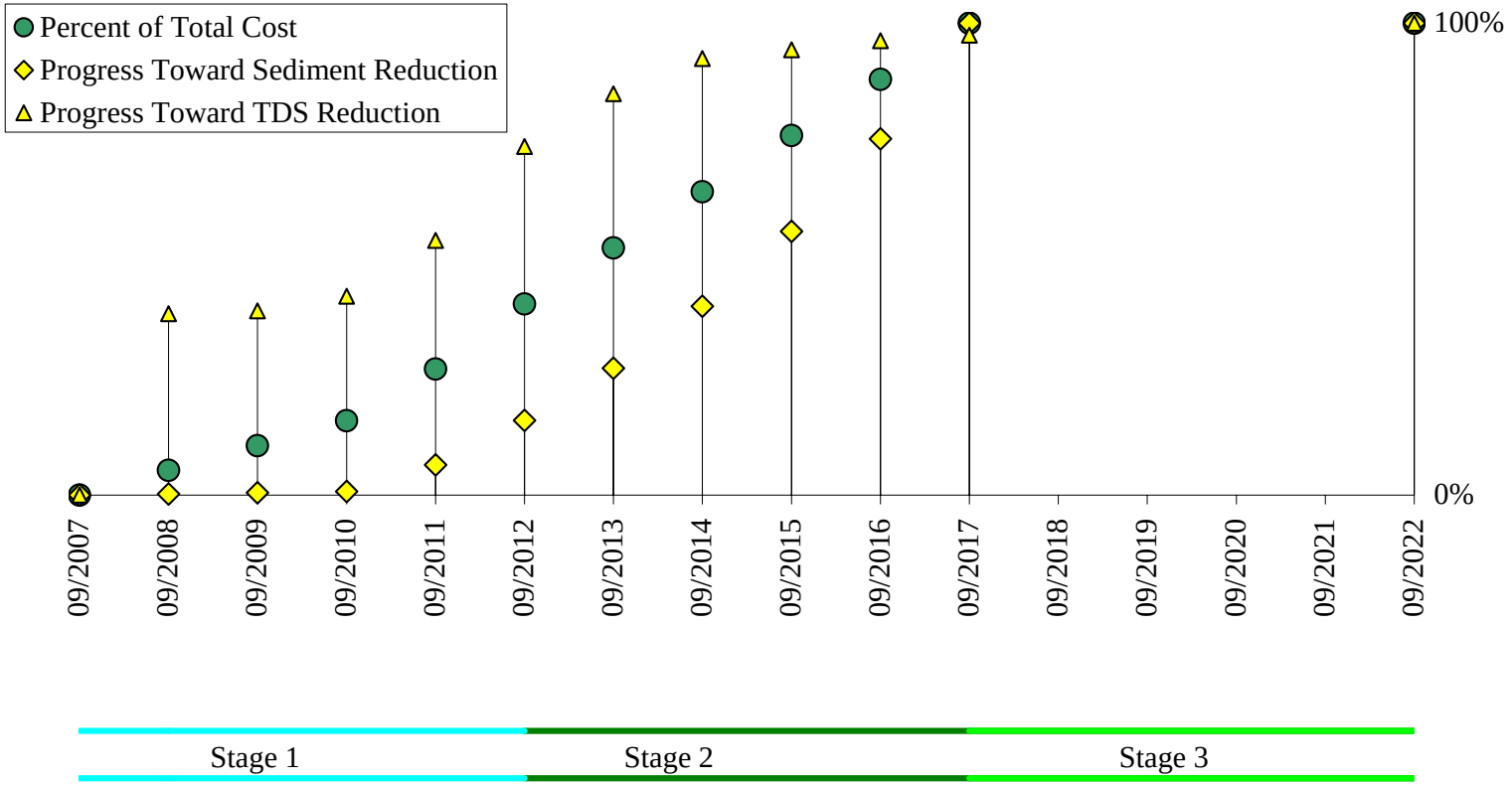

Figure 6.2 Timeline for implementation in the Pawpaw Creek watershed.

Table 6.4 Timeline for implementation in the Pawpaw Creek watershed – Stage I.

Pawpaw Creek Implementation Milestones	Existing	Year 1	Year 2	Year 3	Year 4	Year 5
Cumulative Progress Toward BMP Installation						
***Agricultural*:**						
Grazing Land Protection System (SL-6)	0%	10%	20%	30%	40%	50%
Stream Protection System (WP-2T)	0%	10%	20%	30%	40%	50%
Improved Pasture Management	0%	10%	20%	30%	40%	50%
Waste Storage Facilities (WP-4) - Horses	0%	10%	20%	30%	40%	50%
Vegetated Stream Buffer	0%	10%	20%	30%	40%	50%
Residential:						
Septic Systems Pump-out Program (RB-1)	0%	20%	40%	60%	80%	100%
Septic System Repair (RB-3)	0%	20%	40%	60%	80%	100%
Septic System Installation/Replacement (RB-4)	0%	20%	40%	60%	80%	100%
Alternative Waste Treatment System Installation (RB-5)	0%	20%	40%	60%	80%	100%
Residential Education Program	0%	20%	40%	60%	80%	100%
Erosion and Sediment Control	0%	0%	0%	0%	0%	0%
Vegetated Stream Buffer	0%	10%	20%	30%	40%	50%
Industrial:						
Reclamation of Abandoned Mine Land	0%	0%	0%	0%	10%	25%
Dirt Road Stabilization	0%	0%	0%	0%	10%	25%
Forest Harvesting BMPs	0%	0%	0%	0%	10%	25%
Streambank Stabilization	0%	10%	20%	30%	40%	50%
Exceedance of Endpoints (%)						
Sediment Endpoint (6,034 t/yr)	47.2%	47.1%	47.0%	46.9%	44.2%	39.7%
TDS Endpoint (334 mg/L)	14.7%	9.0%	8.9%	8.5%	6.8%	3.8%
Cost (% of Total)	0%	5.2%	10.4%	15.5%	26.5%	40.2%

Table 6.5 Timeline for implementation in the Pawpaw Creek watershed – Stages II and III.

Pawpaw Creek Implementation Milestones	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15
Cumulative Progress Toward BMP Installation						
***Agricultural*:**						
Grazing Land Protection System (SL-6)	60%	70%	80%	90%	100%	100%
Stream Protection System (WP-2T)	60%	70%	80%	90%	100%	100%
Improved Pasture Management	60%	70%	80%	90%	100%	100%
Waste Storage Facilities (WP-4) - Horses	60%	70%	80%	90%	100%	100%
Vegetated Stream Buffer	60%	70%	80%	90%	100%	100%
Residential:						
Septic Systems Pump-out Program (RB-1)	100%	100%	100%	100%	100%	100%
Septic System Repair (RB-3)	100%	100%	100%	100%	100%	100%
Septic System Installation/Replacement (RB-4)	100%	100%	100%	100%	100%	100%
Alternative Waste Treatment System Installation (RB-5)	100%	100%	100%	100%	100%	100%
Residential Education Program	100%	100%	100%	100%	100%	100%
Erosion and Sediment Control	20%	40%	60%	80%	100%	100%
Vegetated Stream Buffer	60%	70%	80%	90%	100%	100%
Industrial:						
Reclamation of Abandoned Mine Land	40%	55%	70%	85%	100%	100%
Dirt Road Stabilization	40%	55%	70%	85%	100%	100%
Forest Harvesting BMPs	40%	55%	70%	85%	100%	100%
Streambank Stabilization	60%	70%	80%	90%	100%	100%
Exceedance of Endpoints (%)						
Sediment Endpoint (6,034 t/yr)	34.5%	28.3%	20.8%	11.6%	0.0%	Healthy Aquatic Life
TDS Endpoint (334 mg/L)	2.2%	1.1%	0.8%	0.5%	0.4%	Healthy Aquatic Life
Cost (% of Total)	52.2%	64.1%	76.1%	88.0%	100%	100%

Table 6.6 Costs to implement Stage I (1st 5 years) for Knox Creek and Pawpaw Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Industrial BMPs ($)	Streambank Stabilization ($)	Tech. Assist. ($)	Total ($)
Knox Creek	$233,778	$2,812,866	$4,366,300	$0	$875,000	$8,287,944
Pawpaw Creek	$13,850	$634,148	$1,429,500	$1,643,400	$250,000	$3,970,898
Total	$247,628	$3,447,014	$5,795,800	$1,643,400	$1,125,000	$12,258,842

Table 6.7 Costs to implement Stage II (2nd 5 years) for Knox Creek and Pawpaw Creek.

Impairment	Agricultural BMPs ($)	Residential BMPs ($)	Industrial BMPs ($)	Streambank Stabilization ($)	Tech. Assist. ($)	Total ($)
Knox Creek	$233,778	$116,374	$13,098,900	$0	$250,000	$13,699,051
Pawpaw Creek	$13,850	$8,310	$4,288,500	$1,643,400	$125,000	$6,079,060
Total	$247,628	$124,684	$17,387,400	$1,643,400	$375,000	$19,778,111

6.3 Targeting

Implicit in the process of a staged implementation is targeting of control measures: this ensures optimum utilization of resources. Targeting of critical areas for livestock fencing was accomplished through analysis of livestock population and the fencing requirements for each subwatershed. The subwatersheds were ranked in descending order based on the ratio of animals per fence length. If feasible, effort should be made to prioritize resources in the order of subwatersheds in Table 6.8. For example, the BSSWCD should initiate participation from farmers/horse owners in subwatershed 19. The targeting priority list should be used to focus outreach by promoting the cost-share programs available. However, interested parties should not be turned away if their land is in a low ranking subwatershed.

Table 6.8 Targeting subwatershed order for streamside fencing.

Subwatershed Priority	Streamside Fencing
1st	19
2nd	10
3rd	22
4th	2
5th	8
6th	23
7th	12
8th	4
9th	21
10th	17
11th	11
12th	9
13th	5
14th	3
15th	13
16th	14
17th	24
18th	1
19th	16
20th	20
21st	15
22nd	7
23rd	18
24th	6

Modeling results showed that prioritizing the main stem of Knox Creek (subwatersheds 1-7) for straight pipe correction was more effective than correcting the same amount randomly throughout the watershed. The rest of the subwatersheds were prioritized in order of most fecal load from straight pipes and failing septic systems combined. The results of the targeting analysis show the order in which straight pipes should be identified and corrected (Table 6.9).

Table 6.9 Targeting subwatershed order for residential waste treatment BMPs.

Subwatershed Priority	Straight Pipes and Failing Septic Systems
1st	2
2nd	3
3rd	1
4th	4
5th	5
6th	6
7th	7
8th	17
9th	22
10th	10
11th	20
12th	14
13th	9
14th	19
15th	8
16th	13
17th	15
18th	12
19th	23
20th	16
21st	21
22nd	11
23rd	18
24th	24

One method of targeting involves considering the cost-efficiency of specific practices. Table 5.13 indicates the cost-efficiencies of the practices proposed in this IP. Practices with high cost-efficiencies, relative to other practices, will provide the greatest benefit per dollar invested.

7. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

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

7.1 Federal Government

The United States Environmental Protection Agency

The EPA has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states.

The United States Department of Agriculture, Natural Resources Conservation Service (NRCS)

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

7.2 Virginia Agencies and Programs

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are seven state agencies responsible for regulating and/or overseeing statewide activities that impact water quality in Virginia. These agencies are: VADEQ, VADCR, DMME (DMLR and DGO), VCE, VDH, VDOF, and the Virginia Department of Agriculture and Consumer Services (VDACS).

Virginia Department of Environmental Quality

The State Water Control Law authorizes the SWCB to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years, the focus of VADEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of VADEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs. The VADEQ is the lead agency in the TMDL process. The Code of Virginia directs the VADEQ to develop a list of impaired waters, develop TMDLs for these waters, and develop IPs for the TMDLs. The VADEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to the EPA and the SWCB for approval. The VADEQ is also responsible for implementing point source WLAs, assessing water quality across the state, and conducting water quality standard related actions.

Department of Mines, Minerals, and Energy – Division of Mined Land Reclamation

The DMLR presently regulates all of the land-disturbing, mining, and reclamation activities from coal-mining operations by issuing Coal Surface Mining Operation (CSMO) permits. The DMLR is delegated by the Federal Office of Surface Mining to administer the requirements of the Federal Surface Mining Control and Reclamation Act (SMCRA). Also, the EPA grants the DMLR the authority to administer the VPDES permit program under the Clean Water Act for the coal industry. To that end, the DMLR utilizes enforcement action under the Virginia Coal SMCRA and VPDES to effect compliance with the State Water Control Law.

Department of Mines, Minerals, and Energy – Division of Gas and Oil

The DGO's responsibilities include the regulation of the effects of gas and oil operations (both on and below the surface), issuance of permits, administration of client assistance programs, inspection of well sites and gathering pipelines, reclamation of abandoned well sites, protection of correlative rights, and promotion of resource conservation practices.

Permits are required for ground-disturbing geophysical exploration, exploration wells, development wells, and gathering pipelines. The DGO reviews applications that must address information on acreage to be disturbed, blasting activities, proposed new roads and existing access roads, erosion and sediment control plans, the design and operation of any pits, and the drilling and stimulating plan (including information on the water and constituents of the drilling fluids and management and disposal of pit fluids, produced waters, drill cuttings and solids).

The DGO reviews all applications and may place conditions on a permit or require the applicant to submit more information or amend the proposed operation plan to ensure that the operator will comply with the law and regulation. Applicants must post a bond to guarantee that money is available for site reclamation and plugging should the operator fail to perform the work. The operator may not begin site work until the DGO issues a permit. In order to ensure compliance with the Virginia Gas and Oil Act and Regulation, field staff from the DGO make routine inspections of well sites, gathering pipelines, facilities, and other permitted sites and activities. Frequency of inspection is determined by a priority system that categorizes each permitted site or operation according to its level of activity or the stability of the associated disturbed area. For more information, visit the web site: http://www.dmme.virginia.gov/Dgo/Default.htm.

Virginia Department of Conservation and Recreation

The VADCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. The EPA is requiring that much of the §319 grant monies be used for the development of TMDLs. Because of the magnitude of the NPS component in the TMDL process, the VADCR is a major participant in the TMDL process. The VADCR has a lead role in the development of IPs to address correction of NPSs contributing to water quality impairments. The VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and supporting VADEQ in TMDL development related to NPS impacts. The VADCR staff will also be working with other state agencies, SWCDs,

and watershed groups to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

Virginia Department of Agriculture and Consumer Services

The VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local SWCD. If a producer fails to implement the plan, corrective action (which may include civil penalties) can be taken. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, *etc*. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures.

The Virginia Department of Health

The VDH is responsible for maintaining safe drinking water measured by standards set by the EPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint-driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 *et seq*.).

The Virginia Department of Forestry

Forests provide a vital role in preserving water quality. The VDOF inspects logging jobs to ensure that BMPs are being installed by loggers, because there is a zero tolerance for sedimentation in nearby streams. Effective July 1, 2002, Virginia's General Assembly made changes to the Silvicultural Water Quality Law, Code of Virginia §10.1-1181.2(H) related to Notification of the Commercial Harvesting of Timber. This change gives the State Forester the authority to issue a civil penalty of $250 for the initial violation and up to $1,000 for subsequent violations within a 24-month (2-year) period. The Notification is required by the Operator (as defined in the law) and the civil penalty will be assessed

against the Operator for failure to notify. Notification must be received by the VDOF within three working days of the start of the logging operation, or before completion if the operation will take less than three days to finish. The Virginia DOF has the authority under the Code of Virginia to issue Special Orders to any owner or operator who has conducted or is allowing the conduct on any silvicultural activity in a manner which is causing or is likely to cause pollution, and to implement corrective measures within a stated period of time. Failure to obey a Special Order issued by the VDOF can result in civil penalties of up to $5,000.00 per day. A *Best Management Practices Field Guide* is available at http://www.dof.state.va.us/wq/wq-bmp-guide.htm. 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 (http://www.dof.state.va.us/resources/wq-BMP-Chapter-10.pdf).

The VDOF also has a major role in protecting watersheds through riparian forest buffers. Riparian forest buffers reduce erosion and cleanse water entering streams. These activities are allowed under the **Code of Virginia**: Water Quality Law, Chapter 11, 10.1-1181.7 (http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+10.1-1181.7).

Virginia Cooperative Extension

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

7.3 Kentucky Agencies and Programs

Eastern Kentucky PRIDE

According to their website (www.kypride.org), the PRIDE initiative promotes Personal Responsibility In a Desirable Environment in 38 counties in Southern and Eastern Kentucky. PRIDE combines the resources of federal, state and local governments and the efforts of citizens and focuses on these the goals of improving water quality in the region, cleaning up illegal trash dumps and other solid waste problems, and promoting environmental awareness and education.

Eastern Kentucky PRIDE, Inc. is a nonprofit organization. While it coordinates the initiative and operates grant programs, the work is actually provided by volunteers, schools, local governments, and nonprofit organizations. The program is funded by grants from the National Oceanic and Atmospheric Administration, and the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers fund projects that support the PRIDE initiative.

Division of Water

The Kentucky Division of Water NPS Section has several watershed displays and models that can support the educational effort. To access the information, visit http://www.water.ky.gov/sw/nps/Displays+and+Interactive+Models.htm. The Division of Water also publishes *A Logger's Guide to the Kentucky Forest Conservation Act*, a brochure that describes the requirements for timber harvesting BMPs and provides contact information for Kentucky Master Logger training. The brochure is available at http://www.water.ky.gov/NR/rdonlyres/68D87EFC-E0E8-4742-99A4-C779DE8D70B3/0/kfca_logger_guide.pdf

With regard to construction issues, the Kentucky Division of Water provides various publications, such as the Kentucky Erosion Prevention and Sediment Control Field Guide (http://www.tetratech-ffx.com/wstraining/pdf/esc_guide.pdf), which describe the erosion and sediment control process. The guide, which has sections on pre-project planning and operational activities, discusses the process by starting at the top of the hill (above the

project site) and proceeds down the slope through the bare soil area, ditches and channels, traps and basins, and on down to the waterways below.

The *Draft Kentucky Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites: Planning and Technical Specifications Manual* is also available from the publications web site http://www.water.ky.gov/sw/nps/Publications.htm. The manual was developed to help engineers, landscape architects, developers, construction managers, and others plan and implement measures that reduce harmful water quality impacts from construction projects and other land-clearing activities. The document is currently in the review phase.

Mountain Association for Community Economic Development (MACED)

MACED works to improve life in Appalachian communities by partnering with local businesses and individuals to take advantage of the strengths of the region and create opportunities for low-income people. The Kentucky Forest Landowners Handbook CD ROM is designed to help property-owners better understand their forest and develop a management plan suited to their specific interests, goals and financial requirements. It is suitable for all private forest landowners, whether interested in harvesting wood products, earning income from non-timber forest products (such as herbs and mushrooms), managing for wildlife, recreation or tourism opportunities, or all of the above. This handbook, which is accessible at http://www.maced.org/landowners-handbook.htm, aims to help all private forest landowners make smart decisions about their resources.

7.4 Local Government Agencies

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

Soil and Water Conservation Districts

SWCDs are local units of government responsible for the soil and water conservation work within their boundaries. The role of these districts is to increase voluntary conservation practices among farmers, ranchers and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices. The BSSWCD is working with VDH in continuing efforts to correct failing septic systems and straight pipes in the Knox and Pawpaw Creeks watershed. The BSSWCD received a government grant in 2006 to implement these types of BMPs.

Planning District Commissions (PDC)

PDCs were organized to promote the efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. PDCs focus much of their efforts on water quality planning which is complementary to the TMDL process. The Knox Creek and Pawpaw Creek watersheds fall in the Cumberland Plateau PDC. For more information on the Virginia PDCs, visit http://www.institute.virginia.edu/vapdc/.

The LENOWISCO, Cumberland Plateau, and Mount Rodgers Planning District Commissions came together to prepare *The Southwest Virginia Regional Wastewater Study* (Thompson & Litton, Inc., Lane Engineering, Inc., and Maxim Engineering, Inc., October 2005). This reports identified 15-20 homes requiring a decentralized treatment system (alternative treatment system) at the junction of 645 and 643 near Pawpaw Creek. Another system is needed along Straight Fork above the high school to serve 20-25 homes. The cost per connection in the Hurley area of this study was estimated at $11,387.

County/City Government Departments

City and county government staff work closely with PDCs and state agencies to develop and implement TMDLs. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of the TMDL process.

7.5 Businesses, Community Groups, and Citizens

While successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; *i.e.*, businesses, community watershed groups, and citizens.

Community Watershed Groups

Local watershed groups offer a meeting place for river groups to share ideas and coordinate preservation efforts and are also a showcase site for citizen action. Watershed groups also have a valuable knowledge of the local watershed and river habitat that is important to the implementation process. The Hurley Community Center staff has organized trash pick up along streams and roads in the watershed. They have removed approximately 75-100 tons of debris from the Knox Creek watershed.

Citizens and Businesses

The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings (Chapter 4), assisting with public outreach, providing input about the local watershed history, and/or implementing BMPs to help restore water quality.

Community Civic Groups

Community civic groups take on a wide range of community service including environmental projects. These groups include Ruritan, farm clubs, homeowners' associations, and youth organizations such as 4-H and Future Farmers of America. Groups such as these can assist in the public participation process and educational outreach, and assist with implementation activities in local watersheds.

Animal Clubs/Associations

Clubs and associations for various animal groups (*e.g.*, beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other land owners; not only in rural areas, but in urban areas as well, where pet waste has been identified as a source of bacteria in water bodies. Virginia's approach to correcting non-point source pollution problems continues to be encouragement of participation through education and financial incentives, *i.e.*, outside of the regulatory

framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

The benefits of involving the public in the implementation process are potentially very rewarding, but the process of doing so can be incredibly challenging. It is, therefore, the primary responsibility of these stakeholder groups to work with the various state agencies to encourage public participation and assure broad representation and objectivity throughout the IP development process.

7.6 Monitoring

The VADEQ will continue monitoring the existing stations in the Knox and Pawpaw Creeks watershed (Figure 7.1). In addition, the VADEQ is considering adding a station near or upstream of 6AKOX017.97 for ambient monitoring.

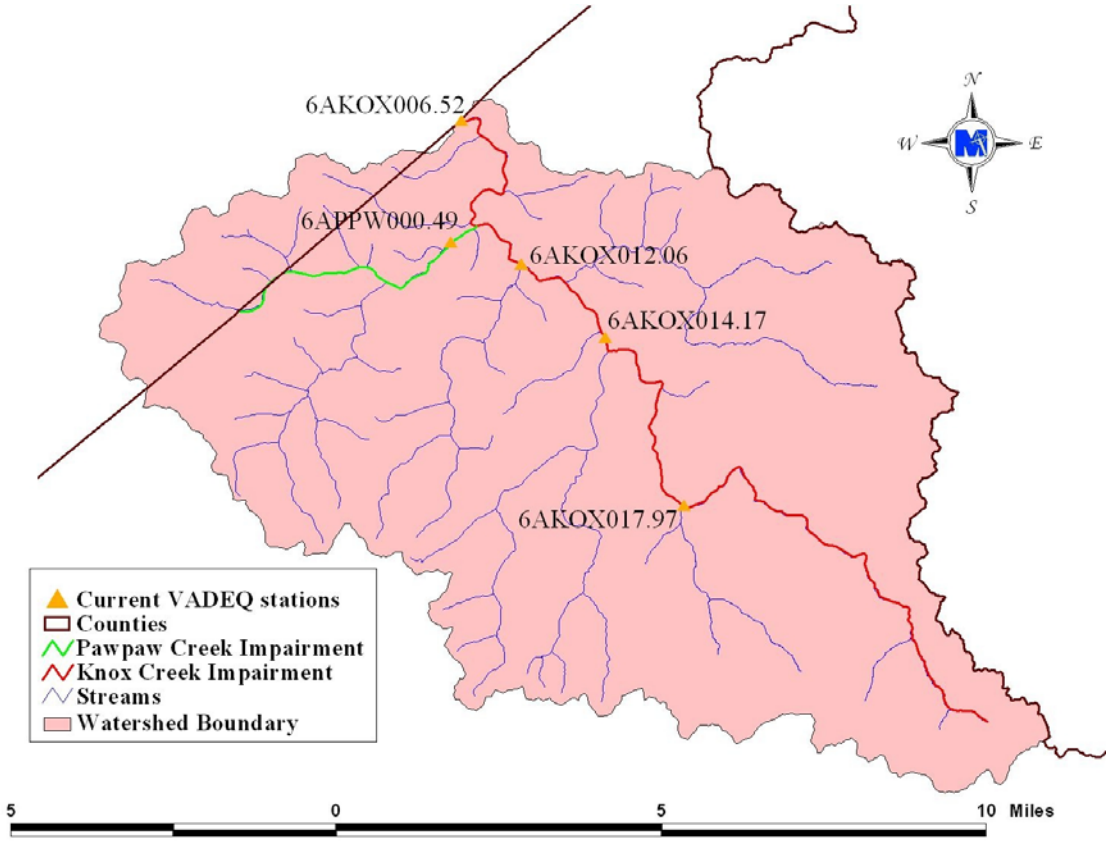

Figure 7.1 Location of monitoring stations in the Knox and Pawpaw Creeks watershed.

Interested residents will be offered the opportunity to participate in a citizen monitoring program. Volunteers may be asked to sample at the VADEQ stations that VADEQ is not monitoring during implementation. These volunteer monitors will be trained and provided with supplies and equipment to conduct water quality monitoring. Measurements of dissolved oxygen, pH, temperature, bacteria and turbidity can be conducted on-site. Bacteria enumerations can be determined by using the Coliscan Easygel method. The citizen monitoring program will be dependent upon annual renewal of funding from VADEQ. For more information on this program, visit http://www.deq.virginia.gov/cmonitor/.

8. FUNDING

The following practices are identified as vital to attaining the goals of the Knox and Pawpaw Creeks IP: SL-6 (Grazing Land Protection), WP-2T (Streambank Protection in TMDL areas), WP-4 (Animal Waste Control Facility), RB-1 (Septic Tank Pump-Out), RB-3 (Septic System Repair), RB-4 (Septic Tank System Installation/Replacement), RB-5 (Alternative On-site Waste Treatment System), improved pasture management, manure incorporation, vegetated stream buffer, infiltration trenches, erosion and sediment control, streambank stabilization, residential education program, reclamation of AML, dirt road stabilization, and forest harvesting BMPs. Potential funding sources available during implementation were identified during IP development. A brief description of the programs and their requirements is provided in this chapter. (Detailed descriptions can be obtained from the SWCDs, VADCR, NRCS, and VCE). Each of the funding sources has specific requirements and benefits that will vary in applicability to specific circumstances. It is recommended that participants discuss funding options with experienced personnel at their local SWCD in order to choose the best option. Information on program description and requirements was provided from fact sheets prepared by Virginia State Technical Advisory Committee, VADEQ, VADCR, and Southeast Rural Community Assistance Project, Inc.

Federal Clean Water Act 319 Incremental Funds

Through Section 319 of the Federal Clean Water Act, Virginia is awarded grant funds to implement the nonpoint source programs. VADCR administers the money in coordination with the Nonpoint Source Advisory Committee (NPSAC) to fund watershed projects, demonstration and educational programs, nonpoint source pollution control program development, and technical and program staff. VADCR reports annually to the EPA on the progress made in nonpoint source pollution prevention and control. A 319 application will be written upon completion of the IP to request funding for the technical assistance required (FTEs).

Virginia Agricultural Best Management Practices Cost-Share Program

The cost-share program is funded with state and federal monies through local SWCDs. SWCDs administer the program to encourage farmers and landowners to use BMPs on

their land to better control sediment, nutrient loss, and transportation of pollutants into our waters due to excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by SWCDs based upon those factors, which have a great impact on water quality. The objective is to solve water quality problems by fixing the worst problems first. Cost-share is typically 75% of the actual cost, not to exceed the local maximum. The Virginia Water Quality Improvement Fund (WQIF) provides funding for this program which is dependent upon a percentage of state surpluses.

Virginia Agricultural Best Management Practices Tax Credit Program

For all taxable years, any individual or corporation engaged in agricultural production for market, who has in place a soil conservation plan approved by the local SWCD, shall be allowed a credit against the tax imposed by Section 58.1-320 of an amount equaling 25% of the first $70,000 expended for agricultural best management practices by the individual. "Agricultural best management practices" are approved measures that will provide a significant improvement to water quality in the state's streams and rivers, and is consistent with other state and federal programs that address agricultural nonpoint source pollution management. Any practice approved by the local SWCD Board shall be completed within the taxable year in which the credit is claimed. The credit shall be allowed only for expenditures made by the taxpayer from funds of his/her own sources. The amount of such credit shall not exceed $17,500 or the total amount of the tax imposed by this program (whichever is less) in the year the project was completed, as certified by the Board. If the amount of the credit exceeds the taxpayer's liability for such taxable year, the excess may be carried over for credit against income taxes in the next five taxable years until the total amount of the tax credit has been taken. This program can be used independently or in conjunction with other cost-share programs on the stakeholder's portion of BMP costs. It is also approved for use in supplementing the cost of repairs to streamside fencing.

Virginia Agricultural Best Management Practices Loan Program

Loan requests are accepted through VADEQ. The interest rate is 3% per year and the term of the loan coincides with the life span of the practice. To be eligible for the loan,

the BMP must be included in a conservation plan approved by the local SWCD Board. The minimum loan amount is $5,000; there is no maximum limit. Eligible BMPs include 23 structural practices such as animal waste control facilities, loafing lot management systems, and grazing land protection systems. The loans are administered through certain participating lending institutions.

Virginia Small Business Environmental Assistance Fund Loan Program

The Fund, administered through VADEQ, is used to make loans or to guarantee loans to small businesses for the purchase and installation of environmental pollution control equipment, equipment to implement voluntary pollution prevention measures, or equipment and structures to implement agricultural BMPs. The equipment 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.

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, Soil and Water Conservation Districts, 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. Successful applications are listed as draft/public-noticed agreements, and are subject to a public review period of at least 30 days.

Community Development Block Grant Program

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

Conservation Reserve Program (CRP)

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

Conservation Reserve Enhancement Program (CREP)

This program is an "enhancement" of the existing USDA CRP Continuous Sign-up. It has been "enhanced" by increasing the cost-share rates from 50% to 75% and 100%,

increasing the rental rates, and offering a flat rate incentive payment to place a permanent "riparian easement" on the enrolled area. Pasture and cropland (as defined by USDA) adjacent to streams, intermittent streams, seeps, springs, ponds and sinkholes are eligible to be enrolled. Buffers consisting of native, warm-season grasses on cropland, to mixed hardwood trees on pasture, must be established in widths ranging from the minimum of 30% of the floodplain or 35 feet, whichever is greater, to a maximum average of 300 feet. Cost-sharing (75% - 100%) is available to help pay for fencing to exclude livestock from the riparian buffer, watering facilities, hardwood tree planting, filter strip establishment, and wetland restoration. In addition, a 40% incentive payment upon completion is offered and an average rental rate of $70/acre on stream buffer area for 10-15 years. The State of Virginia will make an additional incentive payment to place a perpetual conservation easement on the enrolled area. The statewide goal is 8,000 acres.

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

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

Environmental Quality Incentives Program (EQIP)

This program was established in the 1996 Farm Bill to provide a single voluntary conservation program for farmers and landowners to address significant natural resource needs and objectives. This program replaces the Agricultural Conservation Program (ACP) and the Water Quality Incentive Program (WQIP). Approximately 65% of the EQIP funding for the state of Virginia is directed toward “Priority Areas.” These areas

are selected from proposals submitted by a locally led conservation work group. Proposals describe serious and critical environmental needs and concerns of an area or watershed, and the corrective actions they desire to take to address these needs and concerns. The remaining 35% of the funds are directed toward statewide priority concerns of environmental needs. EQIP offers 5 to 10-year contracts to landowners and farmers to provide 75% cost-share assistance, 25% tax credit, and/or incentive payments to implement conservation practices and address the priority concerns statewide or in the priority area. Eligibility is limited to persons who are engaged in livestock or agricultural production. Eligible land includes cropland, pasture, and other agricultural land in priority areas, or land that has an environmental need that matches one of the statewide concerns.

Wildlife Habitat Incentive Program (WHIP)

WHIP is a voluntary program for landowners and land users who want to develop or improve wildlife habitat on private agriculture-related lands. Participants work with NRCS to prepare a wildlife habitat development plan. This plan describes the landowner's goals for improving wildlife habitat and includes a list of practices and a schedule for installation. A 10-year contract provides cost-share and technical assistance to carry out the plan. In Virginia, these plans will be prepared to address one or more of the following high priority habitat needs: early grassland habitats that are home to game species such as quail and rabbit as well as other non-game species like meadowlark and sparrows; riparian zones along streams and rivers that provide benefits to aquatic life and terrestrial species; migration corridors which provide nesting and cover habitats for migrating songbirds, waterfowl and shorebird species; and decreasing natural habitat systems which are environmentally sensitive and have been impacted and reduced through human activities. Cost-share assistance of up to 75% of the total cost of installation (not to exceed $10,000 per applicant) is available for establishing habitat. Applicants will be competitively ranked within the state and certain areas and practices will receive higher ranking based on their value to wildlife. Types of practices include: disking, prescribed burning, mowing, planting habitat, converting fescue to warm season grasses, establishing riparian buffers, creating habitat for waterfowl, and installing filter

strips, field borders and hedgerows. For cost-share assistance, USDA pays up to 75% of the cost of installing wildlife practices.

Wetland Reserve Program (WRP)

This program is a voluntary program to restore and protect wetlands on private property. The program benefits include providing fish and wildlife habitat, improving water quality, reducing flooding, recharging groundwater, protecting and improving biological diversity, and furnishing recreational and esthetic benefits. Sign-up is on a continuous basis. Landowners who choose to participate in WRP may receive payments for a conservation easement or cost-share assistance for a wetland restoration agreement. The landowner will retain ownership but voluntarily limits future use of the land. The program offers landowners three options: permanent easements, 30-year easements, and restoration cost-share agreements of a minimum 10-year duration. Under the permanent easement option, landowners may receive the agricultural value of the land up to a maximum cap and 100% of the cost of restoring the land. For the 30-year option, a landowner will receive 75% of the easement value and 75% cost-share on the restoration. A ten-year agreement is also available that pays 75% of the restoration cost. To be eligible for WRP, land must be suitable for restoration (formerly wetland and drained) or connect to adjacent wetlands. A landowner continues to control access to the land and may lease the land for hunting, fishing, or other undeveloped recreational activities. At any time, a landowner may request that additional activities be added as compatible uses. Land eligibility is dependent on length of ownership, whether the site has been degraded as a result of agriculture, and the land's ability to be restored. Restoration agreement participants must show proof of ownership. Easement participants must have owned the land for at least one year and be able to provide clear title.

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

The mission of this project is to promote, cultivate, and encourage the development of water and wastewater facilities to serve low-income residents at affordable costs and to support other development activities that will improve the quality of life in rural areas. Staff members of other community organizations complement the SE/R-CAP central office staff across the region. They can provide (at no cost to a community): on-site

technical assistance and consultation, operation and maintenance/management assistance, training, education, facilitation, volunteers, and financial assistance. Financial assistance includes $1,500 toward repair/replacement/installation of a septic system and $2,000 toward repair/replacement/installation of an alternative waste treatment system. Funding is only available for families making less than 125% of the federal poverty level. The federal poverty threshold for a family of four is $25,813.

National Fish and Wildlife Foundation

Offers are accepted throughout the year and processed during fixed signup periods. The signup periods are on a year-round, revolving basis, and there are two decision cycles per year. Each cycle consists of a pre-proposal evaluation, a full proposal evaluation, and a Board of Directors' decision. An approved pre-proposal is a pre-requisite to the submittal of the full proposal. Grants generally range between $10,000 and $150,000. Payments are based on need. Projects are funded in the U.S. and any international areas that host migratory wildlife from the U.S. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special grant programs are listed and described on the NFWF website (http://www.nfwf.org). If the project does not fall into the criteria of any special grant programs, the proposal may be submitted as a general grant if it falls under the following guidelines: 1) it promotes fish, wildlife and habitat conservation, 2) it involves other conservation and community interests, 3) it leverages available funding, and 4) project outcomes are evaluated. A pre-proposal that is not accepted by a special grant program may be deferred to the general grant program.

Clean Water State Revolving Fund

EPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source and estuary protection projects. Point source projects typically include building wastewater treatment facilities, combined sewer overflow and sanitary sewer overflow correction, urban stormwater control, and water quality aspects of landfill projects. Nonpoint source projects include agricultural, silvicultural, rural, and some

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

APPENDIX A

Meeting Minutes

Implementation Plan

1st Industrial Working Group Meeting Minutes

Facilitated by Phil McClellan, MapTech
February 6, 2006
Commonwealth of Virginia
Department of Environmental Quality

TO: FILE U:\\TMDL\MN-KnoxTMDL Breakout Sessions 02-06-2006.DOC

Recorded by: R. Craig Lott

SUBJECT: Minutes for Industrial Segment Breakout Session TMDL meeting 02-06-2006. Following presentations from Nancy Norton (DEQ), Megan Laird (MapTech), and Theresa Carter (DCR), and a short break, several working group breakout sessions were held. The purpose of the working groups was to focus discussion on the implementation plan and findings of the draft Knox Creek and PawPaw Creek TMDL Impairments presented earlier the same evening. The focus groups, including Residential, Industrial, and Government were begun around 7:30 and concluded around 9:00.

Following this introduction, are the minutes of the Industrial Working Group meeting. The agenda was presented by Phil McClellan and was followed by an informal discussion of the concerns of the participants. In attendance were: Phillip McClellan (MapTech), Otis Mullins (TECO Energy), Keith Mohn (Arch Coal), Steve Baker (Timber), Dave Gruber (BMI), Joe Rasnake (BMI), Ed Goforth, Jr. (DMME), Anthony Justus (BSSWCD), and Craig Lott (DEQ),. The minutes are a rough transcript of the working group discussion. The words assigned are not intended to be direct quotes, an attempt was made to assign a speaker to the questions and may not be completely accurate.

MINUTES: After handout and presentation of the working group meeting agenda (see attachment B, by Phil McClellan), the discussion and questions began.

Discussion (Phil): Agenda discussion – Purpose of Industrial Group. Since there is no representative of agricultural producers, we won't spend much time on that today. We will concentrate on mining and forestry issues, Identify BMP options and costs, how to get word out for continued participation throughout the process, and define constraints.

First, lets have a discussion on constraints to implementation and TDS and/or sediment issues.

Q (Keith M): Difficult to come up with effluent limitations. I wonder about what we will do in 2 years or so when we don't achieve an improvement in aquatic life?

A (Phil): The State of Virginia has given a gift to industry with allowing them (coal companies) to address TMDL requirements with implementations of BMPs. DMME should correct me, this interpretation, if needed.

A (Ed G.): Shook head, and affirmed what Phil had said.

A (Phil): Currently, the state is not requiring permit limitations as far as concentration or load, but encouraging BMPs.

Q (Otis): What if a new Coal Permittee wants to come into a watershed and get a permit to mine coal and operate, having a permitted NPDES discharge? Will they be able to get a permit? What restrictions on their discharge water quality will there be?

A (Phil): They should be able to get a permit. It may involve assigning a load allocation to the new permittee, revisiting the TMDL, taking a Waste Load Allocation from the TMDL, to reduce the current Load Allocation for the new permittee. This is still pretty new ground as far as mining and TMDL allocations in Virginia. Do you have anything to add Craig?

A (Craig): I wish Nancy were here. Well, it is an ongoing discussion and a pretty new thing, and we are still ironing out the definitions and working with the Water Board and industry, as most of you know. Some states and groups have done similar things to what Phil and the earlier presentations indicated. Permits for new mines in impaired watersheds elsewhere require remining, taking in existing AML or stream bank restoration projects, etc. I don't know what we will end up with. DMME should know better than me, perhaps.

A (Phil): It all starts with BMPs, these Best Management Practices are what will bring down our TDS and sediment loadings and help with our Aquatic Life impairment. Our steering committee for this TMDL will be responsible for determining which BMPs are going to be applied here.

Q (Otis): But that's going to take a long time to improve, and what if someone comes in to DMME tomorrow wanting a coal mining permit?

A (Phil): Another good question. They will go through the normal permitting process and certain BMPs will be assigned to roads, sumps cleanout schedules, etc.

Q (Dave G.): We are under the impression that when you take 2 benthic results and they are nonimpaired you can take the stream off the impaired list. Both Creeks appear to be improving in the category of "Aquatic Life Impairment" category. Can you remove an impairment and a TMDL from a stream yet and if not, when?

A (Phil): Lets Look at the data, at the specifics…

Dave G.: In the draft TMDL, Its on page 6-8, in Table 6-9 for Paw Paw Creek, and on page 6-3, Table 6-3 for Knox Creek.

A (Phil): Okay, it is still slightly or moderately impaired, so the answer would be, no. You can't delist a stream in that category. You would have to have two consecutive sampling from the same site that met the standards for a water body to be delisted. This is not likely without changing the way we do business in our streams. We are all going to have to work together to reach that goal, that is the idea of assigning load allocations to various land use practices so that we are

all working together. Do you have anything to add Craig?

A (Craig): We all want to see the streams improve.

I'm not too much of an idealist, but we've been discussing the extreme worst case scenario, probably because you are all businessmen who want to know the worst case costs and liabilities. To consider the other extreme, it may be that cleaning up the fecal impairments through BMPs and other activities, actually has an impact on the Aquatic Life impairments. What if as you brought up and have indicated earlier, just for a hypothetical case, TDS and/or possibly even sediment are *not* the problems in these streams? Then, what is causing these impairments? Perhaps along the way to doing some of these BMPs and working with the towns and farmers, we hit upon the correct combination of things that brings back the aquatic life. The stream gets delisted and we are not on the margins of impairment/unimpairment anymore. That would be the best case scenario.

(BSSWCD): We can help with the livestock and fencing out the cattle, horses, and all.

Q (Dave BMI): But there's not any cattle and didn't you say there's only one horse barn?

A (BSSWCD): No, there's more than one horse barn, one is in worse shape, and horses are much more of a problem than cattle, we don't have much cattle, maybe a few, but we really need to work on fencing the horses. We've already been working on doing that.

(Phil): We don't want to be on the margins or in the middle of unimpaired and impaired, going back and forth. It's going to take all of us, including coal mining, forestry industries, and agriculture, everyone.

Q (Craig): What's the land use percentage for livestock?

A (Phil): I don't know off the top of my head but it's very small numbers.

Q (Dave G.): Did you look at conductivity or TDS measurements related to flow (low or high) or rainfall as you did with the bacteria?

A (Phil): Typically we wouldn't look at high flow / low flow conditions because if it's a stressor in high flow or low flow it doesn't matter, that's really a cause or effect. What's causing it to be high or low doesn't impact whether or not it's a stressor. Unless it's some sort of interrelationship between the high flow and the low flow and the benthic health. It will affect the Implementation Plan and how or which BMPs are chosen by the working group.

Q (Dave G.): Will you compare flow increases and decreases to determine TDS sources and affects? Do we have scientific proof that TDS is a stressor?

(Phil) Absolutely do.

A (Phil): What I think you are asking is "Are TDS results the same from one location or source to another?" And you are correct. TDS is not all the same from different sources, I know that data may indicate that in some locations you can have higher TDS and moderate aquatic life, but in similar studies to our watersheds, in Kentucky for instance, about 500 TDS is problematic.

Q (Dave G.): Well, we're not so sure and there are plenty of places where TDS is a lot higher and they have lots of healthy aquatic life…

A (Phil): TDS is a stressor to bugs in this watershed. I am confident that it is a stressor to the bugs. What we need to do is to look at the sources of TDS in this watershed and this will affect the I.P. and how BMPs are chosen.

Q (Otis M.): Isn't mining company, CONSOL doing their own TMDL, looking at putting salt into the Levisa River and controlling the I.P. there?

A (Phil): Yes. CONSOL is interested in keeping control of the process and they may find they really didn't want that control. It is still going to have to go through the same review process and they may regret having the responsibility for that watershed.

A (Anthony J.): I was at the recent board meeting and CONSOL said that they are meeting the standards currently for drinking water for conductivity and salt content of drinking water. That is with their discharge right now.

A (Phil): There are two issues there 1) the agency requirement may not be stringent enough to meet the water quality standard, the general standard may or may not be sufficient to meet the aquatic life standard. 2) Where they're discharging there may be sufficient dilution and they do in fact meet it and it's not a problem.

A (Dave G.): And they still have 5 years to show that in the I.P.

A (Phil): They'll have some time to show that… but they haven't done the TMDL yet so we may be getting ahead of ourselves.

A (Ed G.): Stream banks are failing all along here. Not too much habitat along the streamside. Streambanks seriously undercut, in serious need of stabilization.

(Phil): Streambanks were addressed in that. The percentage may not have looked comparable or proportional to what the source is but we have to remember that we have tens of thousands of acres of land discharging to it verses however many miles the stream channel has.

A (Anthony J.): There is a lot we can do to educate folks. That should be one of our main jobs we are trying to do with this IP. Different folks mow down to the water. We have to first educate them, the public that is. It is just one small project at a time and one landowner at a time.

A (Phil): This is an opportunity to do an overall plan for this watershed and include education as part of that plan. We may conclude five years down the road that we can't economically meet our goal. This lays the foundation for that and lays a foundation for a UAA a Use Attainability Analysis. But we've got to go through some hoops to show that. We need to include every concern for the TDS and sediment problems in our plan. We've got to have some changes.

Q (Steve B.): Can mining from another watershed area (deep mines) leak dirty water through seams into our watershed and affect our water quality?

A (Phil): I wouldn't think it would flow very far. That is probably another good question for DMME.

A (Ed G.): Yes, it depends upon the dip and seams. The depth and connectivity between deep mines. They sometimes transport water and it may be pumped out during active mining into a watershed it did not originate in. Also, once mining is complete, mines tend to fill in with water and if they connected to the surface in another watershed, might trap or transport water from another watershed to wherever the lowest relief entrance or vent shaft is that can release that water.

(Phil): It's got to interconnect and surface.

Q (Dave G.): What BMPs do you recommend for these watersheds? That would address the TDS and sediment problems?

A (Phil): Good question. If you will turn to the page with Table 4. Potential BMPs for the Knox Creek and Pawpaw Creek watersheds, we can look at that. This table shows various BMPs, what they address as far as pollutant or impairment and their costs.

Q (Keith): where did the numbers/cost for that Reverse Osmosis system at the bottom come from? What is that for? We looked into one of those systems and the costs were much more than this…maybe add one or more zeros onto it.

A (Phil): I'm not too sure. I didn't do the research on that number. I can find out and let you know if that's right or not. I'll find out whether that is correct for a system and how much the flow rate and what the water quality it was treating is.

Q (Dave G.): Can you let us know what that BMP proposes to do with the reject water. That could also be a problem with one of those systems.

A (Phil): I'll look into it and try to find out. Lets look at livestock fencing with alternative watering…that costs about $4,000/unit; while livestock fencing without alternative watering costs $2,000/unit. Just for an example. The SL-6 and WP2T are the cost sharing programs from DCR codes. Tables 2 and 3 are both pretty much for Agriculture, but they will help us to address the TDS and sediment loading.

Comment: Technically both of these streams are just slightly impaired. What we're looking at is Best Management Practices to take care of that water.

(Phil): Yes I think that's right. Ideally on the mining side you're doing these just one time.

(Phil): What you may not be doing is haul roads. But you're still going to have runoff even with a paved road.

(Phil): That's true. But if you can manage the runoff that's what you need to do.

Q (Dave G.): What about our TDS problems? What BMPs do you recommend to reduce TDS from mining or forestry?

A (Phil): We include in Table 4 several more BMPs that can address mining and forestry issues such as haul roads and dust control, and sumps and sediment ponds. Erosion control and dust are big issues that we all need to address. DMME has some good BMPs on the last page, Table 5. Does anyone use polypavement?

A (Otis): We used it for a stretch from one of our mines and it worked pretty well.

Q (Phil): They say it is cheaper and lasts longer…somewhere between asphalt and concrete. Did you all like it? Does it work?

A (Otis): Well…there are some problems. It works pretty well, but you are always going to have some problems near intersections at bottom of hills, on curves…it would be good on straight stretches. There are several problems, though it won't help much where you use temporary haul roads, it costs too much, it won't help where you have point loading from these heavy trucks even if you put it deeper (it worked well with about 6-8 inch depth, but point loading on steep grades, especially at the bottom didn't work).

Q (Dave): But, are any of these things going to help bring down the TDS? Really? What if they don't after 5 years? There is concern that BMPs aren't going to fix TDS.

Phil: I understand the concern. There has been a watershed, Middle Creek that was impaired for TDS. TDS values have come down significantly through the restoration of the watershed…essentially BMPs.

Comment: But Middle Creek doesn't have mining.

Phil: Doesn't have the mining but they've cleaned up what they left. If we do a better job of reclamation in a timely fashion we'll be closer to our goals. There may be economic reason or logistic reasons why we wouldn't do that. The challenge is to think about how logistically and economically you can structure your mining so that can get things reclaimed so that they're not as exposed to the weather as long as they are currently.

A (Phil): They will and in short order, too. On Straight Creek and Callahan Creek, compared to Middle Creek, TDS impairment has improved because these sites have been through the Implementation Plan phase simply using Best Management Practices!!! It will work here, too. The only way to know is to do it, but I believe they will work and you will see stream aquatic life recovery. One option you may have will be to do reclaim mining as you mine a new site.

A (Keith): One thing, going back to what we were discussing a minute ago, like polypavement, that we've been considering, is that some of these things might not work for surface mining because you may be in one site for such a short period of time, however, deep mines may be there for from one to thirty years, and prep plants, too. They may or may not be cost effective.

A (Phil): Good point. But I know we can do better. But I've been to several mines that were in real need (especially on some of the impaired watersheds) that when I went had very poor maintenance of their sediment ponds and roadside sumps. They weren't following BMPs. Let me say it right now, I should have said this in the beginning. We are not trying to shut down any industry! We are not trying to put any body out of business, many of the BMPs that I can think of are housekeeping and practical things that just make sense.

A (Craig): If industry is not around, then we won't have any jobs. We aren't on a witch hunt or trying to get you all to point fingers at each other or at other industries. We do need to know where the problems are in the watershed.

A (Keith): Another thing that we tried is those "Track Off Areas" you know where you have a straight

stretch of road (maybe a ½ mile of pavement), where you can achieve about 25 mph, with a good sized sump or pond below. This helps Trucks to loosen any dirt or dust they may be going to lose on a road before they get to it. Cause those roads even when you spray them with dust suppressant, don't have the sumps and catchbasins to handle the runoff later.

Q (Phil): What about Forestry? What is your biggest problem, do you think? Do they enforce enough? Do they have strict enough regulations?

A (Keith): What about temporary crossings? I know, here, we have maybe 2 foresters in the county and it is hard to catch offenders.

Q (Phil): Can they write you up? Do they do anything else if they catch someone?

A (Steve): Yes! They can write you up, and they can fine you, too. Just within the last 2 – 3 years, the regulations have changed. Now, you have to call the state forester the day of the job or before and have them come out to checkout your water bars, grass sowing you may have done, runoff containment proposals, etc. Probably a lot of jobs that aren't being governed.

Gas wells look like they are a real problem to me. And there are always those folks who don't do a good job of following the rules. They may be logging for one or two days and then get out of there. But they have already ruined the land and the streams and seem to never get caught or penalized.

A (Keith): As far as Gas wells, we have some and we or our contractors maintain a regular schedule to maintain our sumps and sediment traps which we've started putting in above our sumps to catch the gas well water needing treating. It is different for different times of the year in the dry summer or fall we watch the rainfall and just have to check the sumps about once every 2 months, but much more frequently in rainy periods.

That's something we could do a better job of in Virginia, we do a good job in Kentucky. Part of it …is that it's scheduled over there.

Some of these are great ideas for sediment for Pawpaw, but Knox is just TDS. What BMPs will be appropriate for TDS?

You don't believe if we manage haul dirt roads, if we stabilize a haul dirt road so we're not moving soil to the stream? How about reforestation of erodible lands?

Q (Phil): Who has these gas wells?

A (Ed G.): Various companies, including CNX?

(Phil): We are trying to get mitigation credits for what you do way up from the stream as well as streamside. There is a proposal to OSM where a credit will go against where we are now. If we get below where we need to go then it might open up more capacity.

Q (Keith): What does the credit do and go against? The TMDL load allocations? How much AML is in this watershed and where is it? We were looking at a map during the meeting earlier.

A (Phil): If we using targeting…I wouldn't target hauls roads first. I'd target AML first. Get them healing.

Well for instance, we've got an aerial photo which indicates that there is just a lot of problems in this watershed. Aerial photos shows how much land has AML and how much is active mining. There is stippling to represent ? and pink shading to represent the AML.

Q (BMI): How much credits will mining companies get for AML cleanup? Where are the ones worth cleaning up?

A (DMME): Hunt's Fork is the worst, and then next is Lester's Fork.

A (Phil): There's a lot more than you'd think, and it's spread over the entire watershed.

Q (BMI): Can mining operators get credits for TMDLs for fixing up AMLs?

A (Phil): We are working on that. Perhaps you might have some influence. Do any of you know Fred Fox in the Washington Office at OSM? Telling me that they couldn't hardly give the money away.

A (Keith): AML projects are funded based upon tonnage that a state does. For instance, Wyoming gets lots of money, but we don't because of the way the ACT was structured. They use money for AML to build bridges and hospitals. Very little coming back to the Eastern States now.

That may be changing. We hope so.

Phil: Well we need to wrap up this meeting so, we've discussed many things tonight and covered a lot. We still need two folks for the steering committee from industry. Any volunteers?

Otis D. Mullins: I'll do it. (coal mining representative)

Steve Baker: I'll do it (forestry/timber industry representative)

Phil: Great. There is no date yet on the working group, or the steering committee meetings, yet. I'll email you all that information; I've got all of your email addresses.

Hopefully we'll get some agriculture folks. Though there are not a lot, but we need to get them involved.

I need you all to be looking at agenda items 3, 4, and 5 and think about questions. I've got a note to try to get efficiencies for some of the BMPs we have. I will work on getting a chart relating conductivity to flows.

Any other BMPs you can suggest and I'll be looking for other good ones for this watershed. If you have some ideas let us know. We had some great discussion tonight. Thank you all for such a great participation.

Other Considerations:

Recommendations for Follow up:

Attachments

Attachment A – Preceding meeting powerpoint presentations printout (Nancy Norton, Megan Laird, Theresa Carter).
Attachment B – Agenda for first Industrial Working Group Meeting (prepared by Phil McClellan)

Knox Creek and Paw Paw Creek

TMDL Implementation Plan Development

1st Residential Working Group Meeting

February 6th, 2006

Meeting Attendees:

Megan Laird, MapTech, Inc.
Nancy Norton, Virginia Department of Environmental Quality (DEQ)
Michael Lester
Edna Justus, Big Sandy Soil and Water Conservation District
Harold Vance
Darwin Bailey
Wade McNeeley
Bradley K. Matney

Introductions

Brief Review of TMDL

TMDL Study was presented to the working group during the first part of the meeting within the power point presentation by MapTech.

Primary Role of the Residential Working Group

Megan Laird discussed this topic.

- Identify technical and financial resources to carry out implementation plan
- Identify legal or regulatory controls
- Recommend how to deliver residential implementation
- Find ways to identify and eliminate straight pipes
- Identify funding means for corrections of these sources
- Identify difficulties faced by landowners in correcting these problems
- Determine educational and outreach tools
- Report findings to Steering Committee

Issues Discussed:

If more people know about septic corrections there might be more involvement.

At Race Fork below this tributary, fish have sores and there is no small mouth bass.

Since the 2001 Flood new houses in downtown Hurley have septic systems

Old septic systems are not up to standards and specifications however.

Restraints to correcting failing septic systems include:

1. Pride – people don't want to ask for help
2. Fear – people are afraid to ask because they may get assessed a $10,000 fine
3. Illiteracy – Elderly can not read the information in flyers and understand

Methods to reach the local population:

1. Have demonstrations at the Kids In the Creek Fishing Rodeo
2. Develop a booklet explaining the septic issues

When bonds are released on Coal Permits, they bulldoze the dam on the sediment ponds and let all the sediment and water go.

The costs of septic systems are $6,000-$8,000 or $10,000

One septic contractor asked for more information about alternative septic systems.

Steering Committee Representation

Harold Vance

Knox Creek and Paw Paw Creek
TMDL Implementation Plan Development
1st Government Working Group Meeting

February 6th, 2006

Meeting Attendees:

Theresa Carter, Virginia Department of Conservation and Recreation (DCR)
Chris Clark, Virginia Department of Environmental Quality (DEQ)
Robert M. Hall, Big Sandy Soil and Water Conservation District (BSSWCD)
Dennis Sanders, Virginia Department of Transportation (VDOT)
Gary Shifflet, Virginia Department of Mines, Minerals and Energy (DMME)

Introductions

Brief Review of TMDL

TMDL Study was presented to the working group during the first part of the meeting within the power point presentation by MapTech.

Primary Role of the Government Working Group

Theresa Carter discussed the role of the Government Working Group.

- Identify technical and financial resources to carry out implementation plan
- Identify legal or regulatory controls
- Recommend how to deliver agriculture and residential implementation
- Report findings to Steering Committee

Issues Discussed:

Can or should the Big Sandy SWCD work with the installation of septic systems?

The Big Sandy SWCD has put in 143 septic tanks in past year. 80% of the systems installed were in the Knox Creek and Paw Paw Creek Watersheds. BSSWCD used mainly Southeast RCAP funds.

Other financial resources?

Due to changes in legislation AML Funding may not be a good source in the near future.

According to VDOT, they spend litigation funds often on numerous projects. The question was asked how do we get more litigation funds from DEQ or Army Corps of

Engineers. There was also a request on how to get litigation funds that have been sent from the Big Sandy Watershed back into the watershed. There needs to be follow up with Army Corps Engineers in regards to litigation funds.

Suggestion was made to review the Kentucky PRIDE Program and see how it would benefit the watersheds. Suggestion was also made to send copies of the TMDL to Congressman Hal Rogers-Kentucky and Congressman Nick Rayhall-West Virginia.

OTHER TECHNICAL RESOURCES

According to the group, there is not much assistance from local companies. Coal companies might help with funding for septic/sewage projects if approached in a correct way but do not mention ground water.

Alpha Resources is extremely helpful and sensitive with community issues.

Brown & Root may assist with projects. Ask Edna from Big Sandy SWCD for contact names.

What are some legal and regulatory controls?

DMME is the agency responsible for mining related regulatory controls. Virginia Department of Health is the agency with the lead on regulations on sewage issues.

What constraints to implementation exist?

For residential septic projects, if contractors are used then bids need to be sent out. Usually 5 or 6 bids are sent and end up with 1 or 2 contractors. Then take the lowest bid that doesn't necessarily do the best job.

For agricultural projects most of the farmers install the water systems, troughs, fencing, etc. themselves.

In order to move forward with implementation goals, BSSWCD would need additional staff.

How do we get more participation?

Most folks hear about the meetings and the TMDL process by word of mouth from Big Sandy SWCD. Direct Mailing would also work the best. Suggestion was made to contact Rick Boucher's office or the State Board of Elections.

OTHER COMMENTS

The TMDL Implementation plan has one objective, water quality. There are so many agencies that work with water quality. There has to be a way that water quality comes together under one umbrella to help.

Steering Committee Representation

Robert M. Hall

Knox Creek and Paw Paw Creek TMDL Implementation Plan

1st Steering Committee Meeting

April 20, 2006

Meeting Attendees:

Nancy Norton DEQ,
Megan Laird MapTech,
Bobby Hall Big Sandy Soil and Water Conservation District
Edna Justice Big Sandy Soil and Water Conservation District (Govt. Working Group),
Brian Stanley VA Dept. of Health,
Otis Mullins and Gary Shifflett (Industrial Working Group),
Harold Vance (Residential Working Group)
Mattie Christian (Residential Working Group).

Thursday, April 20, 2006, the Knox Creek Steering Committee met at the Hurley Community Center. There were 9 people in attendance. All of the working groups were represented by at least one of the two representatives even though several members were unable to attend.

Minutes from the first working group committee meetings and an agenda for the first steering committee meeting were handed to each person attending.

The TMDL was discussed as to the impairments and where they apply.

Mr. Vance requested that more monitoring be done in the headwaters on Knox Creek to better define where the hot spots or highest loading was coming from. Nancy noted that Guess Fork has monitoring on it and was listed for bacteria violations. There may be further monitoring and study on this tributary. Mr. Vance said that there are sources above Hurley and that Guess Fork flows into Knox Creek below Hurley. We discussed opportunities for additional monitoring. Monitoring could possibly be performed by coal companies working in the watershed such as United, TECO or Alpha. Otis Mullins agreed that TECO would cooperate in collecting additional samples. Other opportunities may be to involve a citizen group to do Save our Streams macroinvertebrate (bug) collections and counts. DEQ plans to return to Knox Creek and Pawpaw Creek to monitor in 2008 as part of the Phase 1 monitoring plan. In terms of collecting bacteria data at more sites, Nancy will pin down monitoring plans and report back to the group in May. The Kids in the Creek day is May 27th this year and we discussed possibility of establishing some Save our Stream bug stations in the areas that there will be lots of traffic. Nancy checked with DEQ education specialist Christine Smith after the meeting and it is possible that DEQ can help in education outreach at this event. Anthony Justus can help with bug collections and Lisa Harris will be contacted to see if she can join us for the fishing day May 27th to demonstrate bug collection and identification.

Megan will review her mining permits and layer with abandoned mine lands to determine what corrective actions are already in place and where abandoned mine lands could be addressed as part of the implementation plan to reduce sediment.

Comments were made that the horse numbers were too low in the TMDL study. The group located and estimated numbers of horses in the watershed. Horses are stabled at a number of sites and manure management consists of moving the manure from the barn to the adjacent creek bank or in the creek. That means that many of the horses are not seen from windshield surveys in the watershed. Megan will review this information in developing several scenarios for putting corrective actions (BMPs) on the ground and report these results back to the steering committed May 19.

Megan asked the committee if further identification of housing clumps (5-7 houses grouped closely together) in each of the smaller units of the watershed would be helpful to the group in terms of estimating the costs of correcting sewer problems such as straight pipes or failing septic systems. Brian pointed out that the Regional sewer study is complete and lists cost estimates and potential treatment options for Knox Creek. This information will be extracted from the Regional Sewer Study so that the committee can see it and determine if it is adequate for planning where to fix sewer problems first. One question raised about the small multi home sewer treatment plants was the cost of maintenance. This question will be answered as the study moves along. Another issue with these small plants that serve only 5-7 houses is the need for the county public service authority to take over their maintenance. Brian noted that Tazewell County and Dickenson County public service authorities are moving to accept these and the work and responsibility that they entail. However, Buchanan County public service authority has not done so yet. The head of the public service authority is Daryl Cantrell. He has not been in the position long and takes his lead from the County Board of Supervisors. The discussion centered around the need to get both parties involved in the Implementation Plan development. Brian noted that some funding agencies will not release funding for water projects unless there is adequate sewer treatment at homes signing up for water. Drinking water is an issue in Knox Creek area. High iron and high levels of sulfur in the well water are not uncommon. Some of these problems are due to faulty well construction but iron and sulfur are present in the geology of the region so many people in the watershed need a water source as well as a sewerage treatment option.

Gary Shifflett noted that the DMLR has funded projects in Knox Creek such as a water line construction, streambank stabilization with gabion baskets, and closing mine portals. Although not all of these projects affect the water quality directly, they may have an indirect impact on water quality. The Knox Creek Implementation Plan may identify opportunities where DMLR funding can be paired with other funding to do projects more directly linked to water quality improvements. The abandoned mine land tax will sunset this summer and this funding may not be available if Congress allows the tax to end. Abandoned Mine Lands are a major source of sedimentation some of the committee felt. Permit sediment ponds were discussed and Gary clarified their purpose and their life time. The release of bond and permit responsibility by the mining company may result in removal of sediment ponds or the landowner may choose to have the pond left. During

the life of the ponds, they must be cleaned out when the dirt trapped in them reaches 60% of the pond capacity.

The committee discussed possible agencies or organizations in the watershed that may be available or willing to provide oversight for grant funds. Big Sandy Soil and Water Conservation District is one agency, the Big Sandy River Basin Coalition was another entity that was suggested. Mattie Christian told us that Hurley Community Center provides food, clothing, housing repairs and stimulates litter clean up efforts in the watershed. The education component of the implementation plan may be aided by using Hurley Community Center as an outlet for passing along information. She also noted that drinking water and stream conditions in the watershed have deteriorated over her life time so that today, many in the watershed recognize there is a problem and may be ready to take the needed steps to correct them. If the public are involved from the beginning and from within rather than from an outside agency, sewage plants may be an easier sell to the community today. Other possible education opportunities include coal companies. Otis Mullins noted that the coal company he works with goes to schools and has taken an active role in environmental awareness and education in Kentucky. He thought these same activities could be done in the watershed. Brian said that there is a summit at Breaks Park each year about watershed improvements and groundwater protection where students in Hurley already participate.

Milestones for the implementation efforts were discussed in a general way. No one was ready to determine when a certain amount of effort should be expended. This was tabled until Megan gets scenarios run on the computer model of Knox Creek so we can look at some examples then the committee with think about how long these efforts will take to complete.

Future Steering Committee Meeting was scheduled for May 19th.

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Knox Creek and Paw Paw Creek

TMDL Implementation Plan Development

2nd Steering Committee Meeting

May 19th, 2006

Meeting Attendees:

Megan Laird, MapTech, Inc.
Nancy Norton, Virginia Department of Environmental Quality (DEQ)
Justin Ford, Kentucky Division of Conservation
Corrine Wells, Kentucky Division of Water
Ted Withrow, Big Sandy River Basin Coordinator (KY)
Edna Justus, Big Sandy Soil and Water Conservation District
Harold Vance
Theresa Carter, Virginia Department Conservation and Recreation (DCR)
Brian Stanley, Virginia Department of Health (VDH)
Anthony Justus, Big Sandy Soil and Water Conservation District
Blaine Delaney, Black Diamond RC&D
Joey O'Quinn, Virginia Department of Mines Minerals and Energy (VDMME)
Steve Baker
Otis Mullins, TECO Energy

Introductions

TMDL Status Update

TMDL Study has been revised with new TDS loads in the TMDL tables in Chapter 11. The error in loads was a transcription error, not an error with the modeling results. Since changes to the TMDL table are considered a significant change to the document, DEQ is providing public notice and public comment from May 29 to June 27th, 2006. Copies of the corrections were handed out to the group as well as the public notice about public comments. The IP study can not be concluded until the TMDL is approved by EPA which means that the draft implementation study will be delayed some so a draft will be provided by MapTech in September 2006 instead of June.

Scenarios for consideration

Megan Laird provided four Tables for Steering Committee comment.

- Table 1 included 3 scenarios for addressing all TMDL reductions. The costs of each practice that would reduce pollution to the stream were discussed. Question was raised about $5/acre for AML reclamation. The cost of this was not correct. Joey O'Quinn recommended lumping mining BMPs into one practice called reclamation

and estimating the cost at $10,000 per acre. The reductions for bacteria on Pawpaw were part of the reduction needed for the Knox TMDL.

- Table 2 included 3 scenarios for Knox Creek to meet the bacteria and TDS reductions. The same comments that were applied to Table 1 apply here. Education was discussed as a strong component of efforts to reduce pollution loadings.

- Table 3 demonstrated the difference between targeting reductions in a watershed and not targeting the reductions. This table does not mean that only failing septic systems or straight pipe situations can be addressed. The corrections need to be made through out the watershed but the most reduction in violations will be realized when those systems closest to Knox Creek are corrected. In terms of milestones, a table showing which watersheds to target first would be developed. It provides guidance as to which sub-watersheds identified during the TMDL study to go after first.

- There were 2 variations of Table 4 in the handout. Each table was an example of a different way to display the amount of corrective actions per year. The choices discussed were either milestone measurements by % of total corrective actions needed or milestones measured by the number of practices put on the ground each year. The steering committee concluded there were positive aspects to each. The critical decision will be how many corrective actions are feasible to target each year, then the steering committee can decide how to represent this in table form.

Issues Discussed:

Gas wells are very active in the watershed. The Steering committee recommended taking the gas well activity into account in determining where to reduce sedimentation.

The Knox Hunt Club cleaned up the headwaters removing tons of litter.

Assign A Highway has probationers assigned to roads and they pick up litter.

Education of children is a critical component of the implementation plan. Black Diamond RC & D will work with Big Sandy SWCD to address this. One possibility for education is an outdoor classroom. It was pointed out that this was very successful in other watersheds.

Next Meeting:

The next meeting is tentatively planned for the week of July 10th. The participants indicated that 5:30 pm would be late enough in the evening to accommodate the various working group work schedules.

Summary Knox and Pawpaw Creek

2nd Industrial Working Group Meeting

July 10, 2006

Industrial Participants:

Joey O'Quinn-DMME
Otis Mullins-TECo
Frank Pinter-Alpha
Larry Damgron-Alpha
David Gruber-BMI
Mark Sproles-Alpha
Anthony Justus, BSSWCD
Edna Justus, BSSWCD
Bob Brendlinger - Wellmore Energy
Tad Nunley - Wellmore Energy

Introductions

June 27th Comment Period ended

Nancy gave TMDL Update

Pawpaw Creek

Possible Scenarios

One horse waste facility was discussed as a target. Nancy asked participants if the horse waste were composted, could it be used as a soil amendment on reclamation of coal sites. The steepness of the slopes preclude its use unless it is thinned so it is sprayed onto the surfaces. One would need to determine the amount of compost to see if there is a demand/supply balance. Coal representative asked how much the farmer would pay for them taking the manure. The general feeling was that there wasn't an opportunity to partner between horse owners and coal company reclamation. It was suggested that perhaps the manure could be composted, bagged and sold but some questioned the market opportunity in this rural watershed.

VA BMP Manual IX-1 Need to double check on if horses are eligible or not?

May contact Jon Rockett?

After the meeting Joey O'Quinn wrote that livestock manure has not been used as a soil amendment in reclaimed mined lands due to steep slopes that the industry indicated.

Knox Creek

Coal company representatives asked if they were going to be prevented from future mining permits because of the TMDL. Joey O'Quinn stated that DMME is already looking at loading for new permits in TMDL watersheds. Joey discussed re-mining as an option to reduce abandoned mine lands contribution to TDS and TSS in the streams. He was asked what incentives DMME offers to re-mine and what funding opportunities for AML reclamation are available. Joey commented that the funding was not readily available and that is why re-mining is encouraged.

DISCUSSION OF TABLES 1 AND 2 – SCENARIOS TO REDUCE POLLUTANTS: Stakeholders asked why forestry/logging contributions were not a line item in the tables. Nancy said that the forest contributions were included in modeling. Logging activities were discussed. Stakeholders felt that they contribute a large sediment load to the streams that should be reduced if the coal companies reduce their sedimentation. The BMPs on logging jobs are voluntary, Theresa noted and Nancy disagreed. *After the meeting Nancy contacted VDOF and discussed the BMP issue with Forester Brad Carico. DOF requires notification of all logging jobs and they inspect all logging jobs. Although BMPs are voluntary (as Theresa indicated), Code of Virginia 10.1-1180.2, says that there is zero tolerance for sedimentation. That means that during an inspection, if the forester finds sedimentation problems or the potential to likely cause sedimentation, the logger is issued a water quality correction recommendation with 10 days to address. In the case of logging jobs on permitted mining sites, Mr. Carico said that the DMME permits have E&S structures in place before the logging begins and that the DMME inspector also enforces E&S activities. DOF will meet with us at the next Industrial Working Group meeting tentatively scheduled for August 10, 2006.*

We discussed the responsible party when logging occurs. Nancy mentioned that The Forest Land Group told her they do not employ/lease to loggers without expressing best management practices employed on their lands. The participants said that since mining leases were for coal they did not own forest and the land owner was hiring the loggers.

Gas well contributions were not a line item in the reduction scenarios either and the stakeholders think the Gas Wells need to be included. Participants said that gas wells are not regulated as hard as mining. Roads are left open and the well has to be maintained as an active site for up to 30 years. There are about 200 gas wells in Buchanan County that are not affecting the watershed. Question was raised about the BMPs required on roads to a gas well. Nancy had a map with the Gas wells on it and since it was difficult to see each well, she told participants that she will send them a map of the gas well sites in order that everyone has an idea of the severity of the problems. Stakeholders recommended that MapTech model the sediment loads with the gas wells sites.

After the meeting, Nancy contacted DMME Division of Gas Wells and spoke with Lydia Sinemus about the program. She said that Gas well construction sites are inspected monthly. The Division has tentatively agreed to meet with us to discuss possible implementation strategies for Gas Well installation within TMDL watersheds. They have been invited to the August 10 stakeholder meeting.

TARGETS: The group was asked if reduction of 1882 acres of AML in Knox Creek by 2009 was a reasonable goal. Wellmore currently has about 100 acres mining in the watershed. They plan to surface mine in the future however. Otis Mullins said that TECO has 3 permits with about 600 acres. It takes several years to completely reclaim mining lands so 2009 is not a realistic target for 1882 acres when none of the people at the meeting could even come up with 1800 acres permitted and active in the watershed. One suggestion was to target the reclamation in terms of % per year instead of all the 1800+ acres being completely reclaimed by 2009 as table 4 proposed.

After the meeting Joey O'Quinn surveyed current operations regarding remining and wrote: "Approximately 80% of active coal surface mining operations in southwestern Virginia include re-mining of abandoned mine lands. If new surface mining operations are proposed for the Knox Creek watershed, those operations will very likely eliminate some AML features." He further wrote, "Current DMME/DMLR issued SCMRA permits in Knox Creek watershed are held by the Rapoca (Wellmore) Group or by Clintwood Elkhorn Mining Company."

The E&S program in Buchanan County was discussed as well. Anthony Justus with Big Sandy SWCD said Big Sandy has erosion and sediment control oversight for the county building permits.

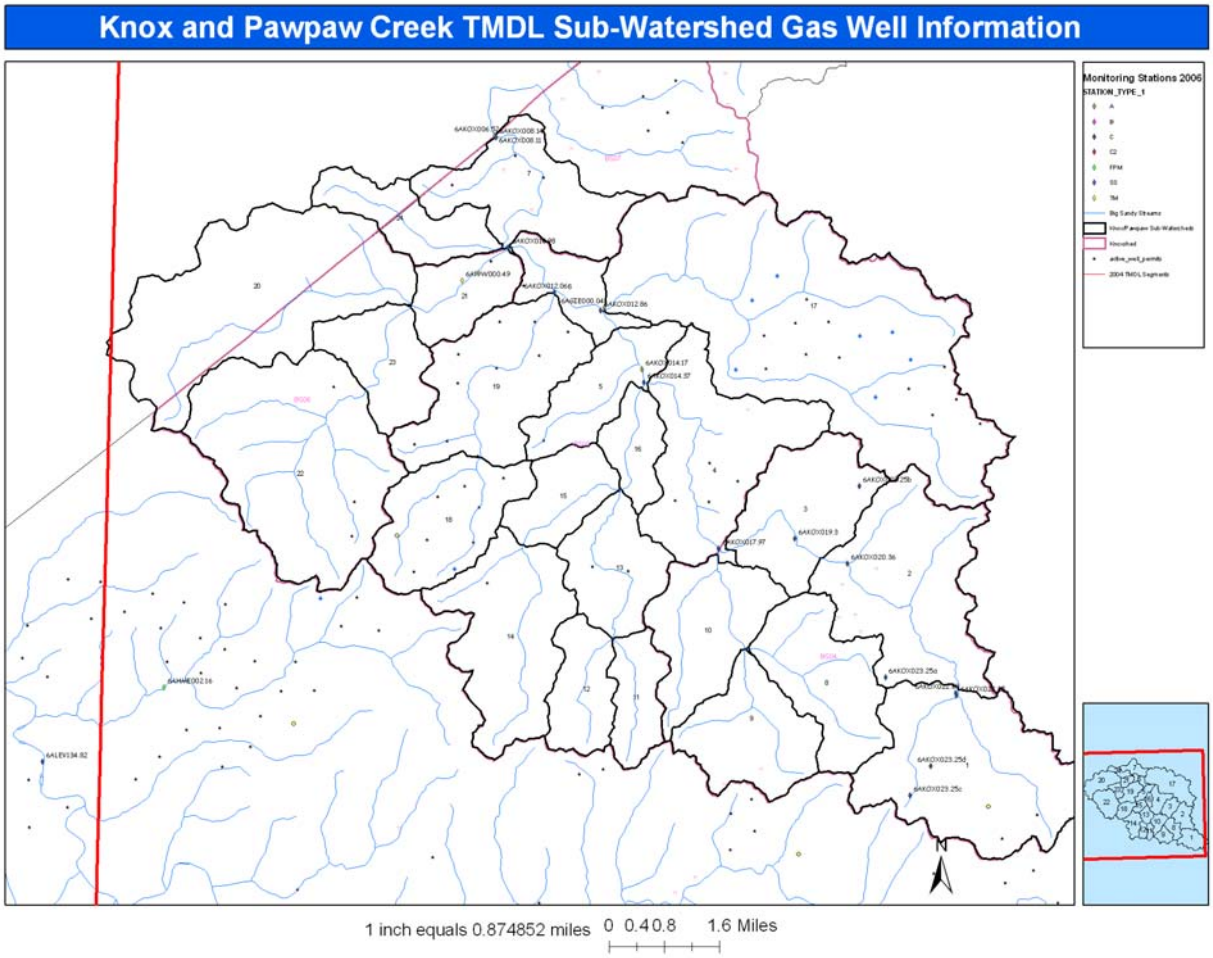
Gruber said that a recent TVA study on trees on stream banks says they cause flooding. Gruber is going to find that citation and send it to Nancy.

There was some discussion of stream mitigation funding and the possibility that the Trust Fund could be used to do some stream bank stabilization in the watershed. The Nature Conservancy manages this fund for USCOE.

Can we determine how many acres are active verses AML?

Tentatively Nancy planned to have one more Steering Committee Meeting and then a public meeting after the draft implementation plan was completed and reviewed by all the working groups. After the discussions about other industries were raised, it appeared that another Working Group meeting was probably necessary. It was tentatively scheduled for August 10 at 10 am somewhere in Grundy such as Law School, SVCC, Library or Comfort Inn. The next steering committee date was tentatively set as Aug 14th .

Nancy will finalize the next meeting date and place and send the information to all the stakeholders for a third industrial working group meeting with Gas, Coal and Logging representatives.


Knox and Pawpaw Creek TMDL Sub-Watershed Gas Well Information
Monitoring Stations 2006
1 inch equals 0.874852 miles
0 0.4 0.8 1.6 Miles

Summary Knox and Pawpaw Creek

2nd Residential Working Group Meeting

July 10, 2006

Residential Participants:

Nancy Norton
Theresa Carter
Edna Justus
Harold Vance
Tara Scarberry
Andrea Estep

Harold Vance said that DEQ needed to measure the water quality in the headwaters where watershed folks are hauling water from. One time sample to determine if the water is safe to drink for the folks that are hauling water.

There is a need to find funding sources in order to start implementing the septic systems repairs or installations. VDH may require O&M on home septic systems in future legislation. There are still a number of systems in the floodplain.

TARGETING: The group looked at the prioritized list targeted for repairs in terms of reducing bacteria counts. The following comments concern their knowledge of each sub-watershed. Big Sandy SWCD got a EQIP grant for a 4 house cluster at Darwin Bailey's land. WQIA Knox Creek Restoration Project needs to be in the IP. Participants noted that Subwatershed 1 up to Dan Branch has no houses and wondered why it had the highest priority.

First house on Dan Branch (Cluster 8 or 10)

They noted there are 5 houses with standing water at Bakertown.

Toms Branch couple of houses

Subwatershed 4 ok

Subwatershed 5 ok

Subwatershed 2 just a few

Subwatershed 3 Cane Branch (Long Branch) 10 houses

Pounding Mill a lot of houses

Devils Branch is all mining; no houses

Subwatershed 17 has a number of houses

Subwatershed 10 Straight Fork a lot of houses; heavily popoulated

Blackey's Fork (Bolrd Camp) Charles Fork (Right Fork is 9 Harm Fork)

Subwatershed 22 Hunt's Fork lots of houses (10-15 houses in a row as you come into Punching Camp)

Subwatershed 20 Assistance from KY

Subwatershed 18 very few houses if any

Lots of clusters of houses that would work for decentralized systems. It was suggested that a survey of septic systems permitted in the Knox Watershed is necessary. Maybe work with Big Sandy SWCD on developing through the WQIA project.

People are throwing animal (dog and horse) waste in the stream. Mr. Vance said that bacteria contributions are not a wildlife issue now.

After the flood of 2002, when VDOT repaired the roads, they stabilized the stream banks. For streambank stabilization in the implementation plan, perhaps VDOT will be a partner. Check with Conrad Hill with the county DOT.

POLITICAL CONSIDERATIONS: There will be new Board of Supervisors after the elections in 2007. There may be a change in sewer situation after this election. The Board of Supervisors meet 1st Monday every month. If DEQ or DCR want to bring the IP issues before the board, Mr. Vance and Edna Justus volunteered to come to the board meeting to discuss grant money needs to correct the sewage issues.

Summary Knox and Pawpaw Creek

2nd Government Working Group Meeting

July 10, 2006

Government Participants:

Joey O'Quinn, DMME
Brian Stanley, VDH
Rhonda Sluss, VDH
Edna Justus, BSSWCD
Blaine Delaney, Black Diamond RC&D
Theresa Carter, DCR
Nancy Norton, DEQ
Wade McNeely, BSSWCD

- Nancy reviewed status TMDL, the Knox and Pawpaw Creek TMDL Studies have been completed and are next going to EPA for approval. It is anticipated that the Implementation Plan will be completed after EPA has approved the TMDL Report.
- Waste Management Facility: Horse Manure may be a source of bacteria in the watershed and Bill Keith with NRCS told Nancy Norton by telephone that the horse sites do not qualify for Best Management Practice funding opportunities. However treatment could be composting the waste in a storage facility built to serve the entire watershed. The question was raised as to whether the owners would be willing to transport the manure and if there could be a demonstration project. Participants indicated that use of compost on mining reclamation in the watershed would not be feasible because of steep slope and compost application issues. There is a need to discuss further with DMME and with Bill Keith to determine if there are any opportunities to minimize or reuse the animal waste. Another participant indicated that the waste is already used as garden compost/fertilizer in some places. Briefly we touched on the educational aspect of proper waste management, soil testing etc. This should be addressed as an education component.

  What are the requirements of Land Application of waste? Who regulates the manure or the transportation of the manure? Joey O'Quinn said that DMME doesn't regulate compost, DEQ would not regulate horse manure as compost, and VDH does not regulate either. Would it be possible to put a manure facility in both watersheds? Edna emphasized that there is VERY LITTLE AG in both watersheds.
- Streambank Restoration: We looked at the cost figure in the handout for Streambank restoration. Everyone thought the number is too high and need a better number for unit cost.

- Sewer Systems Installed: Brian Stanley and Rhonda Sluss noted that there should be more sewage treatment units in the watershed than represented in the hand out tables. They estimated that more than 60 new homes were built with new septic systems since the flood in 2002. Edna said that the Cumberland Plateau PDC did not put in a new septic system for each new house. She wants to build a database of all the permitted septic systems in the watershed. We could add this as an item in the Implementation plan. Brian said that VDH tracks permits by note cards now so the information isn't readily available. Patricia Gray at Cumberland Plateau PDC may have a more accurate count of the systems/houses installed after the flood in 2002.
- Sewer System Costs: Traditional septic system cost should be $6000. Brian said that the failure assumption requiring alternative systems should be 50% and not 5-10% in both watersheds. He said that the $11,300 cost for alternative system is a good estimate even in the cluster system situations that added each home together would cover the cost of the cluster systems.
- Funding: How much funding has been allocated to SR verses Bay for the 319 funds, WQIA, State Cost share. Question from Wade McNeely) Blaine asked about funds for education in the IP. Not quite sure what the $900 targets in the table.
- Verify active and abandoned mine lands estimates of acres and then re-word Table 2A as Reclamation of Abandoned mine lands by active mining. Is 2,751 acres accurate? Verify acres AML not targeted as active.
- Get the PSA director to the table regarding WWTP in Hurley. The Hurley High School for example has 7 houses which could be connected to the plant.
- Check the livestock exclusions, 83 on 432 acres. Is this accurate. Change the titles of practices SL-6 or WP-2T because this implies the landowner would qualify for funding to pay for these practices. SL-6 numbers way to high according to Edna, FSA said that there are 572 farmers in the entire county.
- Blaine asked if the IP clock begins ticking does it effect the hired person's timeframe. That needs to be defined within the IP report. RC&D would like to have separate tables for the straight pipes, urban practices, etc. to keep up with the work that is being accomplished.
- The participants asked about bacteria numbers since the 2002 flood. From tables in the TMDL study, the bacteria samples were collected after the flood. Brian asked if the monitoring could look at another parameter that would indicate that straight pipes were being eliminated like nutrients, optical brightners and the need for more stations were discussed. Consensus was that two additional stations sampling for bacteria or other parameters would seem to meet the needs. For future alternative systems O&M needs to be addressed…what is the language in permit handling?
- It was suggested that we could make contact with horse owners through horse shows, 4H contacts at High School or other places frequented to educate about the

water quality concerns in livestock waste disposal. Possible club membership should be explored. Double check on horse specifications within the State Cost share program. Probably need to replace conservation tillage with cover crops…possibly of demonstration projects with horses…education.

Summary Knox and Pawpaw Creek

3rd Industrial Working Group Meeting

August 10, 2006

Industrial Participants:

Joey O'Quinn-DMME-DMLR 276 523 8151
Otis Mullins-TECo 606 835 3222
Mike Edwards-Alpha 276 679 6078
John Paul Jones-Alpha 276 619 4443
David Gruber-BMI 540 953 2821
Lydia Sinemus-DMME-DGO 276 676 5423
Brad Carico – VDOF 276 676 5488
Nancy Norton – DEQ 276 676 4807

Introductions were made and then Nancy began the meeting.

1. Gas Well BMP's - Lydia Sinemus with the Division of Gas and Oil answered questions and described the requirements that are associated with gas well development. In this area, the gas wells are conventional wells with site restrictions of 2500' between wells. Inspections are made before the site is active, during site construction, during drilling, and once per month after vegetation and site stabilization occurs. Once site stabilization is successful, inspection frequency may drop to 1/yr. Some of the items that inspectors look for during a site visit is proper E&S controls in place and that culverts are adequate, outslopes are stablilized and sumps are maintained. If drillers go out of business, then sites are plugged by DGO. Now, gas companies are required to have bonds that will be held to insure plugging and site contours are reestablished after wells are closed. Drillers are required to close sites by putting in the original contours and stabilize the site for 2 years. Virginia does not allow any production fluids from the well to be released to streams. All production fluids are managed through direct injection wells permitted by EPA. The only other on-site fluid is the water used during well drilling. This water may be applied to roads if it meets certain effluent limits. The average well disturbs about ½ acre. CNR is one of the larger companies controlling gas in Knox watershed. They use existing coal roads. Lydia reported that it looks like there are 24 plugged wells, 60 active wells and 9 or 10 permits where the wells haven't been drilled yet.

2. Forestry BMP's - Brad Carico answered questions about Forestry requirements and laws related to logging. There are approximately 60 harvests in Buchanan County per year. This is estimated based on the notification that is required for all jobs. The Department of Forestry inspects each job. Their goal is to inspect 85 to 90% of all notifications within 15 days and they may inspect before, during logging and make a final inspection. Forestry inspectors finding sedimentation or conditions likely to cause sedimentation will issue a water quality correction recommendation to correct the situation. After the job is complete, the DOF has no further jurisdiction. Brad noted that

sometimes the landowner may alter the best management practices left in place to prevent sedimentation. This does not seem to fall in any agencies jurisdiction. This seems the ideal opportunity for landowner education. DOF provides logger certification and workshops but reaching the landowner is not necessarily accomplished through this educational activity. The average size of a logging operation is probably 30 acres, Brad estimated, but cautioned that he would need to look into the files to verify that. Brad also noted that there is very little bare soil on logging projects and that they are not usually located in close proximity to the streams.

3. Status of DMME Mitigation Credit for AML Reclamation - Joey O'Quinn discussed the Royal City Refuse Project in terms of an additional way to encourage AML reclamation by Mining Companies. DMME has hired Terra Tech to propose a way to determine stream mitigation credits for sedimentation corrections at AML sites. TECo is cooperating/participating in this study. The Corps of Engineers – Norfolk district has indicated a willingness to entertain the concepts and review will probably be forthcoming in the next several weeks.

4. Milestone Portrayal - Nancy handed out a draft graph that shows the % BMP installation in 3 phases with associated water quality improvement. The graph and tables were discussed and participants were encouraged to contact Nancy if they had comments. Under the Industrial milestones in the table, the title "Reclamation of Active and Abandoned Mine Lands" seemed to imply that Active mining operations were required to reclaim AML. It is recommended that the title be clarified. "Endpoint Violations" as the title for the recovery line items was questioned. We wondered if there was a better way to label this section.

5. Other Comments - Otis Mullins said that after reviewing the permit activity in the watershed he found that TECo has about 3000 acres permitted with less that 1000 acres disturbed currently.

Gruber asked that the participant sign in sheet be included in minutes. Since the names are included, Nancy will add telephone contact information in the future. Email access should be available by using the email list from meeting notifications. If anyone has problems with contacts, please let Nancy know.

Nancy has scheduled one more Steering Committee Meeting for Monday, August 14 at 10 am in Hurley at the Soil and Water Conservation District offices. As soon as MapTech provides a draft Implementation Plan Report, it will be forwarded to all stakeholders and if the working groups want to have additional meetings then we will plan them as requested. Once the working groups are satisfied or concur with the report, a final public meeting will be scheduled to present the IP findings to the watershed landowners and stakeholders. After a 30 day public comment period, the IP would be submitted to the State Water Control Board for approval. Now we are looking for these final steps to occur this fall.

Knox Creek and Paw Paw Creek TMDL Implementation Plan Development

3rd Steering Committee Meeting

August 15, 2006

Meeting Attendees:

Megan Laird, MapTech, Inc.
Nancy Norton, Virginia Department of Environmental Quality (DEQ)
Edna Justus, Big Sandy Soil and Water Conservation District
Harold Vance
Theresa Carter, Virginia Department Conservation and Recreation (DCR)
Anthony Justus, Big Sandy Soil and Water Conservation District
Blaine Delaney, Black Diamond RC&D
Otis Mullins, TECO Energy

Introductions

TMDL Status Update

TMDL Study has been submitted to EPA, approximately 3 weeks ago and we are waiting for EPA comments.

Scenarios for consideration

Megan Laird provided a handout for Steering Committee comment.

- **Gas Well Data** - Comments were made that some of the gas well roads are much wider than 15 feet and there is one 2 mile long road. After discussion of the potential for additional build out it seemed that ½ mile may be reasonable. Megan will look at the contributions based on the increase in well development over 2004 and 2005. Public Relation efforts need to be focused on gas wells so that the public understands that each land use has sedimentation reduction practices in place. In an appendix to the IP spell out BMP expectations for each industry.

- **Forestry -** The committee indicated that there is a need for outreach and education of landowners who may harvest in the watershed. The Sharp Logger program was discussed as a method to educate loggers in the watershed.

- **AML** - Megan pointed out that Knox Creek AML value 2,085 acres is not consistent on page 4 handout Table. She will correct. The Coalfield Expressway is going to be along the ridge in Knox Creek between Grundy and the state line. Megan should look at the R-O-W and see if there is an opportunity to reclaim AML in Knox Creek due to the project. It could be the first acres corrected without

seeking outside funding. Megan explained that stream buffers were calculated by multiplying the amount of stream on the AML feature by 35'wide buffer by 2 stream banks and then by a conversion factor to equal acres of buffer. There are AML sites in Kentucky and will those be corrected? Megan said that reductions were calculated only in Virginia and that they could be achieved, however KY has been a positive participant so it is hoped that sedimentation can also be reduced in the headwaters of Pawpaw in KY.

- **Active Mine Operations** - TECo has about $10-15 million/year indirect effect in the watershed economy. The reductions are currently tied to remining the AML features without reductions to permit discharges. It appears that there is movement to look at AML reclamation in terms of stream mitigation credits. Otis Mullins said that this option would make reclamation much more attractive to coal companies in the watershed. The concept was discussed in the Industrial Working Group meeting last Thursday.

- **Possible Final Scenarios** - Megan explained the 22 acres of AML vegetated buffers and indicated that the active mine site references would be removed since the reductions are aimed at AML and not active mining jobs. Manure incorporation on cropland was discussed as being a problem if the slopes are steep, however Harold Vance indicated that at one time there were 350 cows on a mine bench that were starving. The cattle have been removed but there are some flat spots that could benefit from manure spreading. Megan noted that infiltration trenches on pasture are the bottom of the tool kit of BMPs in terms of application. These are used after all easier and less expensive BMPs are put in place and the reductions have not been met. Education is a critical component of land use changes to reduce sedimentation and bacteria.

- **Possible Final Scenarios Table** – Blaine Delaney noted that the cost of septic system repairs should be increased from $3000. This was discussed at the last meeting as being too low. The 89% reduction in livestock fencing is not feasible. Big Sandy has only had 4 participants in the entire county in the past 2 years so this is very hard to find in the watershed. Megan indicated that she could increase vegetated buffers instead of targeting 84 BMP systems in agriculture land use.

- **Milestones** - Pet waste management was discussed and Blaine Delaney recommended it be used in year 7 instead of the first because of the possible reception by landowners. Others insisted that pet waste management be introduced in the beginning as a practice to reduce bacteria. By the 7th year, the pet waste management should be emphasized if reductions are not being met. Straight pipe corrections are targeted for 20% per year for 5 years so that all straight pipes are corrected by the 5th year; however the stakeholders recommended starting at 10% per year and AML corrections begin in the 4th year.

- **Table 2 Example milestones** - Megan will remove the active mine reference in Industrial milestones to clarify that AML is the target and not active mining.

Issues Discussed:

Education is a critical component of the implementation plan. Black Diamond RC & D will work with Big Sandy SWCD to address this. Harold Vance noted that the DOF doesn't hand out the information to lower grades any more. That is one outreach form that should be reinstated. The younger students may have a greater influence on their parents than older students. Flyers that mention Gas Well and Logging BMPs in the TMDL watershed were also discussed.

Next Meeting:

The next meeting is tentatively planned for late September with the public after the implementation plan is drafted and circulated to the working groups and the steering committee first.

APPENDIX B

Streamside Fencing Ground Truth Results from the Big Sandy Soil and Water Conservation District Staff

Table B.1 Ground truth results of the original streamside fencing estimates.

ID	Stream	Latitude	Longitude	Streambank	BSSWCD Observations
0	Pawpaw mainstem	37.445533	-82.061989	Right	Woodlot
1	Pawpaw mainstem	37.446219	-82.060274	Right	Woodlot
2	Pawpaw mainstem	37.444806	-82.063298	Right	Woodlot
3	Pawpaw mainstem	37.443683	-82.065361	Right	Woodlot
4	Mill Creek	37.447231	-82.060898	Left	Woodlot
5	Trib to Pawpaw near Kelsa	37.440447	-82.05816	Right	Woodlot
6	Left Fork Pawpaw	37.432532	-82.086861	Right	Residential
7	Left Fork Pawpaw	37.424704	-82.089134	Right	Residential
8	Left Fork Pawpaw	37.413343	-82.102046	Right	Residential
9	Puncheon Camp Trib Pawpaw	37.40526	-82.110622	Right	Residential
10	Abners Fork Pawpaw	37.404802	-82.102506	Left	Residential
11	Headwater Trib Pawpaw	37.38505	-82.108503	Right	Residential
13	Knox mainstem	37.416917	-82.013064	Right	Residential
14	Knox mainstem	37.416345	-82.012684	Right	Residential
15	Knox mainstem	37.411088	-82.006539	Right	Residential
16	Knox mainstem	37.407737	-82.007612	Right	Residential
17	Knox mainstem	37.400698	-82.008006	Right	Residential
18	Knox mainstem	37.397726	-82.008199	Right	Residential
19	Knox mainstem	37.397451	-82.00773	Right	Residential
20	Knox mainstem	37.397233	-82.007192	Right	Residential
21	Knox mainstem	37.39354	-82.006004	Right	Pasture/Estimated: 750ft stream fencing
22	Knox mainstem	37.386129	-82.000485	Right	Pasture/Estimated: 900ft stream fencing
23	Knox mainstem	37.384912	-81.997499	Left	Residential/Woodlot
24	Knox mainstem	37.392444	-81.986875	Left	Residential
25	Knox mainstem	37.393026	-81.985846	Left	Residential
26	Knox mainstem	37.390063	-81.980665	Right	Residential
27	Knox mainstem	37.38796	-81.979203	Left	Residential

Table B.2 Ground truth results of the original streamside fencing estimates (cont.).

ID	Stream	Latitude	Longitude	Streambank	BSSWCD Observations
28	Knox mainstem	37.387273	-81.979572	Right	Residential
29	Knox mainstem	37.375024	-81.949365	Left	Residential
30	Knox mainstem	37.372814	-81.948802	Right	Residential
31	Guess Fork	37.439482	-82.024625	Right	Residential/Pasture estimated: 250ft stream fencing
32	Guess Fork	37.427528	-81.99799	Right	Residential
33	Guess Fork	37.425158	-81.999588	Right	Residential/Business (garage, junkyard)
34	Guess Fork	37.414751	-81.960814	Left	Residential
35	Trib to Guess Fork	37.409977	-81.958798	Right	Residential
36	Trib to Guess Fork	37.420302	-81.964417	Right	Residential
37	Trib to Guess Fork	37.42049	-81.964577	Left	Residential
38	Trib to Guess Fork	37.4201	-81.964787	Left	Residential
39	Trib to Guess Fork	37.426261	-81.977626	Left	Residential
40	Trib to Guess Fork	37.429191	-81.975619	Left	Residential
41	Trib to Guess Fork	37.430672	-81.975005	Left	Woods
42	Trib to Guess Fork	37.444548	-82.004463	Left	Woods
43	Trib to Guess Fork	37.439233	-82.02789	Left	Woods
44	Trib to Guess Fork	37.440981	-82.02894	Left	Residential
45	Trib to Guess Fork	37.447643	-82.023425	Right	Woods
46	Trib to Guess Fork	37.447631	-82.023747	Left	Woods
47	Left Fork Guess Fork	37.43976	-81.958387	Right	Residential/Woodlot
48	Left Fork Guess Fork	37.440096	-81.960123	Right	Residential/Woodlot
49	Left Fork Guess Fork	37.43682	-81.988294	Left	Residential/Business (Car dealership)
50	Trib to Left Fork Guess Fork	37.443529	-81.979541	Left	Residential
51	Trib to Left Fork Guess Fork	37.433043	-81.958308	Left	Woods
52	Trib to Left Fork Guess Fork	37.433017	-81.958643	Right	Woods
53	Trib to Left Fork Guess Fork	37.443359	-81.979323	Right	Residential
54	Trib to Left Fork Guess Fork	37.442286	-81.980008	Left	Residential/Pasture estimated: 100ft stream fencing

Table B.3 Ground truth results of the original streamside fencing estimates (cont.).

ID	Stream	Latitude	Longitude	Streambank	BSSWCD Observations
55	Pounding Mill	37.423993	-82.023342	Right	Residential
56	Race Fork	37.425986	-82.052536	Right	Residential
57	Pounding Mill	37.423042	-82.025684	Right	Residential/Business (Mining belt supply shop)/Woodlot
58	Pounding Mill	37.420806	-82.027944	Right	Woods
59	Pounding Mill	37.420178	-82.028148	Left	Woods
60	Pounding Mill	37.420091	-82.028401	Fork of 2 streams	Woods
61	Pounding Mill	37.419787	-82.028354	Right	Woods
62	Pounding Mill	37.41567	-82.031076	Right	Woods
63	Pounding Mill	37.413325	-82.036071	Right	Woods
64	Pounding Mill	37.412888	-82.041536	Right	Woods
65	Left Fork Lester Fork	37.394248	-82.027687	Right	Residential
66	Left Fork Lester Fork	37.391906	-82.02844	Right	Residential
67	Left Fork Lester Fork	37.390082	-82.03009	Right	Grassy lot
68	Left Fork Lester Fork	37.38184	-82.032415	Right	Horse pasture estimated: 200ft stream fencing
69	Left Fork Lester Fork	37.362387	-82.032127	Right	Woods
70	Left Fork Lester Fork	37.361981	-82.032058	Left	Woods
71	Left Fork Lester Fork	37.359682	-82.033828	Right	Woods
72	Left Fork Lester Fork	37.353121	-82.03537	Left	Residential
73	Brushy Fork Left Fork Lester Fork	37.36258	-82.023546	Right	Residential
74	Brushy Fork Left Fork Lester Fork	37.362194	-82.023181	Right	Residential
75	Brushy Fork Left Fork Lester Fork	37.355449	-82.02061	Left	Residential
76	Brushy Fork Left Fork Lester Fork	37.354348	-82.020743	Right	Residential
77	Brushy Fork Left Fork Lester Fork	37.353384	-82.020667	Right	Residential
78	Brushy Fork Left Fork Lester Fork	37.350088	-82.020325	Right	Residential/Pasture estimated: 1,500ft stream fencing
79	Straight Fork	37.379237	-82.004039	Right	Residential/Pasture estimated: 100ft stream fencing

Table B.4 Ground truth results of the original streamside fencing estimates (cont.).

ID	Stream	Latitude	Longitude	Streambank	BSSWCD Observations
80	Right Fork	37.365923	-81.992991	Right	Residential/Pasture estimated: 50ft stream fencing
81	Right Fork	37.364729	-81.992096	Right	Residential
82	Right Fork	37.36029	-81.99151	Right	Residential
83	Right Fork	37.358828	-81.991303	Left	Residential
84	Right Fork	37.357932	-81.991519	Right	Residential
85	Right Fork	37.354613	-81.989705	Right	Residential
86	Headwaters Right Fork	37.338569	-81.98112	Left	Residential
87	Headwaters Right Fork	37.338651	-81.98139	Right	Residential
88	Headwaters Right Fork	37.336203	-81.982126	Right	Residential/Pasture estimated: 100ft stream fencing
89	Headwaters Right Fork	37.337067	-81.997924	Right	Residential
90	UT Blackey Fork Straight Fork	37.372301	-81.975774	Left	Woodlot
91	UT Blackey Fork Straight Fork	37.363562	-81.964111	Left	Residential
92	UT Blackey Fork Straight Fork	37.365615	-81.96005	Left	Residential
93	Blackey Fork Straight Fork	37.355547	-81.974496	Left	Residential
94	Blackey Fork Straight Fork	37.355287	-81.974664	Right	Residential
95	Blackey Fork Straight Fork	37.355052	-81.97403	Left	Residential
96	Blackey Fork Straight Fork	37.355011	-81.974333	Right	Residential
97	UT Blackey Fork Straight Fork	37.355666	-81.960604	Left	Potential pasture (could not physically drive to point)
98	UT Blackey Fork Straight Fork	37.355279	-81.960453	Right	Potential pasture (could not physically drive to point)
99	UT Knox mainstem	37.390993	-81.970133	Left	Woodlot
100	UT Knox mainstem	37.402425	-81.974929	Left	Residential/Woods
101	UT Knox mainstem	37.413191	-82.005962	Left	Residential
102	UT Knox mainstem	37.4131	-82.005705	Right	Residential
103	UT Knox mainstem	37.400707	-81.980604	Right	Residential /Woods
104	UT Knox mainstem	37.400593	-81.980937	Left	Residential /Woods

Table B.5 Ground truth results of the original streamside fencing estimates (cont.).

ID	Stream	Latitude	Longitude	Streambank	BSSWCD Observations
105	UT Knox mainstem	37.420155	-82.007848	Right	Potential pasture (could not physically drive to point)
106	UT Knox mainstem	37.391266	-81.969758	Right	Potential pasture (could not physically drive to point)
107	Headwaters Lester Fork	37.353653	-82.049851	Right	Residential
108	Headwaters Lester Fork	37.353807	-82.049683	Left	Residential
109	Headwaters Lester Fork	37.349924	-82.048824	Fork of 2 streams	Residential
110	UT Knox mainstem	37.376717	-81.9562	Right	Residential
111	UT Knox mainstem	37.385985	-81.943613	Left	Residential/Woods
112	UT Knox mainstem	37.388963	-81.940389	Right	Residential
113	UT Knox mainstem	37.388919	-81.941021	Left	Residential
114	UT Knox mainstem	37.395319	-81.968096	Left	Potential pasture (could not physically drive to point)
115	UT Knox mainstem	37.420299	-82.008385	Left	Potential pasture (could not physically drive to point)
116	UT Knox mainstem	37.39239	-82.01643	Right	Potential pasture (could not physically drive to point)
117	Headwaters Lester Fork	37.350345	-82.049042	Right	Residential