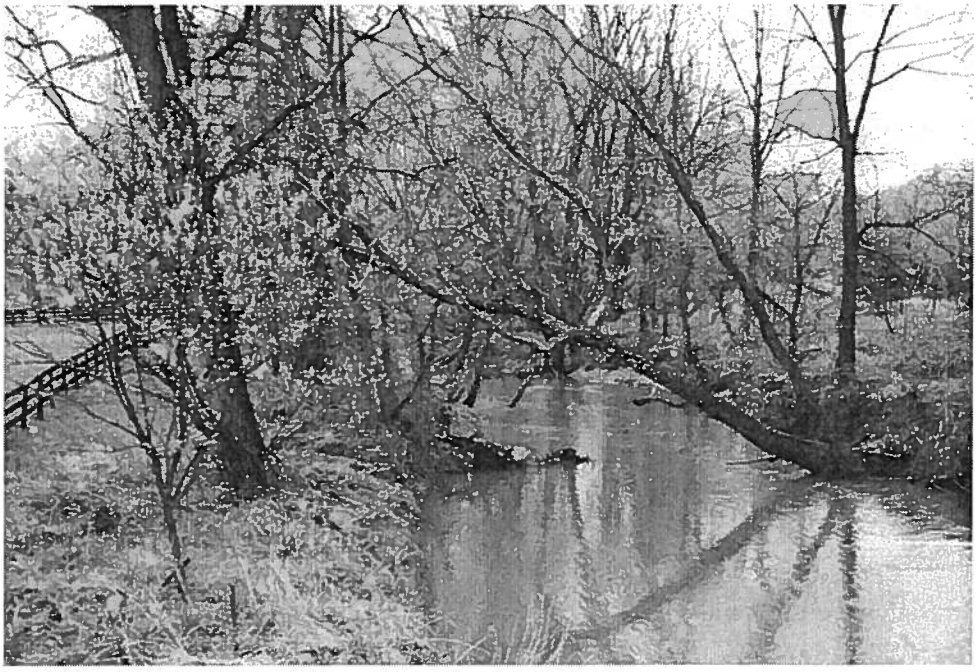
A Total Maximum Daily Load Implementation Plan For Fecal Coliform



Submitted to
The Stakeholders of
Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek Watersheds

On Behalf of
The Commonwealth of Virginia:
Department of Conservation and Recreation

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Portions of Catoctin Creek, North Fork Catoctin Creek, and South Fork Catoctin Creek were listed as impaired on Virginia's 1998 Section 303(d) Total Maximum Daily Load Priority List and Report (VADEQ, 1998) due to violations of the state's water quality standard for fecal coliform at three monitoring stations. The Upper South Fork Catoctin Creek was added to the 2002 303(d) Report on Impaired Waters based on monitoring at upstream stations. The segment length was extended from the 1998 303(d) listing to account for upstream special study monitoring stations on the South Fork Catoctin Creek. These streams do not support primary contact recreation (*e.g.,* swimming, wading, and fishing). These streams violated the instantaneous standard (*i.e.,* more than 1,000 colony forming units (cfu) / 100 milliliters (ml) in any sample) more than 10% of the time. As a result of the listings and court actions taken against the United States Environmental Protection Agency (EPA), a total maximum daily load (TMDL) report was developed (MapTech, 2002), which established the reduction in loads needed to restore these waters. Virginia law requires that a plan be implemented to achieve fully supporting status for impaired waters. In fulfilling the state's requirement for the development of a Total Maximum Daily Load (TMDL) Implementation Plan (IP), a framework was established for reducing fecal coliform (FC) levels to achieve the water quality goals for the impaired stream segments in the Catoctin Creek watershed for which TMDL allocations were developed.

Review of TMDL Development

MapTech, Inc., a privately held environmental engineering firm, developed TMDL reports for the Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, which were consequently approved by United States Environmental Protection Agency in 2002. Modeling conducted in support of the TMDL report considered fecal coliform loads in runoff resulting from wildlife (*i.e.,* deer, raccoon, muskrat, beaver, turkey, goose, duck), livestock (*i.e.,* beef, dairy, sheep, goat, horse, and swine), and residential (*i.e.,* failing septic systems, dogs, and cats) sources. Direct loads to the stream that were modeled included direct deposition from cattle and wildlife, septic system lateral flow, uncontrolled discharges, and permitted sources. The geometric mean standard was used as the water quality endpoint because

modeling produces results at regular time intervals (*e.g.,* 15 minute). At the time the TMDL report was developed, the geometric mean standard in Virginia required that, if two or more samples are available during any 30-day period, the geometric mean of those samples should not exceed 200 cfu/100 ml. The TMDL results dictate that all uncontrolled discharges must be identified and corrected, all livestock must be excluded from streams, and a majority of the direct deposition from wildlife must be reduced. Implicit in this requirement for 100% correction of uncontrolled discharges is the need to maintain all functional septic systems. Reductions required for wildlife direct deposition were 91%, 93%, 25%, and 85% in the Upper South Fork Catoctin Creek, South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek watersheds, respectively. Wildlife direct deposition will not be explicitly addressed by this implementation plan. All efforts will be directed at controlling anthropogenic sources.

Public Participation

The actions and commitments described in this document are drawn together through input from citizens living in the watersheds, the Loudoun County government, Loudoun Soil and Water Conservation District (LSWCD), Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Environmental Quality (VADEQ), Virginia Department of Health (VDH), Virginia Cooperative Extension (VCE), Natural Resources Conservation Service (NRCS), Virginia Department of Forestry (VDOF), Environmental Protection Agency (EPA), and MapTech, Inc. to form the Upper South Fork Catoctin Creek, South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek Total Maximum Daily Load (TMDL) Implementation Plan (IP). Every citizen and interested organizations in the watersheds are encouraged to become involved in this initiative to contribute to the restoration of these streams.

Public participation was encouraged through public meetings, focus groups, and a steering committee. Public meetings were conducted to distribute information, gain feedback, and solicit participation in the smaller forums (*i.e.,* focus groups and steering committee). The focus groups were comprised of stakeholders with similar concerns (*e.g.,* agricultural and governmental). Representatives from each focus group participated in the steering committee, where input from the focus groups was reviewed and decisions about the IP were made. Within this framework, public input was considered on the

general attitude of residents affected by the plan, technical assistance and educational needs during implementation, funding needs, and availability. Varied opinions were voiced throughout the public participation 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 among the citizens in the watershed and government agencies in order to reduce fecal bacteria pollution.

Assessment of Implementation Action Needs

The quantity of control measures required during implementation was determined through spatial analyses of land use, taxed use, zoning, stream network, and elevation, along with data archived from the VADCR Agricultural Best Management Practice (BMP) Database and TMDL development documents, as well as some field inspections. The map layers and archived data were combined to establish high and low estimates of number of control measures required overall, in each watershed, and in each subwatershed. Additionally, input from agency representatives and working groups were used to verify the analyses. Overall, the following needs for the 5-year implementation period were identified:

83	Livestock Exclusion Systems (SL-6)
43	Horse Exclusion Systems (WP-2)
76	Hardened Crossings
10	Septic System Installations
10	Alternative Waste Treatment System Installations
5 man-years	Agricultural Technical Assistance
2.5 man-years	Residential Technical Assistance

Cost/Benefit Analysis

Unit costs for control measures were determined through analysis of control measures previously installed through the state cost-share program by the Loudoun Soil and Water Conservation District (LSWCD), discussion with local agency representatives, and focus groups. The cost of technical assistance was determined through discussion with representatives of the LSWCD and VADCR. The estimated total cost range to install control measures that will ensure full livestock exclusion from streams in the Catoctin Creek watershed is $740,000 to $1,038,000, excluding technical assistance. The

estimated total cost range of residential control measures (*e.g.,* straight pipe replacements) is $140,000 to $720,000, excluding technical assistance. The estimated total cost to provide agricultural technical assistance during implementation is expected to be $250,000. For residential technical assistance, approximately $125,000 is needed during the 5-year course of implementation. The total cost estimated for five years of implementation is $1.72 million.

The primary benefit of implementation is the reduction of fecal coliform concentrations in Upper South Fork Catoctin Creek, South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek. The risk of fecal bacteria illness through swimming in or drinking water from these streams will decrease with the completion of this IP. Stream-bank protection, provided through exclusion of livestock from streams, will lead to improved aquatic habitat. Soil and nutrient losses should decrease due to vegetated buffers, and infiltration of precipitation should increase through the implementation of agricultural BMPs. The agricultural and residential practices recommended in this document will provide economic benefits to the landowner as well as 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

The LSWCD has agreed to undertake the responsibility of overseeing the agricultural program during implementation in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, while VDH has agreed to be the lead agency for the residential program. Full implementation is expected to be completed in 5 years. Potential funding sources are Federal Clean Water Act 319 Incremental Funds, Virginia Agricultural Best Management Practices Cost-Share, Tax Credit, and Loan Programs, Virginia Small Business Environmental Assistance Fund Loan Program, Water Quality Improvement Fund, Community Development Block Grant Program, Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentive Program (WHIP), Wetland Reserve Program (WRP), Southeast Rural

Community Assistance Project (SE/R-CAP), National Fish and Wildlife Foundation, Chesapeake Bay Small Watershed Grants Program, and Clean Water State Revolving Fund.

The funding sources that are expected to play the largest role in implementation are the Federal Clean Water Act 319 Incremental Funds and the Virginia Agricultural BMP Cost-Share and Tax Credit Programs. A possible funding scenario includes moneys from 319 Incremental Funds for agricultural BMPs and all technical and administrative assistance, and Cost-Share for residential waste treatment issues.

The milestones for implementation are 20% installation of livestock exclusion systems (*i.e.,* full livestock exclusion systems and hardened crossings), 20% of straight pipes corrected (50% with septic systems and 50% with alternative systems), two agricultural technical FTE, one agricultural administrative FTE, and a half residential technical FTE each year for five years. These milestones are intended to achieve full implementation within 5 years, leaving five years to assess water quality for de-listing. The end goals of implementation are restored water quality in the impaired waters and de-listing of the waters from the Commonwealth of Virginia's Section 303(d) list within 10 years. Stakeholders established that implementation would begin in August 2004 after which five milestones need to be met within the next five years.

Targeting of critical areas for agricultural BMP installation was accomplished through analysis of land use, farm boundaries, stream network GIS layers, and monitoring results. The subwatersheds were ranked by the ratio of animals per length of fence needed. If feasible, effort should be made to prioritize resources in the Catoctin Creek watershed in the following order of subwatersheds: 2, 1, 11, 8, 12, 13, 4, 16, 7, 14, 3, 10, 6, 15, 5, 9.

For residential programs, targeting was geared toward narrowing the search for straight pipes. Analysis of water quality monitoring conducted during the TMDL development and spatial data were used to identify the most promising areas to look for straight pipes. Spatial analysis was performed to identify land parcels next to a stream with buildings not known to have a wastewater treatment system. These land parcels have the potential for straight pipes. The results indicate that subwatershed 3 in the most likely area to find straight pipes, followed by subwatersheds 7 through 10 and subwatershed 5. Using this

data, efforts can be made to contact residents in these areas first to correct straight pipes. A workbook for tracking implementation is provided to the responsible parties for agricultural and residential programs to guide IP efforts and progress.

Stakeholders and their Role in Implementation

The only water quality monitoring that is currently funded is performed by VADEQ. Loudoun Watershed Watch (LWW) has developed a complementary monitoring plan for Catoctin Creek (Appendix B).

Three organizations will be involved in public education: LWW, VCE, and LSWCD. The LWW plans to provide a "Watershed Day", monthly e-mailed newsletter, display posters at local businesses, and give handouts at local events relating information about restoring Catoctin Creek. The VCE responds to the needs of individuals, families, groups and organizations with educational programs. Citizens of Virginia can participate through their local extension office. The LSWCD will be in charge of initiating contact with farmers in the Catoctin Creek watershed to encourage the installation of cattle and horse exclusion systems. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The LSWCD also publishes a newsletter, can send out mailings, and arrange field days to educate the public during implementation.

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, 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

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". In fulfilling the state's requirement for the development of a Total Maximum Daily Load (TMDL) Implementation Plan (IP), a framework was established for reducing fecal coliform (FC) levels and achieving the water quality goals for the Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek impaired segments for which TMDL allocations were developed.

Portions of Catoctin Creek, North Fork Catoctin Creek, and South Fork Catoctin Creek were listed as impaired on Virginia's 1998 Section 303(d) Total Maximum Daily Load Priority List and Report (VADEQ, 1998) due to violations of the State's water quality standard for fecal coliform at three monitoring stations. The Upper South Fork Catoctin Creek was added to the 2002 303(d) Report on Impaired Waters based on monitoring at upstream stations. The segment length was extended from the 1998 303(d) listing to account for upstream special study monitoring stations on the South Fork Catoctin Creek. In the 2004 Section 303(d) Water Quality Assessment Integrated Report, 3.4 miles of Upper South Fork Catoctin Creek was listed as impaired for violations of the General Standard (benthic).

Catoctin Creek is located in Loudoun County and is part of the Potomac River Basin. The segment of the North Fork Catoctin Creek from the confluence of the North Fork Catoctin Creek with Catoctin Creek to a point 10.53 miles upstream is impaired. The impaired segment begins approximately 0.83 river miles upstream from the Route 719 bridge near Hillsboro. The segment of the South Fork Catoctin Creek from the confluence of the South Fork Catoctin Creek with Catoctin Creek to a point 6.01 miles upstream is impaired. As indicated above, the 2002 Virginia Water Quality Assessment indicated that the entire length of the South Fork Catoctin Creek (17.26 miles) is impaired, and therefore the TMDL addresses all of the South Fork Catoctin Creek. The

Upper South Fork Catoctin Creek impairment begins approximately 1.10 river miles upstream from the Route 761 and Route 719 intersection, downstream to its confluence with the Lower South Fork Catoctin Creek. The Lower South Fork Catoctin Creek impaired segment begins approximately 0.55 river miles upstream from the Route 9 bridge downstream to its confluence with Catoctin Creek. The segment of Catoctin Creek from the confluence with Milltown Creek 7.40 miles downstream to its confluence with the Potomac River is impaired. The confluence of Milltown Creek to Catoctin Creek is approximately 1.20 river miles downstream from Route 673 bridge.

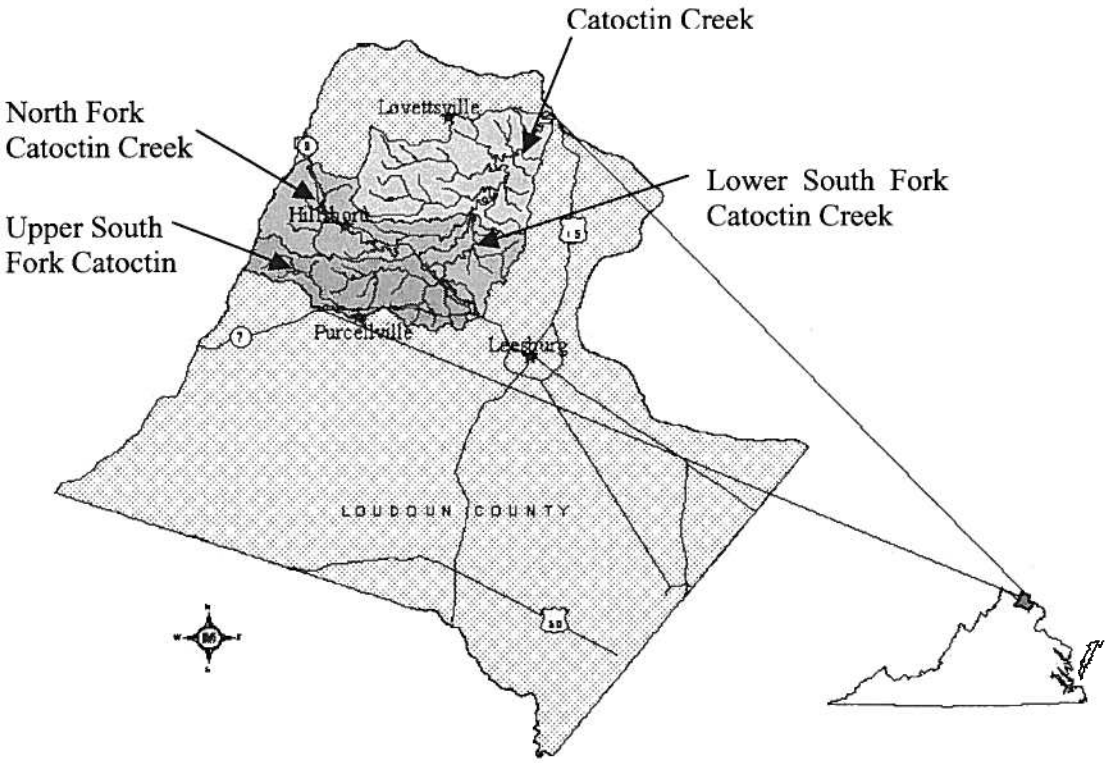

Figure 1.1 Location of the Catoctin Creek watershed.

The Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek are part of the Catoctin Creek watershed, located in Loudoun County, Virginia, just north of Purcellville and approximately five miles to the

northwest of Leesburg, Virginia (Figure 1.1). The Catoctin Creek watershed empties into the Potomac River, which empties into the Chesapeake Bay. The Catoctin Creek watershed is located within USGS hydrologic unit Code 02070008 and Virginia hydrologic planning unit VAN-A02R. The total area of the Catoctin Creek watershed is approximately 59,090 acres, with agriculture and forest as the primary land uses (Figure 1.2, Table 1.1). Of this, the Upper South Fork Catoctin Creek watershed is approximately 14,117 acres comprised of forest (24.3%), agricultural (70.2%), urban (4.8%), and water (0.7%) land uses. Similarly, the 6,953 acres in the Lower South Fork Catoctin Creek watershed are distributed between forest (23.6%), agricultural (73.3%), urban (2.4%), and water (0.7%). The total area of the North Fork Catoctin Creek watershed is approximately 14,856 acres comprised of forest (41.0%), agricultural (57.6%), urban (0.6%), and water (0.8%). The Catoctin Creek watershed is approximately 23,164 acres comprised of forest (30.1%), agricultural (67.7%), urban (1.1%), and water (1.1%). Loudoun County ranks 1st among Virginia counties for the number of horses, 44th for the number of dairy cows, 9th for beef cattle, 11th for the number of all cattle, and 23rd for production of corn silage (VASS, 2001). For the period from 1930 to 2003, Loudoun County received average annual precipitation of approximately 41.9 inches, with 55% of the precipitation occurring during the growing season (May through October) (SERCC, 2004). Average annual snowfall is 22.0 inches; the highest snowfall occurs during January (SERCC, 2004). Average annual daily temperature is 55.7 °F; the highest average daily temperature, 88.8 °F, occurs in July, while the lowest average daily temperature, 24.6 °F, occurs in January (SERCC, 2004). The estimated population within the Catoctin Creek drainage area in 2001 was 9,757.

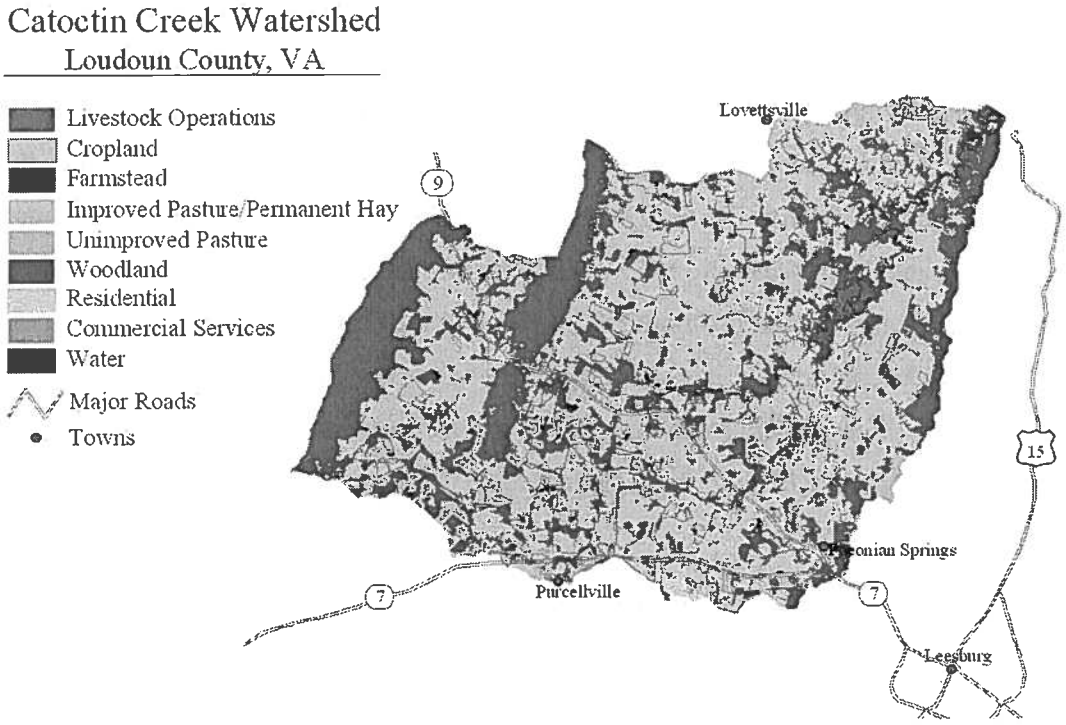

Figure 1.2 Landuses in the Catoctin Creek watershed.

Table 1.1 Spatial distribution of land use in the Catoctin Creek drainage area.

Land Use	Upper South Fork Catoctin Creek (ac)	Lower South Fork Catoctin Creek (ac)	North Fork Catoctin Creek (ac)	Catoctin Creek (ac)
Woodland	3,433	1,639	6,102	6,981
Water	100	48	114	248
Commercial & Services	200	37	2	6
Residential	473	129	83	247
Cropland	2,161	246	934	1,646
Livestock Operations	11	0	0	1
Farmstead	75	32	37	55
Unimproved Pasture	155	125	114	403
Improved Pasture	7,511	4,696	7,470	13,579

In developing the IP, elements from both State and Federal guidance were incorporated. Specifically, Virginia's 1997 WQMIRA establishes 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 impact of addressing the impairments. United States Environmental Protection Agency (EPA) outlines the minimum elements of an approvable IP in its 1999 proposal, *Guidance for Water Quality-Based Decisions: The TMDL Process*. These elements include implementation actions/management measures, time line, 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, VADEQ will take TMDL implementation plans to the State Water Control Board (SWCB) for approval as the plan for implementing the pollutant allocations and reductions contained in the TMDLs. Also, VADEQ will request SWCB authorization to incorporate the TMDL implementation plan into the appropriate Water Quality Management Plan (WQMP) in accordance with the CWA's Section 303(e). In response to a Memorandum of Understanding (MOU) between EPA and VADEQ, VADEQ also submitted a draft Continuous Planning Process to EPA in which VADEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

1.2 Applicable Water Quality Standards

According to Virginia Water Quality Standard (9 VAC 25-260-5), the term "water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

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

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

◆

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

◆

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

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

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

◆

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

At the time when Catoctin Creek was designated as impaired and the TMDL was developed, the State's water quality criterion for fecal bacteria was based on fecal coliform. For a non-shellfish supporting waterbody to be in compliance with Virginia fecal coliform standard for contact recreational use, VADEQ specified the following criteria (Virginia Water Quality Standard 9 VAC 25-260-170):

> *A. General requirements. In all surface waters, except shellfish waters and certain waters addressed in subsection B of this section, the 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 30-day period, or a fecal coliform bacteria level of 1,000 per 100 ml at any time.*

If the waterbody exceeded either criterion more than 10% of the time, the waterbody was classified as impaired and a TMDL was developed and implemented to bring the waterbody into compliance with the water quality criterion. Based on the sampling frequency, only one criterion was applied to a particular datum or data set (Virginia Water Quality Standard 9 VAC 25-260-170). If the sampling frequency was one sample or less per 30 days, the instantaneous criterion was applied; for a higher sampling frequency, the geometric criterion was applied.

Sufficient fecal coliform bacteria standard violations were recorded at VADEQ water quality monitoring stations to indicate that the recreational use designations are not being supported (VADEQ, 1998). Most of the VADEQ ambient water quality monitoring is done on a monthly or quarterly basis. This sampling frequency does not provide the two or more samples within 30 days needed for use of the geometric mean part of the standard. Therefore, VADEQ used the 1,000 cfu/100 ml standard in the 1996, 1998, and 2002 Section 303(d) assessments of the fecal coliform bacteria monitoring data. A five-year time span was used for each assessment period.

1.3 Water Quality Standard Changes

Two regulatory actions related to the bacteria water quality standard in Virginia have been implemented. The first rulemaking pertains to the indicator species used to measure bacteria pollution. The second rulemaking is an evaluation of the designated uses as part of the state's triennial review of its water quality standards.

1.3.1 Indicator Species

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 coliform. *E. coli* and *enterococci* are both bacteriological organisms that can be found in the intestinal tract of warm-blooded animals. Like fecal coliform bacteria, these organisms indicate the presence of fecal contamination. The adoption of the *E. coli* and *enterococci* standard has been in effect in Virginia as of January 15, 2003.

1.3.2 Designated Uses

All waters in the Commonwealth have been designated as "primary contact" for the swimming use regardless of size, depth, location, water quality or actual use. The fecal coliform bacteria standard is described in 9 VAC 25-260-170 and in Section 1.2 of this report. This standard is to be met during all stream flow levels and was established to protect bathers from ingestion of potentially harmful bacteria. However, many headwater streams are small and shallow during base flow conditions when surface runoff has minimal influence on stream flow. Even in pools, these shallow streams do not allow full body immersion during periods of base flow. In larger streams, lack of public access often precludes the swimming use.

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

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

1.3.3 Wildlife Contributions

In some streams for which TMDLs have been developed, water quality modeling indicates that even after removal of all of the sources of fecal coliform (other than wildlife), the stream will not attain standards. TMDL allocation reductions of this

magnitude are not realistic and do not meet EPA's guidance for reasonable assurance. Based on the water quality modeling, many of these streams will not be able to attain standards without some reduction in wildlife. **Virginia and EPA are not proposing the elimination of wildlife to allow for the attainment of water quality standards.** This is obviously an impractical action. While managing over-populations of wildlife remains as an option to local stakeholders, the reduction of wildlife or changing a natural background condition is not the intended goal of a TMDL. In such a case, after demonstrating that the source of fecal contamination is natural and uncontrollable by effluent limitations and BMPs, the state may decide to re-designate the stream's use for secondary contact recreation or to adopt site specific criteria based on natural background levels of fecal coliforms. The state must demonstrate that the source of fecal contamination is natural and uncontrollable by effluent limitations and BMPs through a UAA as described above. 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.

1.4 Project Methodology

The overall goal of this project was to begin the process of restoring water quality in the Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek impaired stream segments. Specific objectives in meeting this goal are:

1. Development of a staged IP;
2. Coordination of public participation; and
3. BMP implementation.

As stated above, key components of an IP include public participation, assessment of needs, cost / benefit analysis, measurable goals, and a timeline to achieve water quality objectives. Public participation was an integral part of the TMDL IP Development, and is 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 a forum for soliciting participation in the smaller, more-targeted meetings (*i.e.,* working groups and steering committee). Second, working groups were assembled from communities of people with common concerns regarding the TMDL process and were the primary arena for seeking public input. Working groups consisted of the following: Agricultural, Residential, Environmental, and Governmental. A representative from VADCR or MapTech attended each working group in order to facilitate the process and integrate information collected from the various communities. Third, a steering committee was formed with representation from all of the working groups, VADCR, VADEQ, VDH, and MapTech, and had the expressed purpose of formulating the TMDL IP.

Potential control measures were identified through working group input, literature review, and discussion with the LSWCD, Natural Resources Conservation Service (NRCS), VADCR, VADEQ, VDH, Virginia Cooperative Extension (VCE), and Loudoun County Government. Control measures that can be promoted through existing programs were identified, as well as control measures that are not currently supported by existing programs and their potential funding sources. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts. The cost of installing potential control measures was determined through discussion with working groups, LSWCD, NRCS, VADCR, VADEQ, VDH, VCE, and Loudoun County Government. Availability of existing programs was determined through discussion with state and local officials participating in the Governmental Working group. The assurance of implementation of specific control measures was assessed through discussion with appropriate working groups, and control measures were assessed based on their perceived potential for being successfully implemented. The assessment of water quality impacts consisted of the development and evaluation of implementation scenarios. Implemental strategies were presented to and evaluated by the steering committee.

Based on the evaluated strategies, a staged implementation timeline was developed. Implicit in the process of a staged implementation is targeting of control measures. Targeting was proposed to ensure optimum utilization of resources. Monitored data

collected during the TMDL development process was used together with modeling to target the staged implementation. Modeling was used to evaluate measurable goals and milestones by linking water quality with specific levels of implementation (*e.g.*, a 50% reduction in livestock access to streams may result in a 90% reduction in violations of the state standard). Through this process, a staged implementation plan was developed that will establish full implementation within five years.

The stated key components of the staged implementation plan are discussed in detail in the following sections: Review of TMDL development, Process for Public Participation, Assessment of Needs, Cost / Benefit Analysis, and 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

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

2.1 State Requirements

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs 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 WQMIRA.

2.2 Federal Recommendations

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

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

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

2.3 Requirements for Section 319 Fund Eligibility

EPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States. The guidance is subject to revision and the

most recent version should be considered for IP development. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine elements that must be included in the IP to meet the 319 requirements:

1. Identify the causes and sources 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 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; and
9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

3. REVIEW OF TMDL DEVELOPMENT

MapTech, Inc., contracted by the VADCR, developed a TMDL for the Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek in Loudoun County, Virginia. The approved TMDL documents can be obtained at the VADEQ office in Woodbridge, VA or via the Internet at www.deq.state.va.us. Water quality monitoring, water quality modeling, and allocated reductions were reviewed to determine the implications of TMDL and modeling procedures on IP development.

3.1 TMDL Water Quality Monitoring Results

MapTech, Inc. was contracted to do bacterial source tracking during the Catoctin Creek TMDL development. Bacterial source tracking is intended to aid in identifying sources (*i.e.,* human, livestock, or wildlife) of fecal contamination in water bodies. While the short time-frame available, and the subsequent small number of observations taken in this case made drawing conclusions difficult, the 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.

Figure 3.1 shows the relationship between fecal coliform concentration at the time of sampling and the percentage of isolates from each source. Results of monitoring in all Catoctin Creek impairments are shown for comparative purposes. Each sample is represented by three symbols, one each representing the proportion of human isolates, livestock isolates and wildlife isolates within that sample. For example, the sample depicted on the far right of the graph indicates a fecal coliform concentration of 9,400 cfu/100 ml with the predominant source of fecal contamination being wildlife (71%), followed by livestock (25%), and then human (4%), while the sample on the far left of the graph indicates a fecal coliform concentration of 18 cfu/100 ml with the predominant source being livestock (46%), followed by human (33%), and then wildlife (21%). Due to the time constraints of the contract, an assessment of seasonal impacts could not be performed on this data.

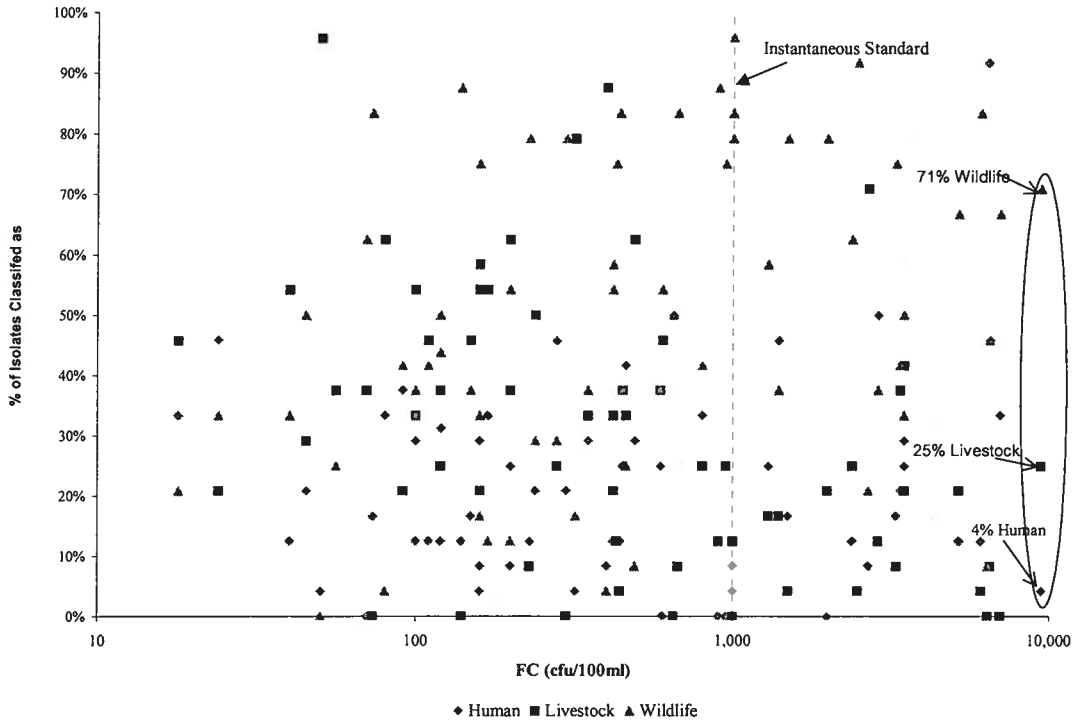

Figure 3.1 Results of in-stream monitoring for fecal coliform concentrations and fecal sources conducted by MapTech during development of the TMDL for Catoctin Creek.

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. United States Geological Survey (USGS) Hydrologic Simulation Program - Fortran (HSPF) water quality model was selected as the modeling framework to simulate existing conditions and perform TMDL allocations. Seasonal variations in hydrology, climatic conditions, and watershed activities can be explicitly accounted for in the HSPF model.

3.2.1 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 3.1.

Table 3.1 Permitted point sources in the Catoctin Creek Watershed.

Facility	VPDES #	Design Discharge (MGD)[1]	Impairment	Permitted for Fecal Control	Data Availability
Hamilton STP	VA0020974	0.16	Upper South Fork Catoctin Creek	Yes	February 1993 - Present
Purcellville WTP	VA0089940	NL[1]	Upper South Fork Catoctin Creek	No	April 1999- Present
Waterford STP	VA0060500	0.058	Lower South Fork Catoctin Creek	Yes	February 1993 - Present
Private Residence	VAG406086	0.001	North Fork Catoctin Creek	Yes	N/A

[1] NL indicates no limitation on discharge volumes.

At the time the Catoctin Creek TMDL was created, permitted point discharges that may contain pathogens associated with fecal matter were required to maintain a fecal coliform concentration below 200 cfu/100 ml. One method for achieving this goal is chlorination. Chlorine is added to the discharge stream at levels intended to kill off any pathogens. The monitoring method for ensuring the goal is to measure the concentration of total residual chlorine (TRC) in the effluent. If the concentration is high enough, pathogen concentrations, including fecal coliform concentrations, are considered reduced to acceptable levels. Typically, if minimum TRC levels are met, fecal coliform concentrations are reduced to levels well below the 200 cfu/100 ml limit.

Both urban and rural nonpoint sources of FC bacteria were considered. Sources included residential sewage treatment systems, land application of waste (livestock and biosolids), livestock, wildlife, and domestic pets. During the TMDL development, MapTech collected samples of FC sources (*i.e.,* wildlife, livestock, and human waste) and enumerated the density of FC bacteria to support the modeling process, and expand the database of known FC sources for purposes of BST.

It is important to understand the types of sources modeled, their delivery mechanisms, and temporal variations. Table 3.2 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 landuse 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, direct discharge from houses without sewage treatment (*i.e.,* straight pipes)). 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 3.2 FC 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	Temporal and Spatial
Swine	Land-Based	Temporal and Spatial
Sheep	Land-Based	Temporal and Spatial
Goat	Land-Based	Temporal and Spatial
Residential		
Failing Septic Systems	Land-Based	Temporal and Spatial
Septic Lateral Flow	Direct	Temporal and Spatial
Uncontrolled Discharges	Direct	Temporal and Spatial
Dogs & Cats	Land-based	Temporal and Spatial

3.2.2 Model Allocation

Several model runs were made investigating scenarios that would meet the 30-day geometric mean TMDL goal of 190 cfu/100ml (includes 5% margin of safety). The final load allocations are shown in Table 3.3 for all impairments. Each allocation had no reduction of land applied fecal material, 100% reduction of livestock in-stream deposition, 100% reduction of uncontrolled residential discharges and a reduction of wildlife in-stream deposition. Although there is no reduction of land applied fecal material, implicit in this allocation is a need to maintain loadings at or below current levels.

Table 3.3 Load reductions allocated during TMDL development.

Impairment	Straight Pipes (%)	Livestock Direct Deposition (%)	Wildlife Direct Deposition (%)
Upper South Fork Catoctin Creek	100	100	91
North Fork Catoctin Creek	100	100	93
Lower South Fork Catoctin Creek	100	100	25
Main Stem of Catoctin Creek	100	100	85

The wildlife contributions of fecal bacteria from species that spend time in waterbodies (*e.g.,* muskrats, beavers, and waterfowl) are at their highest counts during base flow conditions when there is little or no pollutant wash-off from the adjacent land areas. Therefore, base flow events represent the critical condition because the allocations needed to attain water quality standards during these flow regimes insure that standards were met in all other flow ranges.

3.3 Implications of TMDL and Modeling Procedure on Implementation Plan Development

The three major implications of the TMDL development are that all uncontrolled discharges must be identified and corrected, all livestock must be excluded from streams, and a majority of the direct deposition from wildlife must be reduced. However, there are subtler implications as well. Implicit in the requirement for 100% correction of uncontrolled discharges is the need to maintain all functional septic systems. Wildlife direct deposition will not be explicitly addressed by this implementation plan. All efforts

will be directed at controlling anthropogenic sources. See Section 1.3.3 in this report for a discussion of regulatory issues regarding wildlife.

Modeling of the watersheds showed that reduction of direct loads (*i.e.,* uncontrolled discharges, livestock in streams, and wildlife direct deposition) is critical to improving water quality. In terms of livestock access to streams, only cattle were modeled explicitly as supplying direct inputs to the stream (Table 3.2). Implicit in the modeling scheme was that other livestock do not have access to the stream. The HSPF model is calibrated to measured levels of FC, regardless of source, so the modeled load of FC 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.,* 100%). Additionally, calibration helps to ensure that all direct loads have been included in spite of the transport pathway.

4. PUBLIC PARTICIPATION

Public participation was an integral part of the TMDL Implementation Plan Development, and is critical to promote reasonable assurances that the implementation activities will occur. 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 a forum for soliciting participation in the smaller, more-targeted meetings (*i.e.,* working groups and steering committee). Second, working groups were assembled from communities of people with common concerns regarding the TMDL process and were the primary arena for seeking public input. The following working groups were formed: Agricultural, Residential, Environmental, and Governmental. A representative of VADCR and/or MapTech attended each working group in order to facilitate the process and integrate information collected from the various communities. Third, a steering committee was formed with representation from all of the working groups, VADCR, VADEQ, VDH, and MapTech. Reports from each of the working groups to the steering committee are included in Appendix A.

The goal of the Agricultural and Residential Working groups was to identify obstacles to implementation in their respective communities and workable solutions that will overcome these obstacles. The goals of the Environmental Working Group were to identify funding/partnering opportunities that would help to overcome obstacles to implementation, and to review the IP from an environmental perspective. The goals of the Governmental Working group were to identify the regulatory authority in the specific areas related to implementation (*e.g.,* livestock stream access and sewer line connections), to identify existing programs and resources that might be relevant to the situation, and to propose additional programs that would support implementation. The steering committee had the expressed purpose of formulating the TMDL implementation plan. In addition, this committee had the responsibility for identifying control measures that are founded in practicality, establish a time-line to ensure expeditious implementation and set measurable goals and milestones for attaining water quality standards.

All meetings conducted during the course of the TMDL Implementation Plan Development are listed in Table 4.1. Over 390 man-hours were devoted to attending meetings by individuals representing agricultural, residential, environmental, and governmental interests on a local, state, and federal level.

Table 4.1 Meetings held pertaining to the Catoctin Creek TMDL Implementation Plan development.

Date	Meeting Type	Location	Attendance
9/29/2003	Steering Committee	Loudoun County Government Center – Leesburg	11
9/30/2003	Public	Lucketts Community Center	34
11/18/2003	Residential Working Group	Lovettsville Community Center	13
11/18/2003	Government Working Group	Loudoun County Government Center – Leesburg	15
11/19/2003	Environmental Working Group	Lovettsville Community Center	9
11/20/2003	Agriculture Working Group	Lovettsville Community Center	6
12/3/2003	Steering Committee	Loudoun County Government Center – Leesburg	9
1/13/2004	Residential Working Group	Lovettsville Community Center	9
1/14/2004	Agriculture Working Group	Wheatland Farms 38474 John Wolford Road Waterford, VA	26
1/20/2004	Residential Working Group	Lovettsville Community Center	6
1/22/2004	Environmental Working Group	Loudoun County Government Center – Leesburg	4
1/22/2004	Government Working Group	Loudoun County Government Center – Leesburg	9
2/4/2004	Agriculture Working Group	Wheatland Farms 38474 John Wolford Road Waterford, VA	17
2/10/2004	Residential Working Group	Lovettsville Community Center	8
4/19/2004	Steering Committee	Loudoun County Government Center – Leesburg	13
6/10/2004	Steering Committee	Loudoun County Government Center – Leesburg	TBA
6/24/2004	Public	The Old School, 40222 Fairfax Street, Waterford, Virginia	TBA

4.1 Public Meetings

Attendance at public meetings is critical to the public participation effort, and was encouraged through announcements in the *Virginia Register*, *Loudoun Times-Mirror*, *Leesburg Today*, and *Washington Post*, and contact with local community groups (*e.g.*, LSWCD, agricultural producer associations, county board of supervisors). MapTech and VADCR worked closely to integrate presentations, so that undue repetition was avoided and information was delivered in a manner that was accessible to the general public.

The first formal public meeting was held in Loudoun County on September 30, 2003, with approximately 68 man-hours invested from the community, government agencies, and MapTech by attending the meeting. Information delivered to the public at the meeting included: a general description of the TMDL process, a more detailed description of TMDL development and Implementation Plan Development, and a solicitation for participation in working groups. Public response to the presentation was subdued, but sign-up for Working Group was promising and most attendees remained after presentations were complete to discuss the process.

The final public meeting was on June 24, 2004 in Waterford, VA with attendees from the community, government agencies, and MapTech. The primary purpose of this meeting was to present the Final TMDL Implementation Plan. A presentation was given describing the implementation plan using major components as an outline: Review of TMDL development, public participation, assessment of needs, cost/benefit analysis, and implementation. A draft implementation plan and presentation was distributed to attendees. In addition, informational pamphlets describing programs associated with LSWCD, VADCR, and VADEQ were available. Maps with land use, topographic features, and analysis results were displayed and discussed after the presentation.

4.1.1 Agricultural Working Group

The Agricultural Working group consisted of 33 members, predominantly beef producers and horse owners throughout the watershed. Representatives from organizations that serve this community and will have a role in implementation were also included (*e.g.* LSWCD, VCE, NRCS).

The first meeting occurred on November 20, 2003 in Lovettsville, VA. Attendance at this meeting was disappointing (*i.e.,* six attendees, including the contractor – MapTech, and three representatives of local and state agencies). Discussion focused on increasing attendance.

The second meeting occurred on January 14, 2004. The focus of this meeting was to figure out what programs (*e.g.,* incentive programs, educational programs) would work best in promoting implementation. The following factors were identified: constraints (*e.g.,* costs) and how to get around them, funding sources (*e.g.,* 319 funds) and their requirements, appropriate measurable goals, the timeline, and implementation strategies. A representation of comments, questions and answers addressed during the meeting included:

- What good are efforts to fence cattle out of stream knowing that the runoff will carry manure into the stream anyway?
- What about municipalities that dump sewage into streams?
- What about highway practices that result in chemicals being washed into streams?

It was noted that each of these potential pollution sources needed to take responsibility for their impact on water quality, but the Catoctin TMDL study for fecal bacteria highlighted the need for residential and farmers' responsibility.

- The additional costs that farmers will have to bear cannot be made up by charging more for their product.
- While CREP pays $70.00/acre and many of the working group members noted that was a pretty good value for fencing off land for buffers, both sides of the stream need to be fenced in order for CREP to fund the process.
- While funds are available to assist in startup costs for installations such as fencing, concerns were raised about ongoing maintenance costs that the landowner will have to bear.

It was noted that while participation is not currently mandatory, down the road it might be. Acting voluntarily at this time allows for use of federal dollars that are currently

available, funds that are not guaranteed for the future. Federal funds are earmarked for additional assistance when implementation plans are complete. Labor for these installations might be available from Virginia Tech students or from other volunteers. Also, there is currently a 25% tax credit for maintenance of stream fencing.

A third meeting of this group was held in Waterford, VA on February 4, 2004 to discuss summary of previous meeting, description of applicable BMPs, obstacles to implementation, and proposed alternatives. The AWG decided the most promising practices were SL-6 (Grazing Land Protection System) for cattle producers and a WP-2 (Stream Protection) for horse owners/boarders. For small farms a SL-6A (Small Acreage Grazing Land Protection System) may be appropriate. The SL-6B (Stream Protection without Fencing) was viewed as a less attractive option, given that streamside fencing may still be required at some point in the future. A representation of comments, questions and answers addressed during the meeting included:

- The manager of the Wheatland Farms discussed his experience with installing and maintaining BMPs.
    - After some trial and error, he and his crew were able to position the fencing such that they no longer have problems with fences being washed out during flood events
    - The proper head-to-waterer ratio eliminated problems with waterers freezing
- A design rule-of-thumb is to set the fence out at least 1/3 of the floodplain to avoid most damage from flood flow debris
- Are stream crossings acceptable with these practices? Yes, for moving cattle/equipment.
- Is stream access allowed for watering/drinking?
    - Traditionally, it has been allowed, but in this situation, requiring restriction of most/all of the livestock in the watershed from the stream, it would probably not be allowed. Alternatively, it may be allowed with the understanding that sometime in the future the participant may be asked to eliminate this access.

- Is someone looking into the insurance for repair of fencing after floods?
    - Yes, it is being pursued for inclusion in the IP. (Note: No willing offers were identified at the time of this printing, however, this option can be pursued during implementation.)
- What about fence maintenance?
    - There is currently a 25% tax credit available in the watersheds where IPs have been developed.
- Is it better for a farmer to hold off – do SL-6B and not SL-6 – and wait for regulation to put the rest in?
    - Generally speaking, no. It would be smarter to install the fencing now, with cost-share money, than to wait, since cost-share money will probably not be available if the program becomes regulatory.
- Sell me on doing this, my 10 cattle do not add to the pollution. Target perennials first or do some of the 'critical' areas at 100% first.
    - There will be targeting of critical areas. As part of the IP development, MapTech will look at different targeting strategies that will have the greatest impact on water quality with the least expense.
- The required 35-ft buffer could be a deterrent.
- In Loudoun County, there is not enough land on individual farms, while larger farms might be able to absorb the loss to buffers.
- The $80/acre rent payment associated with the CREP program would not be enough for horse properties. Another reimbursement option for buffer land might be conservation easements, where the landowner is paid a percentage of the land value to leave it undisturbed.

4.1.2 Governmental Working Group

This group contained 15 members from the Loudoun County government, VADCR, VADEQ, NRCS, LSWCD, EPA, VDH, and VCE. The first meeting on November 18, 2003 in Loudoun County included discussion on the Catoctin Creek TMDL, potential funding programs in Loudoun County, and selection of a representative for the Steering Committee. It was described that the primary role of the Government Working group is

to identify technical and financial resources that are in place to assist in carrying out the implementation plan and to identify legal or regulatory controls that can facilitate participation. A representation of comments, questions and answers addressed during the meeting included:

- NRCS
    - Provides financial and technical assistance through several farm programs mandated by the Farm Bill: the Conservation Reserve and Enhancement Program (CREP), the Environmental Quality Incentives Program (EQIP), and the Wildlife Habitat Incentive Program (WHIP)
    - Area projects are "ranked" mainly for environmental benefits and compete for funding with projects across the state. CREP has not been a popular program in Loudoun County. CREP provides funds for farmers to fence streams if they have livestock, and to established riparian buffers with trees or grass.
- The Loudoun Soil and Water Conservation District
    - Provides financial and technical assistance to farmers through the Virginia Agricultural BMP Cost-Share and Tax Credit Programs.
    - Many of the BMPs that are cost-shared by the state at 50% to 75% are also funded through federal programs.
- The local Agricultural Marketing Office
    - Provides business plans for agricultural producers as well as horse operations and wineries, works with non-traditional farmers/landowners with 25 to 30 acres, leaves the technical details to the District and NRCS, has a lot of contact with the farm community in the Catoctin Creek watershed, Corey Childs, County Extension Agent, provides education and outreach to agricultural producers
- Loudoun County staff
    - The Planning Department
        - public outreach and mapping.
    - The Stormwater Program - stormwater ordinance was recently passed.

- VADEQ
    - Currently on a two year intensive monitoring cycle in the Catoctin Creek watershed and then will rotate off the monitoring stations for four years
- Health Department
    - Can offer assistance on locating straight pipes
- EPA
    - May be able to assist with public education grants and can provide information on BMP efficiencies

4.1.3 Residential Working Group

The Residential Working group consisted of 15 members. The purpose for the group was to develop a plan to (1) identify and eliminate straight pipes of wastewater from dwellings and businesses, (2) recognize difficulties faced by landowners in correcting these problems, (3) identify potential means of funding corrections, (4) determine how to get landowners to come forward when there is fear of regulatory action and unknown costs, (5) determine technical assistance needed, (6) determine educational tools that are most likely to help and determine the cost to the taxpayer. Thirteen homeowners participated in this group at the first meeting on November 18, 2003 in Lovettsville. The results of the Catoctin Creek TMDL were mentioned, brainstorming for each section of the plan was conducted, and a Steering Committee representative was elected.

At the second meeting on January 13, 2004 nine residents attended. An explanation of how MapTech identified potential straight pipes was given. A representation of comments, questions and answers addressed during the meeting included:

- Ways that residents of the watershed can be educated:
    - Press release
    - Advertisements
    - Reporter story in news
    - Mailings
    - Flyers

- A Health Study or other survey can be done for the parcels identified without pollution source
- Need to clarify the problem to the public through education:
- With education should also come amnesty from fines and prosecution, funding sources to help where needed, and to "scare" them
- Additional sampling points, closer together would help to narrow the point where the straight pipes are and would aid in identifying problems

At the third meeting on January 20, 2004 there was discussion on the funding questions and the pros and cons of 100% funding. A representation of comments, questions and answers addressed during the fourth meeting on February 10, 2004 included:

- A health study and door-to-door visits of selected areas were considered the same
- Funding was indicated as a significant reason for not correcting straight pipes, but when asked what financial assistance is likely to get the best results, no answers were given.
- Several people indicated that a strong case of pollution had not been made and to their knowledge no one had been sick from being in the creek. Individuals had been in the creek and their children played there often and they saw no adverse effects.
- Expecting someone to "turn themselves in" due to a sign, posted on the creek, stating that it is polluted, is very unlikely.
- A discussion of the funding options (and the strong vote for no funding) resulted in the recommendation not to fund anything that is designed to specifically address the problem.

4.1.4 Environmental Working Group

The Environmental Working group consisted of ten members. At the meeting held in Lovettsville on November 19, 2003, nine individuals participated in the Environmental Working group. The tasks of the working group were reviewed, and the question arose as to whether this group should develop a comprehensive monitoring plan for the watershed. It was agreed that while monitoring recommendations geared toward

validating the effectiveness of implementation strategies would be valuable (*i.e.*, *E. coli* monitoring), development of a comprehensive plan (*e.g.*, including aquatic life – benthic – monitoring) is beyond the scope and requirements of this study. (Note: Loudoun Watershed Watch did develop a monitoring plan, which is included in Appendix A). Four areas for which funding would be sought were identified:

- Implementation Practices
- Technical Assistance
- Education
- Monitoring

A representation of comments, questions and answers addressed during the meeting included:

- The county, Loudoun Watershed Watch, LSWCD, and VADEQ should make a collaborative effort with regard to monitoring.
    - While DEQ's existing monitoring program is adequate to establish de-listing of the impaired segments, a more spatially refined monitoring network would be advantageous in determining the efficacy of implementation as it proceeds. This would include establishing baseline conditions, monitoring progress during implementation, and assessment monitoring to establish final results.

At the second Environmental Working group meeting on January 22, 2004, MapTech presented some suggestions for ways the Environmental Group can contribute: focus on identifying funding sources, help develop/take a lead on educational programs and cooperative arrangements, help identify partners within the community, identify conservation easement money for the farming community, and lobby the county to provide tax incentives for buffer for green spaces. A representation of comments, questions and answers addressed during the meeting included:

- Discussed how education can be implemented.
    - The need for a coordinator was presented.

- Could work specifically on the Catoctin Watershed IP or have countywide responsibilities.
- Suggested responsibilities: organizing local citizens to get involved in order to provide monitoring, cleanup, education, restoration, education, writing grants for funding.

- Discussed how to focus on the community benefit from improved water quality: recreational use, aquatic life.
- The committee needs to define monitoring methods and field techniques that will work.
- There are two kinds of monitoring data; 'approved' data is used for regulatory issues, 'unapproved' data is less strict but still serves a purpose. In cases where decent local data conflicts with VADEQ data, VADEQ would be hard pressed to change an impairment. There is value in getting citizens involved for monitoring because it results in increased awareness in the community.
- The committee needs to define monitoring and have a QA program for the local monitoring.
    - Goals for the monitoring include: education of the public, providing VADEQ with supplemental data, refining the data spatially, and getting the public involved.

4.1.5 Steering Committee

The committee consisted of 19 members with representatives from the Agricultural, Residential, Environmental, and Governmental Working groups, LSWCD, VADCR, VADEQ, VDH, local government agencies, and MapTech.

The first steering committee meeting was held on September 29, 2003 in Leesburg to inform some key community members of the upcoming public meeting and formation of Working Groups. The intention was that the invited attendees would form the basis of the Steering Committee, while participation from additional stakeholders would be encouraged and welcomed.

The second Steering Committee meeting was held on December 3, 2003 in Leesburg to discuss comments from recent agricultural and governmental working group meetings; how to get more participation from producers, representatives from each group to Steering Committee, how monitoring can help implementation, and finding potential funding resources available.

The third Steering Committee meeting was held on April 19, 2004 in Leesburg to bring the results of the working group meetings together. The reports from each group are documented in Appendix A.

4.1.6 Summary

Varied opinions were voiced throughout the public participation meetings regarding the IP process. A need to clarify the problem to the public through education was a concern for the Residential group. Most members of the working groups agreed that the cornerstone of the IP is cultivating public involvement and education and encouraging commitment and partnerships among the citizens and government agencies in the watershed in order to reduce fecal bacteria pollution. 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 Catoctin 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.

5.1 Identification of Control Measures

Potential control measures were identified through Working Group input, literature review, and discussion with the LSWCD, NRCS, VADCR, VADEQ, VDH, VCE, and Loudoun County Government. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts (Table 5.1).

The cost of installing potential control measures was determined through discussion with working groups, LSWCD, NRCS, VADCR, VADEQ, VDH, VCE, and Loudoun County Government. Control measures that can be promoted through existing programs were identified, as well as control measures that are not currently supported by existing programs and their potential funding sources. Availability of existing programs was determined through discussion with LSWCD, NRCS, VADCR, VADEQ, and VDH officials participating in the Governmental Working group. The assurance of implementation of specific control measures was assessed through discussion with the Agricultural and Governmental Working groups and the Steering Committee.

The allocations determined during the TMDL development dictate, largely, the control measures that must be employed during implementation. In order to meet the 100% reductions in direct deposition from livestock, some form of stream exclusion is necessary. Fencing is the most obvious choice, however, the type of fencing, distance from the stream bank, and most appropriate management strategy for the fenced pasture are less obvious. The 100% reduction in loads from straight pipes implies that all straight pipes in the watersheds should be replaced, and that all onsite sewage treatment systems

(OSTS) (*e.g.,* septic systems and alternative waste treatment systems) must be maintained in proper working condition.

While it is recognized that farmers will want to minimize the cost of fencing and the amount of pasture lost, it was determined that any fencing installed through the use of cost-share programs should follow established NRCS specifications and be located 35-ft from the stream bank, at a minimum, as is specified in existing Virginia cost-share programs. While the model implies that no streamside buffer is needed to attain the reductions in direct deposition that are required, it is recognized that future TMDLs based on sediment or nutrient loads would benefit from a buffer. It is also counterintuitive to recommend placing the fence adjacent to the stream when the fence may have to be moved back from the stream later due to environmental concerns. It is therefore recommended that all fence, even that which is installed solely at the landowner's expense, be placed at least 35-ft from the stream.

Table 5.1 Potential control measure costs and efficiencies in removing FC.

Control Measure	Unit	Cost per Unit[1]	Fecal Coliform Removal Efficiency
Streamside Fencing	ft (length)	$8.00	100% Reduction in direct deposition
Forested Buffer	ft (width)	Varies[2]	50-65% Reduction in land-based loads.
Grass Buffer	ft (width)	Varies	35-50% Reduction in land-based loads.
Alternative Water Source	system	$3,000 – $15,000	50-80% Reduction in direct deposition without streamside fencing.
Cross-fencing for pasture management. (2-strand, non-electric)	ft (length)	$1.00 – $2.00	[3]
Hardened Crossing	system	$2,000 – $3,000	100% Reduction in direct deposition.
Repaired Septic System or Straight-pipe:			
Sewer Line Connection	system	$4,000 – $5,000	100% Reduction in direct load.
Septic System	system	$7,000	100% Reduction in direct load.
Alternative Waste Treatment System	system	$9,000-$36,000	100% Reduction in direct load.
Drainfield Maintenance	system	$100 – $2,000	100% Reduction in direct load.
Septic System Pump-out/Inspection	systems	$200	[4]

[1]Installation costs are represented here. Maintenance costs are discussed in Chapter 6. Costs shown in this table represent an average cost or range of costs used to estimate total and annual expenditures.

[2]Installation costs associated with stream buffers vary widely and can include planting, stream bank stabilization, and the cost of taking the land out of production.

[3]Minimal reduction by itself, however it improves farm production, which makes implementing the full system (*i.e.,* streamside fencing, alternative water, and cross-fencing) more attractive. Additionally, it reduces sediment and nutrient losses from the land, which may help with future TMDLs.

[4]Minimal reduction by itself, however it extends the longevity of septic systems and aids in identifying problems.

An alternative water source will typically be required where pasture is fenced off from streams.. The LSWCD and NRCS staffs have indicated that they have assisted with the installation of many types of alternative water systems. 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 fence 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.

From an environmental perspective, the best management scenario would be to exclude livestock from the stream bank 100% of the time and establish permanent vegetation in the buffer area. This prevents livestock from eroding the stream bank, provides a buffer for capturing pollutants in runoff from the pasture, and establishes (with the growth of streamside vegetation) one of the foundations for healthy aquatic life. From a livestock-production perspective, the best management scenario is one that provides the greatest profit to the farmer. Obviously, taking land (even a small amount) out of production is contrary to that goal. However, a clean water source has been shown to improve milk production and weight gain. Clean water will also improve the health of animals (*e.g.,* cattle and horses) by decreasing the incidence of waterborne illnesses and exposure to swampy areas near streams. Additionally, intensive pasture management, which becomes possible with an alternative water source, has been shown to improve overall farm profitability and environmental impact. From a part-time farmer's perspective, the best management scenario is one that requires minimal input of time. This would seem to preclude intensive pasture management; however, those farmers who have adopted an intensive pasture-management system typically report that the additional management of the established system amounts to "opening a gate and getting out of the way" every couple of days. Additionally, the efficient use of the pasture often means that fewer supplemental feedings are necessary. Among both part-time and full-time farmers there are individuals who are hesitant to allow streamside vegetation to grow unrestricted because of aesthetic preferences or because they have spent a lifetime preventing this growth. Since the problem being corrected is that of direct deposition by livestock in the stream, and since the greatest environmental impact from direct loads occurs during low-flow conditions, it may be possible to establish a management system through which livestock are allowed to graze in the streamside areas for short periods of time (flash grazing) during moderate to high-flow conditions. Specific cost-share programs typically have management constraints outlined for the program, and may not allow flash grazing (*e.g.,* CREP - described in Section 6.1).

Based on these needs, the agricultural control measures identified (Table 5.1) include: streamside fencing, forested and grass buffers, alternative water sources, cross-fencing, and hardened crossings. These control measures will typically be offered packaged

together as a system. For instance, streamside fencing with tree plantings in the stream-buffer area, alternative water source, and cross-fencing to improve pasture management would be a possible solution. For the environment, this system would provide exclusion of cattle from the stream, a forested buffer to filter runoff and a food source for the lower levels of aquatic life; mediate stream temperatures; and provide improved pasture, thereby reducing sediment loads and promoting infiltration. For the producer, this system would provide a clean dependable water source, as well as improved pasture management, both of which would improve profitability. Of course, intensive pasture management is not appropriate for every application, nor is a forested buffer. A different combination of these control measures could be designed for specific scenarios, with the emphasis on livestock exclusion from the stream. While an alternative water source by itself would not provide the 100% exclusion that is the goal of full implementation, it could be seen as a logical first step in the process for some farmers. Additionally, some farmers would be willing to provide their own fencing if cost-share money was available for the alternative water source.

The options identified for correcting straight pipes included: sewer line connection, installation of septic system, and installation of alternative waste treatment system. Connection to a sewer line was viewed as the most permanent solution to the problem, but this solution is only economically feasible if the sewer line is close enough to make the cost competitive with installing a septic or 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 a sewer connection, if a sewer line exists in close proximity, or an alternative waste treatment system.

The public education process can bring the problem to the attention of some individuals who need to correct problems, but it was agreed that a more proactive approach should be taken in identifying problems. The most productive method for identifying straight pipes is typically a stream bank survey. In the case of Catoctin Creek, Loudoun County maintains a database identifying, among other things, the location of existing septic

systems. This database was used to help identify locations that are more likely to have straight pipes than others.

The VDH will be the primary organization for managing residential programs, while the LSWCD will be the primary agency for managing agricultural programs. Historical work records for an agency/group can be utilized to determine the level of technical assistance that a full time equivalent (FTE) can be expected to provide during a year. If historical data is not available to determine FTE production, an estimate derived from discussion with Steering Committee members will need to be utilized. Dividing the total implementation actions needed to be installed per year during implementation by the number of implementation actions that a FTE can process in a year will equal the number of FTE considered necessary for technical assistance during implementation. It is anticipated that ¾ FTE will be dedicated to technical assistance on design and installation of implementation actions and that the remaining ¼ FTE will be devoted to educational outreach. The same processes can be used to determine the number of administrative FTE to support the technical FTE per year.

5.2 Quantification of Control Measures

The quantity of control measures required during implementation was determined through spatial analyses of land use, taxed use, zoning, stream network, and elevation, along with data archived from the VADCR Agricultural BMP Database and TMDL development documents, as well as some field inspections. The map layers and archived data were combined to establish the number of control measures required overall, in each watershed, and in each subwatershed. Estimates of the amount of streamside fencing, number of full livestock exclusion systems, and number of hardened crossings were made through these analyses.

5.2.1 Agricultural Control Measures

To estimate fencing requirements, the stream network was overlaid with land use. Stream segments that flowed through or adjacent to land-use areas that had a potential for supporting cattle (*e.g.,* improved pasture) were identified. If the stream segment flowed through the land-use area, it was assumed that fencing was required on both sides of the

stream, while if a stream segment flowed adjacent to the land-use area, it was assumed that fencing was required on only one side of the stream. These assumptions were further refined to examine taxable land use criteria, size of resultant pasture, zoning, and existing BMPs. Only perennial streams were included in this process. Land uses included cattle operations, pasture, large dairy waste facilities, grazed woodlands, and a portion of forest. Not every land-use area identified as pasture has livestock on it at any given point in time. However, it is assumed that all pasture areas have the potential for livestock access. A map of potential streamside fencing required for perennial streams in the Catoctin Creek watershed is shown in Figure 5.1.

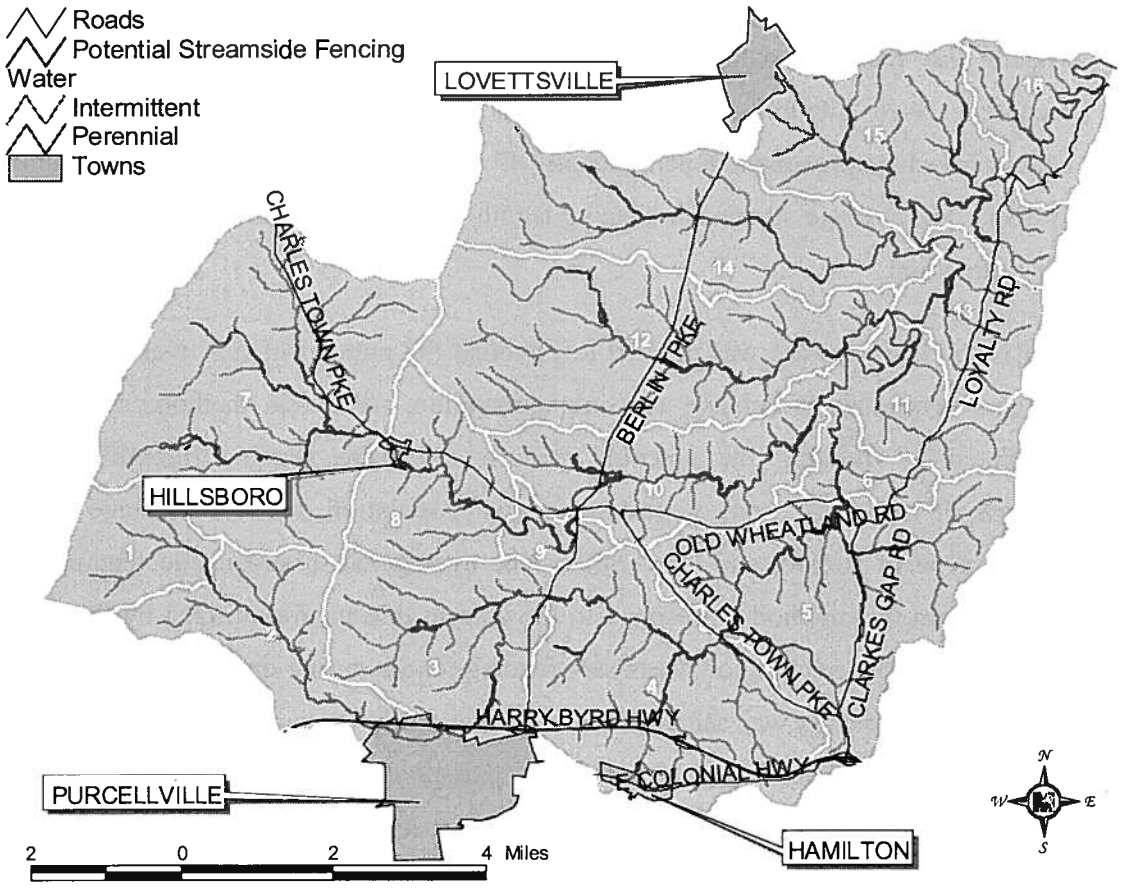

Figure 5.1 Potential streamside fencing for perennial streams in the Catoctin Creek watershed.

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 (WP-2) installed in the area covered by the LSWCD. The SL-6 system includes streamside fencing, cross fencing, alternative watering system, and a 35-ft buffer from the stream. The WP-2 system includes streamside fencing, and a 35-ft buffer from the stream. It is anticipated, based on input from the Agricultural Working group, that livestock producers will most likely implement an SL-6 style system, while horse owners are more likely to implement a system like the WP-2, since horse owners often have alternative water sources available for their animals. Before 1999, the acres benefited from installing the system was recorded, while after 1999, the average streamside fencing length was recorded. Two hundred forty-one systems have been installed with 186 systems characterized by streamside fencing length, 49 with acres benefited, and six as number of systems. The average streamside fencing length was 1,478 feet and 151.6 acres benefited per installation.

MapTech GIS Software was utilized to establish the number of full livestock exclusion systems necessary to achieve full implementation. For this method, systems were calculated by dividing the potential pasture streamside fencing (identified through analysis of taxed use, size of pasture, human population density, coverage of forest, zoning, type of stream, and land use) by the average SL-6 streamside fencing length. Results from this method correspond to the current designation utilized by the LSWCD and will facilitate tracking of streamside fencing length during implementation. Number of hardened crossings was calculated by intersecting the streams passing through grazed land with property boundaries. The resulting parcels were then analyzed for land use and resultant pasture size; those 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.

As depicted in Table 5.2, the length of fencing required for the Catoctin Creek watershed is approximately 32 miles to fence livestock out of perennial streams. This IP focuses on

fencing along perennial streams because the TMDL stated that low flow conditions (dry periods) are critical. It is assumed that at dry periods, intermittent streams will be dry. There will be 126 full livestock exclusion systems installed in the Catoctin Creek watershed. There will be 76 hardened crossings installed during implementation to ensure full exclusion when livestock travel between fields.

Table 5.2 Estimation of total streamside fencing, number of full exclusion systems, and number of hardened stream crossings required in the Upper South fork, Lower South Fork, North Fork and Catoctin Creek watersheds.

Impairment	Subwatershed	Total Stream Length[1] (ft)	SL-6 Livestock Systems Fencing and Water Systems[2] (#)	WP-2 Horse Systems Fencing Only[2] (#)	Hardened Crossings[2] (#)
Upper South Fork	1	1,000	1	1	1
	2	1,000	1	1	1
	3	7,000	4	2	3
	4	15,000	7	4	10
Lower South Fork	5	18,000	9	4	9
	6	3,000	2	1	1
North Fork	7	17,000	8	4	8
	8	7,000	3	2	2
	9	5,000	3	2	4
	10	28,000	13	6	10
Catoctin Creek	11	8,000	4	2	2
	12	12,000	6	3	8
	13	11,000	6	3	1
	14	13,000	6	3	7
	15	17,000	8	4	9
	16	4,000	2	1	0
Total		**167,000**	**83**	**43**	**76**

[1] Values rounded to the nearest thousand.

[2] Values rounded to the nearest whole unit.

5.2.2 Residential Control Measures

The number and location of failing septic systems and straight pipes were based on numbers reported in the TMDL and input from the Steering Committee. A reduction in the number of failing septic systems in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, was deemed unnecessary by the TMDLs. As a result, failing septic systems will not be addressed during implementation unless deemed necessary in the future to meet water quality standards or identified during stream walks.

In the Catoctin Creek TMDL it was estimated that there are eight straight pipes in the entire watershed. The Steering Committee felt that this estimate was low and decided to estimate the number of straight pipes at 20 to perform the cost analysis. The 20 straight pipes were distributed based on the same ratio as the TMDL values exhibited. In Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, seven, three, four, and six straight pipes were distributed between subwatersheds, respectively (Table 5.5). All straight pipes must be identified and replaced during implementation since a 100% load reduction from straight pipes was deemed necessary to meet the TMDL goal.

5.3 Technical Assistance and Education

All members of the Agricultural and Governmental Focus Groups and the Steering Committee agree that technical assistance and education are key to getting people involved in implementation. There must be a proactive approach by agencies to contact farmers and residents to articulate exactly what the TMDL means to them and what will most practically get the job done. Several education/outreach techniques will be utilized during implementation. Articles describing the TMDL process, the reasons why high levels of FC 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 Bureau newsletters, FSA newsletters, flyers included with water bills, 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 is recommended. The emphasis should be on having local farmers discuss their experiences with the 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, small community meetings similar to small workshops proposed for the agricultural community can be organized for educating homeowners about septic system maintenance. A technician dealing with residential issues will contact homeowners after identification of potential straight pipes and explain options available for correcting the problems and for funding sources. Notices using all media outlets should be posted regarding septic systems (*e.g.,* a reminder to pump-out septic tank every 3-5 years). An educational packet should be included about septic system issues for new homeowners. Additionally, educational tools, such as a model septic system that could be used to demonstrate functioning and failing septic systems, and a video of septic maintenance and repair, would be useful in communicating the problem and needs to the public. Technical assistance and educational outreach tasks were identified during plan development that would be needed during implementation. The following tasks associated with agricultural and residential programs were identified:

Agricultural Programs

1. Make contacts with landowners in the watershed to make them aware of implementation goals and cost-share assistance programs.
2. Technical assistance for agricultural programs (*e.g.,* survey, design, layout, and approval of installation).
3. Handle and track cost-share.
4. Develop educational materials & programs, based on local needs.
5. Organize educational programs (*e.g.,* pasture walks, presentations at field days or grazing-club events, etc.).

6. Distribute educational materials (*e.g.,* informational articles in FSA or Farm Bureau newsletters, local media, etc.).
7. Assess and track progress toward BMP implementation goals.
8. Follow-up contact with landowners who have installed BMPs.
9. Coordinate use of existing agricultural programs and suggest modifications where necessary.

Residential Programs

1. Identify straight-pipes (*e.g.,* contact landowners identified as having higher likelihood of having a straight pipe, stream walks, analysis of aerial photos, monitoring) and report to VDH.
2. Track septic system and alternative waste treatment system installations.
3. Handle and track cost-share.
4. Develop educational materials & programs.
5. Organize educational programs (*e.g.,* demonstration septic pump-outs).
6. Distribute educational materials (*e.g.,* informational pamphlets on TMDL & on-site sewage disposal systems).
7. Assess progress toward implementation goals.
8. Follow-up contact with landowners who have participated in the program(s).

Historically, the LSWCD and NRCS have taken the lead for agricultural technical assistance in the four watersheds. The VDH has been the primary organization for managing the residential programs. In order to quantify the number and type of agricultural control practices historically designed and implemented through the cost-share program by the LSWCD, LSWCD personnel were interviewed. The LSWCD staff indicated the amount of BMPs installed (*i.e.,* SL-6 and WP-2) and the number of personnel responsible over the last 5 years.

To determine the number of full time equivalents (FTE) considered necessary for agricultural technical assistance during implementation, the total practices needed to be installed per year during implementation was divided by the number of BMPs that an FTE can process in a year. In determining the maximum needed technical assistance, it was assumed that all practices would need some level of technical assistance. As an estimate, 126 full exclusion systems and 76 hardened crossings need to be installed during implementation (Table 5.2). The number of FTE required was calculated from knowing that 2 FTEs can install 118,724 ft of fence for a livestock exclusion system (SL-

6) and 121,778 ft for a horse exclusion system (WP-2) in 5 years. As a result, 0.6 agricultural technical FTE is needed to provide technical assistance throughout the Catoctin Creek implementation plan. The number of agricultural technical assistance was rounded up to 1 to allow the technician time to do any administration work required.

Members of the Steering Committee agreed that half an FTE over the 5-year implementation period would be adequate for one year to provide residential technical assistance and educational outreach tasks identified during plan development. It is expected that ¾ of the technicians' time will be dedicated to identification and correction of straight pipes and the remaining ¼ of their time will be devoted to educational outreach.

5.4 Cost / Benefit Analysis

5.4.1 Cost Analysis

5.4.1.1 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. High and low estimations of a Grazing Land Protection System (SL-6, typical full livestock exclusion system) and a Stream Protection System (WP-2, full horse exclusion system) installed in the area were established. The cost for one SL-6 and one WP-2 system were estimated from systems already in place in Loudoun County. The cost of an SL-6 system was $7,068.70. The cost of a WP-2 system was $3,594.52. Through stakeholder input and evaluation of the VADCR Agricultural BMP Database in comparable livestock producing regions in the state, the cost of a typical hardened crossing (*i.e.,* WP-2B Stream Crossings and Hardened Crossings) was established as $2,000 per system. The costs of a new septic system or alternative waste treatment system were estimated as ranging from $7,000 to $36,000 by Jerry Franklin of the Loudoun County Health Department (J. Franklin, personal communication, 2 March 2004).

Associated cost for the low estimations of full livestock exclusion systems was calculated by multiplying the unit cost by the number of units in each subwatershed (Table 5.2 and 5.3). The high cost estimations of full livestock exclusion systems were calculated by multiplying the unit cost of an SL-6 system by the total number of exclusion systems required (126). The high cost estimation includes an estimation of hardened stream crossings at $2,000 each; the low cost estimation does not include any hardened crossings.

As depicted in Tables 5.3 and 5.4, approximate high cost for hardened crossings $152,000. Consequently, the total cost to install control measures that will ensure full livestock exclusion from streams in the watersheds is between $0.74 million and $1.04 million excluding technical assistance.

High and low cost estimations to replace identified straight pipes were based on the combination of installing a new septic system or an alternative waste treatment system. The high estimate was based on replacing all 20 straight pipes with an alternative waste treatment, while replacing all straight pipes with new septic systems would result in the lowest estimate. As illustrated in Table 5.5, an estimated total cost between $140,000 and $720,000 will be needed to replace straight pipes in the Catoctin Creek watershed excluding technical assistance.

Table 5.3 High estimated costs to install full exclusion systems and hardened stream crossings in Upper South Fork, Lower South Fork, North Fork and Catoctin Creek watersheds.

Impairment	Subwatershed	Livestock Systems Fencing and Water Systems[1] ($)	Horse Systems Fencing and Water Systems[1] ($)	Hardened Crossings[1] ($)	Total ($)
Upper South Fork	1	7,000	7,000	2,000	16,000
	2	7,000	7,000	2,000	16,000
	3	28,000	14,000	6,000	48,000
	4	49,000	28,000	20,000	97,000
Lower South Fork	5	64,000	28,000	18,000	110,000
	6	14,000	7,000	2,000	23,000
North Fork	7	57,000	28,000	16,000	101,000
	8	21,000	14,000	4,000	39,000
	9	21,000	14,000	8,000	43,000
	10	92,000	42,000	20,000	154,000
Catoctin Creek	11	28,000	14,000	4,000	46,000
	12	42,000	21,000	16,000	79,000
	13	42,000	21,000	2,000	65,000
	14	42,000	21,000	14,000	77,000
	15	57,000	28,000	18,000	103,000
	16	14,000	7,000	0	21,000
Total		**585,000**	**301,000**	**152,000**	**1,038,000**

[1] Values rounded to the nearest thousand.

Table 5.4 Low estimated costs to install full exclusion systems and hardened stream crossings in Upper South Fork, Lower South Fork, North Fork and Catoctin Creek watersheds.

Impairment	Subwatershed	Livestock Systems Fencing and Water Systems[1] ($)	Horse Systems Fencing Only[1] ($)	Hardened Crossings[1] ($)	Total ($)
Upper South Fork	1	7,000	4,000	0	11,000
	2	7,000	4,000	0	11,000
	3	28,000	7,000	0	35,000
	4	49,000	14,000	0	63,000
Lower South Fork	5	64,000	14,000	0	78,000
	6	14,000	4,000	0	18,000
North Fork	7	57,000	14,000	0	71,000
	8	21,000	7,000	0	28,000
	9	21,000	7,000	0	28,000
	10	92,000	22,000	0	114,000
Catoctin Creek	11	28,000	7,000	0	35,000
	12	42,000	11,000	0	53,000
	13	42,000	11,000	0	53,000
	14	42,000	11,000	0	53,000
	15	57,000	14,000	0	71,000
	16	14,000	4,000	0	18,000
Total		**585,000**	**155,000**	**0**	**740,000**

[1] Values rounded to the nearest thousand.

Table 5.5 High and low estimated costs of replacing straight pipes by subwatershed in Upper South Fork, Lower South Fork, North Fork and Catoctin Creek watersheds.

			High Estimate[1]		Low Estimate[1]	
Impairment	Subwatershed	Straight Pipes (#)	Septic Systems ($)	Alternative Sewer Systems ($)	Septic Systems ($)	Alternative Sewer Systems ($)
Upper South Fork	1	0	0	0	0	0
	2	1	0	36,000	7,000	0
	3	1	0	36,000	7,000	0
	4	5	0	180,000	35,000	0
Lower South Fork	5	3	0	108,000	21,000	0
	6	0	0	0	0	0
North Fork	7	1	0	36,000	7,000	0
	8	1	0	36,000	7,000	0
	9	1	0	36,000	7,000	0
	10	1	0	36,000	7,000	0
Catoctin Creek	11	1	0	36,000	7,000	0
	12	1	0	36,000	7,000	0
	13	0	0	0	0	0
	14	1	0	36,000	7,000	0
	15	2	0	72,000	14,000	0
	16	1	0	36,000	7,000	0
Total		**20**	**0**	**720,000**	**140,000**	**0**

[1] Values rounded to the nearest thousand.

5.4.1.2 Technical Assistance

It was determined by the LSWCD, VADCR, VDH, and Steering Committee members that it would require $50,000 and $35,000 to support the salary, benefits, travel, training, and incidentals for education of one technical FTE and administrative FTE, respectively. With quantification analysis yielding a need for 1 agricultural technical FTE and no administrative FTE, per year the total cost to provide agricultural technical assistance during implementation is expected to be $250,000 total for 5 years. It is assumed that one person working full time can fulfill all agricultural technical and administrative needs over the five years. For residential technical assistance, approximately $125,000 is needed to support a half technical FTE over the 5 years. It is assumed that one person working half time can fulfill all residential technical and administrative needs over the five years.

5.4.2 Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal contamination in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek will be reduced to meet water quality standards. It is hard to gage the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, because of the reductions required, the incidence of infection from fecal sources through contact with surface waters should be reduced considerably. Additionally, because of stream-bank protection that will be provided through exclusion of livestock from streams, and restoration of the riparian area through anticipated implementation of the Conservation Reserve Enhancement Program (CREP) in some areas, the aquatic habitat will be improved and progress will be made toward reaching the General Quality (benthic) standard in these waters. The established vegetated buffers will also serve to reduce sediment and nutrient transport to the stream from upland locations. In areas where pasture management is improved through implementation of grazing-land-protection BMPs, soil and nutrient losses should decrease, and infiltration of precipitation should be increased, decreasing peak flows downstream.

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 and residential practices recommended in this document will provide economic benefits to the landowner as well as the expected environmental benefits. Specifically, alternative (clean) water sources, exclusion of cattle from streams, and intensive pasture management, and private sewage system maintenance will each provide economic benefits. 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 VCE (1998a) reports that mastitis currently costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7-2 billion annually or 11% of total U.S. milk production. 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 OSTS, 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.,* driving or parking on top of them), not planting trees in where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper

maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system. Additionally, 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 water system installation 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 large 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. MEASUREABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

The LSWCD has agreed to undertake the responsibility of overseeing the agricultural program during implementation in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, while VDH has agreed to be the lead agency for the residential program. Tasks expected to be completed during implementation are detailed in Section 6.3 of this document. Full implementation is expected in 5 years, with de-listing from the Virginia Section 303(d) list in 10 years. Funding sources, identification of milestones, timeline for implementation, targeting of control measures, and the roles of stakeholders during the process are described in this section.

6.1 Funding

The following practices are acceptable for the Catoctin Creek Implementation Plan (IP): SL-6, WP-2, FR-3, SL-6A, SL-6B. Potential funding sources available during implementation were identified during IP development. A brief description of program and requirements is provided. Detailed description of each can be obtained from the LSWCD, VADCR, NRCS, VCE, and VADEQ. Each of the 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 LSWCD 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, VADCR, VADEQ 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. VADCR also administers EPA grant funds provided through the Chesapeake Bay Program for the implementation of nonpoint source programs within the Chesapeake Bay Drainage Basin. Program requirements are set depending on NPS project funding request. During implementation, standards, specifications, cost-share, and tax credits for practices under the Virginia Agricultural BMP Cost-share Program will be followed for funding eligibility. The SL-6, WP-2 and SL-6A practices have a 75% cost-share through this program not to exceed $50,000. The FR-3 practice further benefits the landowner by paying $200 per acre of trees planted in the stream riparian zone. The SL-6B has a 25% tax credit available through this program. A 319 grant will be written upon completion of the IP, and in subsequent years during implementation, given reasonable progress toward implementation.

Virginia Agricultural Best Management Practices Cost-Share Program:

The cost share program is funded with state and federal moneys 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 from excessive surface flow, erosion, leaching, and inadequate animal waste management. Program participants are recruited by Soil and Water Conservation Districts based upon those factors, which most influence their land use impact upon water quality. The objective is to solve water quality problems by fixing the worst problems first. Cost-share is 75% of actual cost not to exceed $50,000.

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 the Chesapeake Bay, 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 chapter, 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 with 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 best management practices. 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 best management practice 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 the Chesapeake Bay. A primary objective of this fund is to reduce the flow of excess nitrogen and phosphorous into the Chesapeake Bay. Eligible organizations 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 subjected 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 that was planted or considered planted in an agricultural commodity two of the five most recent crop years; and 2) Cropland classified as "highly-erodible" by NRCS or cropland within the Chesapeake Bay priority area. 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 a rental rate of $76/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.

First, the landowner should visit the nearest Farm Service Agency (FSA) center to complete CREP application forms, which are forwarded to local NRCS and SWCD offices. FSA then 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

landowners' 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 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. 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 1 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 $18,850.

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, 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., marine animals, or endangered species. Grants are awarded for the purpose of conserving fish, wildlife, plants, and their habitats. Special

grant programs are listed and described on the NFWF website. If the project does not fall into the criteria of any special grant programs, it may be submitted as a general grant under the following guidelines: 1) the proposal promotes fish, wildlife and habitat conservation, 2) involves other conservation and community interests, 3) leverages available funding, and 4) evaluates project outcomes. A pre-proposal that is not accepted by a special grant program may be deferred to the general grant program.

Chesapeake Bay Small Watershed Grants Program

The purpose of this program is to foster citizen-based resource stewardship and to address the water quality resource needs to the Chesapeake Bay ecosystem. Grants range in size from $5,000 to $50,000. Each year five Community Legacy Grants of $100,000 are awarded to promote innovative projects that restore native aquatic habitat, and develop watershed management plans. Eligible applicants are either non-profit organizations or local governments. Individuals, state and federal government agencies, and private for-profit firms are not eligible for grants under this program. Funding eligibility requires that a project must a) support the development/implementation of a local watershed management plan that deals the ecology in the Chesapeake Bay watershed, or b) promote locally-based pollution/habitat destruction prevention and restoration efforts. Applicants should read the *Chesapeake 2000 Agreement* (http://www.chesapeakebay.net/c2k.htm). In addition, projects must also directly attend to at least one of these priority goals:

- Restore, enhance, and protect the finfish, shellfish, and other living resources, their habitats, and ecological relationships to sustain all fisheries and provide for a balanced ecosystem.
- Preserve, protect, and restore those habitats and natural areas that are vital to the survival and diversity of the living resources of the Bay and its rivers.
- Achieve and maintain the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health.
- Develop, promote, and achieve sound land use practices which protect and restore watershed resources and water quality, maintain reduced pollutant loadings for the Bay and its tributaries, and restore and preserve aquatic living resources.

- Promote individual stewardship and assist individuals, community-based organizations, businesses, local governments, and schools to undertake initiatives to achieve the goals and commitments of the agreement.

Matching funds are not required for this program, however, preference will be given to projects that leverage the grant award with contributions of funds, goods or services from project partners. Projects should demonstrate broad partnerships, such as strong community and local government support. Letters documenting this support are strongly encouraged. Documentation of technical assistance received or review by proper governmental agencies is also encouraged. The project narrative should include a detailed timetable of project progress and completion. Preference will be given to new projects and those that have not previously received support. Include two copies of a signed application form, a proposal narrative, a map indicating the location of the project, documentation of support, and suitable additional materials.

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

6.1.1 Possible Funding Scenario

Aside from the loan programs, the funding sources that are expected to play the largest role in the first year of implementation are the 319 Incremental Funds and the Virginia Agricultural BMP Tax Credit Programs. The 319 Incremental Funds will be used to fund

appropriate BMPs at the levels described in the Virginia Agricultural BMP Cost-Share Program. In addition, these funds will be used to fund technical assistance, support educational programs, and fund residential cost-share programs. Residential programs will be supported through a funding program based on economic need. Based on these funding sources, a possible scenario for first year funding is presented in Table 6.1. This scenario represents 20% installation of needed agricultural systems addressing livestock exclusion (*i.e.,* full livestock exclusion systems and hardened crossings), 20% of straight pipes replaced (*i.e.,* 50% with septic system and 50% with alternative system), one agricultural technical FTE and 0.5 residential technical FTE.

Table 6.1 One possible scenario for funding in the first year.

Funding Source	Agricultural ($)	Residential ($)	Total ($)
319 Incremental Funds			
Practices	122,000	0	**122,000**
Technical Assistance	50,000	25,000	**75,000**
Cost-Share[1]	0	49,000	**49,000**
Landowner	60,000	37,000	**97,000**
Total[2]	232,000	111,000	**343,000**

[1] 25% tax credit and other programs available

[2] Grand Total rounded to nearest $1,000

6.2 Milestones Identification

The end goals of implementation are restored water quality in the impaired waters and subsequent de-listing of the waters from the Commonwealth of Virginia's Section 303(d) list within 10 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. Additionally, a workbook for tracking implementation is being provided to the responsible parties for agricultural and residential programs. Assessment of the streams will be conducted through the VADEQ ambient monitoring program. It is recommended that additional water quality monitoring should be implemented based on the water quality monitoring plan provided in Appendix B.

Expected progress in implementation is established with two types of milestones: *implementation milestones* and *water quality milestones*. Implementation milestones

establish the percentage 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 5 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 5-year mark, and de-listing at the 10-year mark).

Stakeholders established that implementation would begin in August 2004 after which five milestones need to be met within the next five years (Table 6.2). The first milestone will be one year after implementation begins, whereby 20% of the livestock exclusion systems and 20% of the residential control measures will be installed with a 3% to 10% expected reduction in violations of geometric mean FC water quality standard. After five years from the start of implementation, 100% of the livestock exclusion systems will be installed and 100% of straight pipes corrected, resulting in a 71% to 78% anticipated reduction in FC standard exceedances. The final milestone will be de-listing of the impaired segments from the Section 303(d) list, which is anticipated to occur by 2014.

6.3 Timeline

Based on meeting the above milestones, a five-year implementation plan timeline was formulated as depicted in Figure 6.1. This timeline describes the annual needs for implementation in terms of completion of the agricultural and residential control measures. The timelines in Tables 6.3 and 6.4 show the annual implementation needs for agricultural and residential control measures, technical assistance, and total costs. It will cost an estimated $344,000 to complete 20% of the implementation plan each year. Over the 5 years of implementation it will cost an estimated $1.72 million.

Table 6.2 **Implementation and water quality milestones *(i.e.*, estimation of FC geometric mean water quality standard exceedances) in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek watersheds.**

Milestone	Date	Implementation Milestone	Water Quality Milestone: FC geometric mean water quality exceedances in			
			Upper South Fork (%)	Lower South Fork (%)	North Fork (%)	Catoctin Creek (%)
Existing	8/1/2004	Implementation Begins	33	20	34	17
1	8/1/2005	20% Livestock Exclusion Systems Installed, 20% Straight Pipes Corrected	32	18	32	16
2	8/1/2006	40% Livestock Exclusion Systems Installed, 40% Straight Pipes Corrected	29	16	30	14
3	8/1/2007	60% Livestock Exclusion Systems Installed, 60% Straight Pipes Corrected	24	14	25	13
4	8/1/2008	80% Livestock Exclusion Systems Installed, 80% Straight Pipes Corrected	16	11	17	10
5	8/1/2009	100% Livestock Exclusion Systems Installed, 100% Straight Pipes Corrected	6	5	8	5
6	8/1/2014	De-listing from 303(d) List	0	0	0	0

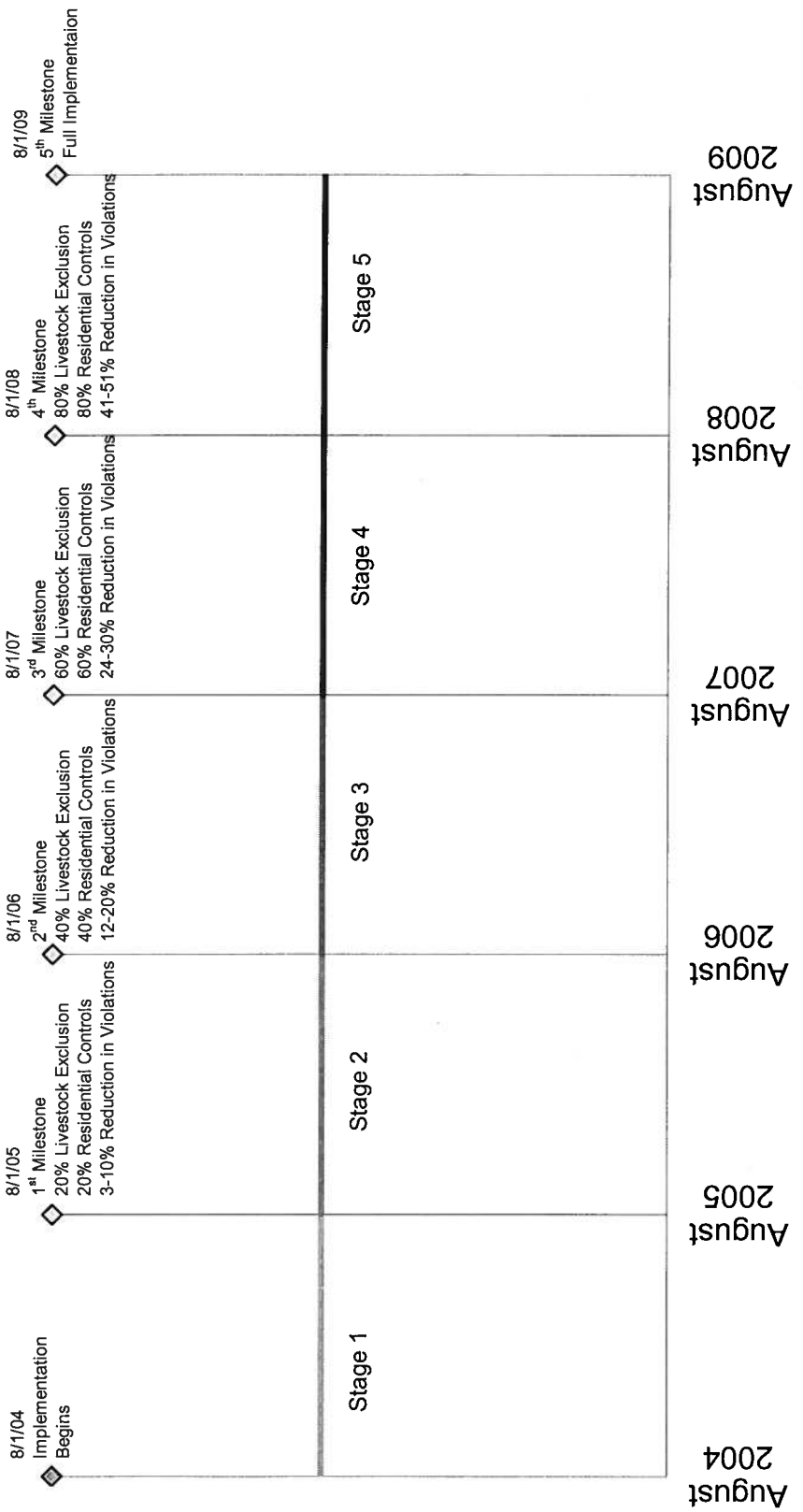

Figure 6.1 Timeline of milestones of the Catoctin Creek IP.

Table 6.3 **Percentage of practices to be installed addressing livestock exclusion and straight pipes with amount of technical assistance needed in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek watersheds.**

			Agricultural Assistance	Residential Assistance
Date (year)	Livestock Exclusion (%)	Straight Pipes (%)	*Technical* (FTE)	*Technical* (FTE)
1	20	20	1	0.5
2	20	20	1	0.5
3	20	20	1	0.5
4	20	20	1	0.5
5	20	20	1	0.5
Total	**100**	**100**	**5**	**2.5**

Table 6.4 **Costs associated with percentage of practices installed addressing livestock exclusion, straight pipes, and technical assistance needed in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek watersheds.**

			Agricultural Assistance	Residential Assistance	Estimated
Date (year)	Livestock Exclusion ($)	Straight Pipes ($)	*Technical* ($)	*Technical* ($)	Total Cost Per Year ($)
1	182,519	86,000	50,000	25,000	344,000
2	182,519	86,000	50,000	25,000	344,000
3	182,519	86,000	50,000	25,000	344,000
4	182,519	86,000	50,000	25,000	344,000
5	182,519	86,000	50,000	25,000	344,000
Total	**913,000**	**430,000**	**250,000**	**125,000**	**1,718,000**

6.4 Targeting

Implicit in the process of a staged implementation is targeting of control measures. Targeting ensures optimum utilization of resources. Targeting of critical areas for BMP installation was accomplished through analysis of land use, farm boundaries, stream network GIS layers, and monitoring results. Monitored data collected during the TMDL development process was used together with spatial analysis results to identify subwatersheds where initial implementation resources would result in the greatest return in water quality improvement. Modeling was performed to evaluate improvements in water quality based on localized implementation of agricultural control measures. For example, 50% livestock exclusion and 100% of the straight pipes corrected resulted in 13% to 26% exceedances in the geometric mean water quality standard, when livestock exclusion systems were evenly installed between subwatersheds (Table 6.5). By distributing the systems in the identified subwatersheds, the geometric mean exceedances were 17%, 16%, 16%, and 12% in Upper South Fork Catoctin Creek, Lower South Fork Catoctin Creek, North Fork Catoctin Creek, and Catoctin Creek, respectively. The subwatersheds were ranked by animals per length of fence needed. If feasible, effort should be made to prioritize resources in the following order of subwatersheds: 2, 1, 11, 8, 12, 13, 4, 16, 7, 14, 3, 10, 6, 15, 5, 9. The subwatersheds ranked by this ratio are shown in Figure 6.2. To understand where the prioritized subwatersheds are geographically, refer to Figure 6.3.

Table 6.5 Example of targeting subwatersheds to maximize implementation efforts and finances.

Implementation Milestone	Targeting	Water Quality Milestone: FC geometric mean water quality exceedances in			
		Upper South Fork (%)	Lower South Fork (%)	North Fork (%)	Catoctin Creek (%)
50% Livestock Exclusion Systems Installed, 100% Straight Pipes Corrected	without targeting (50% reductions for all subwatersheds)	20	13	26	13
50% Livestock Exclusion Systems Installed, 100% Straight Pipes Corrected	with targeting	17	16	16	12

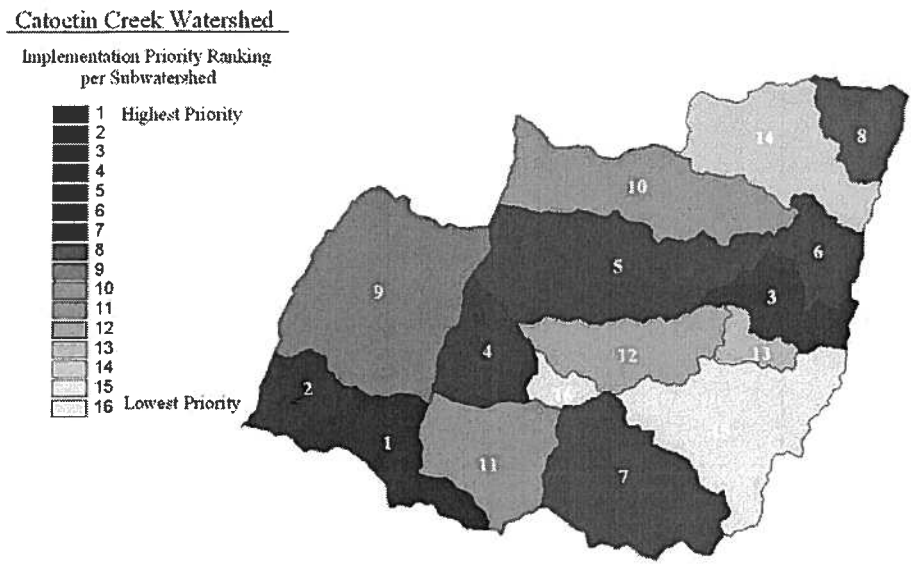

Figure 6.2 Catoctin Creek subwatersheds ranked by implementation priority.

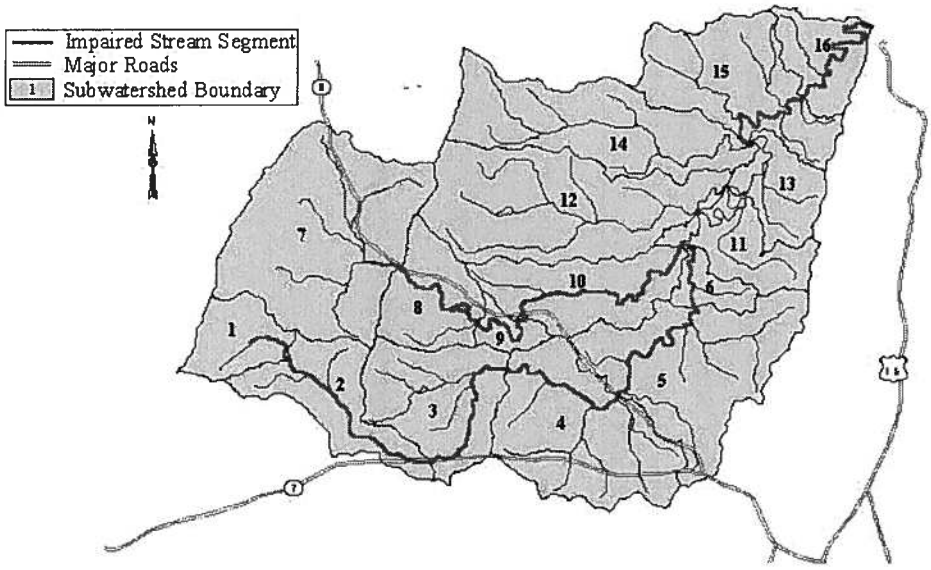

Figure 6.3 Catoctin Creek impaired segments and subwatersheds.

For residential programs, targeting was geared toward narrowing the search for straight pipes. Analysis of water quality monitoring conducted during the TMDL development and spatial data were used to identify the most promising areas to look for straight pipes. Figure 6.4 indicates the summarized results of Bacterial Source Tracking (BST) conducted during the TMDL development. Specifically, the overall human contribution is indicated as a percentage of fecal bacteria analyzed during the study. The results indicate that subwatershed 3 in the most likely area to find straight pipes, followed by subwatersheds 7 through 10 and subwatershed 5. Spatial analysis was performed to identify land parcels next to a stream with buildings not known to have a wastewater treatment system. These land parcels have the potential for straight pipes (Figure 6.5). This map is based on GIS spatial data and has not been ground truthed. These results are documented here to assist in locating straight pipes. Using this data, efforts can be made to contact residents in these areas first during implementation to address straight pipes.

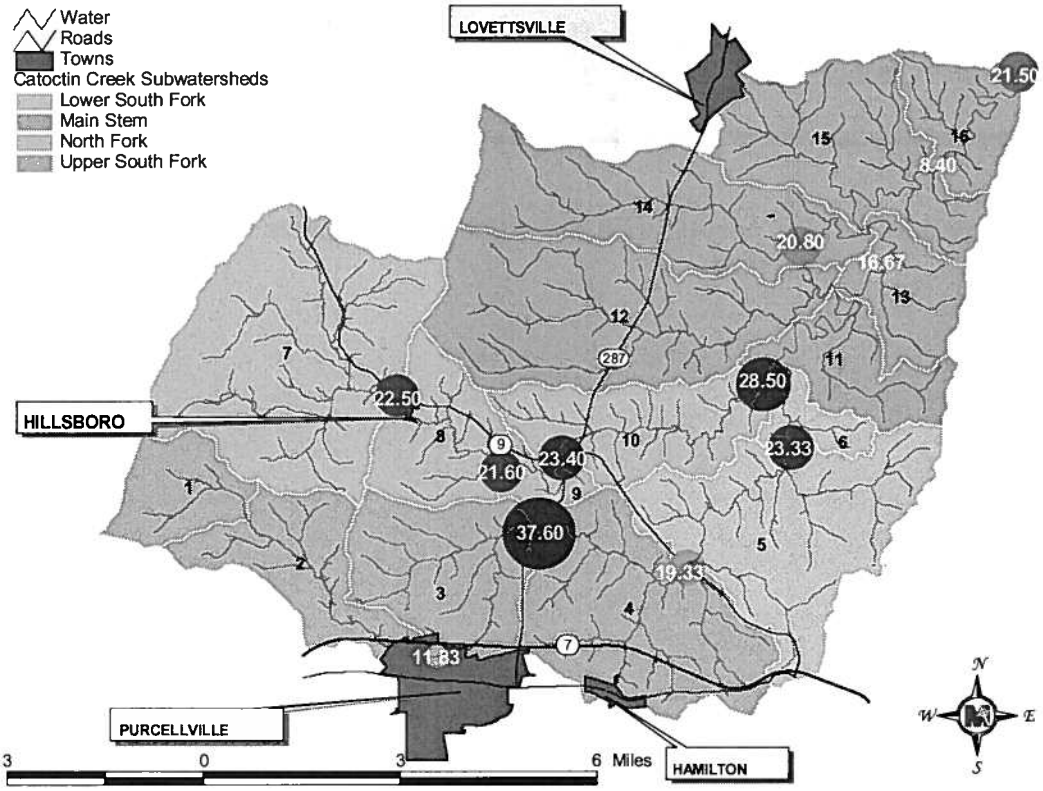

Figure 6.4 BST results from the Catoctin Creek TMDL.

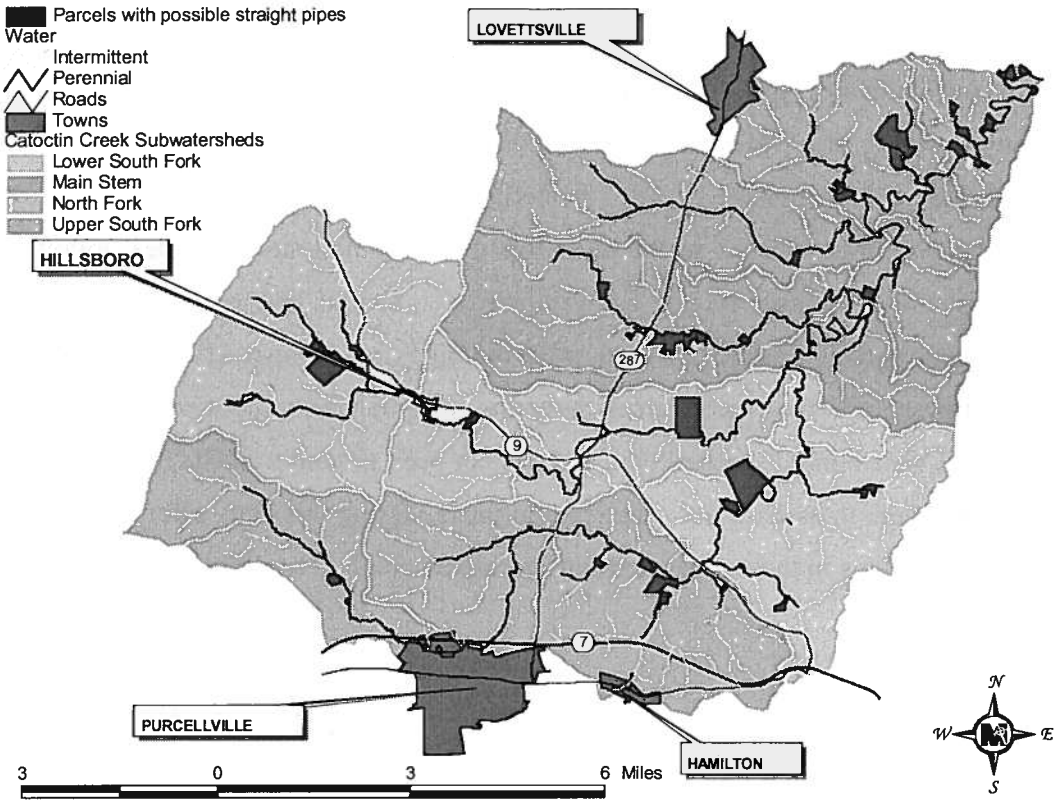

Figure 6.5 Land parcels with potential straight pipes in the Catoctin Creek watershed.

7. STAKEHOLDERS AND THEIR ROLE IN IMPLEMENTATION

Achieving the goals of this effort (*i.e.,* improving water quality and removing these waters from the impaired waters list) is without a doubt dependent on stakeholder participation. Not only the local stakeholders charged with implementation of control measures, but also the stakeholders charged with overseeing our nation's human health. 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.

The detrimental effects of bacteria in food and water supplies have been documented repeatedly. For example, in May 2000, in Walkerton, Ontario, a town of approximately 5,000 people, there were seven confirmed deaths with four other deaths under investigation, and over 2,000 poisonings all attributed to drinking water polluted by *E. coli* Type 0157:H7 (Raine, 2000; Miller, 2000). *E. coli* is a type of FC bacteria commonly found in intestines of humans and animals. Financially, the contamination resulted in a $250 million class action lawsuit filed against the Ontario government. The source of the pollution according to the Cattleman's Association was likely runoff from a feedlot located more than 5 miles from the wells used for the town's water supply. According to veterinarian Gerald Ollis, cattle are the "number one reservoir for this type of *E. coli* " and five to forty % of cattle shed the bacteria at any given time.

On August 8, 1994, VDH was notified that campers and counselors at a Shenandoah Valley summer camp developed bloody diarrhea. It was confirmed that *E. coli* 0157:H7 was the causative agent (CDC, 1995). In Franklin County Virginia, 1997, an outbreak of illnesses involving 3 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 almost died as a result of the exposure (Roanoke Times, 1997a, 1997b, 1998b). In August of 1998, 7 children and 2 adults at a day-care center in rural Floyd County were infected with *E. coli* (0157:H7). Upon investigation, two of the properties' 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 U.S., the Centers for Disease Control estimates at least 73,000 cases of illnesses and 61 deaths per year are caused by *E. coli* 0157:H7 bacteria, a FC pathogen (CDC, 2001). Other 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.

7.1 Monitoring

The only water quality monitoring that is currently funded is performed by VADEQ. A local watershed group, Loudoun Watershed Watch (LWW), has developed a complementary monitoring plan for Catoctin Creek and will seek funding (Appendix B). This plan was developed to better define implementation progress. This effort will increase awareness of the water quality problem and encourage citizen participation.

7.2 Education

Three organizations will be involved in public education: LWW, VCE, and LSWCD. The LWW, a citizen-based group, plans to hold a "Watershed Day" with BMP tours, demonstrations, and a free lunch to all citizens of the Catoctin Creek watershed. They plan to provide a monthly e-mailed newsletter, display posters at local businesses, and give handouts at local events relating information about restoring Catoctin Creek (Appendix B). The LWW website is kept current at: www.loudounwatershedwatch.org.

The VCE responds to the needs of individuals, families, groups and organizations with educational programs. Citizens of Virginia can participate through their local extension office.

The LSWCD will be in charge of initiating contact with farmers in the Catoctin Creek watershed to encourage the installation of cattle and horse exclusion systems. This one-on-one contact will facilitate communication of the water quality problems and the corrective actions needed. The LSWCD also publishes a newsletter, can send out mailings, and arrange field days to educate the public during implementation.

7.3 Legal Authority

The EPA has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are four state agencies responsible for regulating activities that impact water quality in Virginia. These agencies are VADEQ, VADCR, VDACS, and VDH.

VADEQ has responsibility for monitoring waters to determine compliance with state standards, and for requiring permitted point dischargers to maintain loads within permit limits. It has the regulatory authority to levy fines and take legal action against those in violation of permits. Beginning in 1994, animal waste from confined animal facilities in excess of 300 animal units (cattle and hogs) has been managed through a Virginia general pollution abatement permit. These operations are required to implement a number of practices to prevent surface and groundwater contamination. In response to increasing demand from the public to develop new regulations dealing with animal waste, in 1999 the Virginia General Assembly passed legislation requiring VADEQ to develop regulations for the management of poultry waste in operations having more than 200 animal units of poultry (about 20,000 chickens) (ELI, 1999).

VADCR holds the responsibility for addressing nonpoint sources (NPS) of pollution. Most VADCR programs dealing with agricultural NPS pollution have historically been through education and voluntary incentive programs. These cost-share programs were originally developed to meet the needs of voluntary partial participation and not the TMDL-required 100% participation of stakeholders. To meet the needs of the TMDL program and achieve the goals set forth in the CWA, the incentive programs must be reevaluated to account for 100% participation. It should be noted, though, that VADCR does not have regulatory authority over the majority of NPS issues addressed here.

Through Virginia's Agricultural Stewardship Act, VDACS, the Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the

Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty up to $5000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. VDACS has only 2 staff members dedicated to enforcing the Farm Stewardship Act, and very little funding is available to support water quality sampling. The Agricultural Stewardship Act is entirely complaint-driven. In the last year reported (April 1, 2002 through March 31, 2003) 41 complaints, of which 27% were founded, had been received statewide. No fines have resulted from these complaints.

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

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

7.4 Legal Action

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

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

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

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

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

APPENDIX A

Working Group Minutes

Catoctin Creek Water Quality Implementation Plan

Agriculture Working Group

Report to the Steering Committee

Working Group Members

James Kern, MapTech
Phillip McClellan, MapTech
Jim Christian, Loudoun Soil & Water Conservation District (LSWCD)
Pat McIlvaine, LSWCD
Peter R. Holden, LSWCD
Larry Wilkinson, Natural Resources Conservation Service
Mark Moszak, Loudoun County Administration
Corey Childs, Extension
Debbie Cross, Virginia Department of Conservation and Recreation
Carol Evans, Virginia Department of Forestry
John Mazza, Loudoun County Environmental Health

Jack Evans
Robert E. Carr
Sandra D. Hutchison
Charles Light
Jim McIntosh
George Humphries
David Ward
Edwin Potts, Sr.
R.T. Legard
Rodney Crone
Darcy Anderson

Jeennie Evans
Jack Hutchison
Vivian V. Light
Bob Laycock
Reg Jones
Moke Anderson
Justin Potts
Eddie Potts
Al Burgess
Dru Lucia Roia
Bob Grubb

April 14, 2004

The goals of the Agriculture Working Group (AWG) were to

1) Identify constraints to the implementation of BMPs,
2) Identify alternative BMPs that are both effective and more palatable to the participant,
3) Identify alternative funding sources/partnerships that will promote implementation,
4) Identify appropriate measurable goals (50% of stream fenced, 50% of direct deposition removed) for gaging progress,
5) Identify timeline for achieving implementation goals, and
6) Review implementation strategies from an agricultural perspective.

The AWG held three meetings, the first meeting took place on November 20, 2003 with 6 members of the AWG present. Due to the sparse attendance (*i.e.*, only one attendee who owned livestock in the watershed), attention focused on increasing participation. The second meeting took place on January 14, 2004 with 26 members present, followed by a third meeting with 17 members present. The members focused primarily on practices that would reduce livestock access to streams, since the nonpoint source load allocations that must be met for the fecal coliform TMDLs for the Upper South Fork, Lower South Fork, North Fork, and mainstem of Catoctin Creek pertain to reductions to direct nonpoint sources. These include straight pipes and livestock access to the stream. The following summarizes the discussion:

Constraints to Implementation

The constraints to implementing the traditional BMPs were primarily economic and included initial costs of implementation, additional maintenance, loss of productive land in buffer areas between fencing and stream, and an aging farmer population that may be more inclined to subdivide their farm than to participate in cost-share programs.

Out-of pocket expenses are always of concern for small farms with limited budgets. Additionally, there are costs (time and money) associated with maintaining the fence. Flooding can damage streamside fencing incurring repair costs. There is also a cost associated with maintaining the area around the fence (*e.g.*, controlling growth along fence that can interfere with the operation of electric fences and mowing buffer areas). The full cost of streamside fencing and buffer areas include not only the costs associated with installation, repair, and maintenance, but also the cost of taking land out of production. It was suggested that, in Loudoun County, there is not enough land on many individual farms to adsorb this impact. Given these constraints, and an aging farmer community, it is likely that some farmers will opt for retirement rather than participation in cost-share BMP programs. The general perception of the group was that this would have negative impacts on water quality.

Existing BMP Incentive Programs

There was some discussion of existing BMP incentive programs. These programs were originally designed to address some of the same constraints identified by the AWG. The Conservation Reserve Enhancement Program (CREP), and many of the practices offered through Virginia's Agricultural BMP Cost-Share Program (SL-6, SL-6B, WP-2) were discussed. These programs/practices are briefly described below:

CREP: Includes water system(s) and streamside fencing.

35-100' buffer allowable anywhere. Up to the width of the flood plain. Not to exceed 330'.
Tree planting required in buffer area.
Must maintain buffer area and exclude cattle for the duration of the contract.
Cross fencing and additional water systems can be included through the other programs.
50% federal cost-share (Based on county average).
Up to 25% state cost-share (Not to exceed $200).
40% incentive payment upon completion.
$80/acre rent on stream buffer area for 10-15 years.

SL-6: Water system(s) and fencing.

35' minimum average distance from top of bank.
No tree planting required.
Multiple water systems and cross fencing to support rotational grazing included.
75% cost-share.
Tax credit worth 25% of operator's contribution.

SL-6B: Water system(s) without fencing.

No cost-share.
Tax credit worth 25% of total cost.

WP-2: Streamside fencing.

35' minimum average distance from top of bank.
No tree planting required.
75% cost-share.
Tax credit worth 25% of operator's contribution.

CREP and SL-6 are considered the most promising programs/practices for beef operations in the watershed, while WP-2 may be attractive to some horse owners, with existing alternative water supplies. The SL-6B practice was generally viewed as a less attractive option, given that stream exclusion (fencing) may still be required at some point in the future. It was also pointed out that, in the areas that currently have Implementation Plans in place, there is currently a 25% tax credit available for maintenance of streamside fences.

Alternative BMPs/Incentives

Some potential alternatives to existing BMP incentive programs were discussed. These included:

- Increasing the existing cost-share on installation and rental payments.
- Modifying the SL-6B practice to include a 50% cost-share.
- Increasing the support for maintenance.
- Cost-share to assist with horse manure removal

As noted above, most of the constraints to implementation are economic. Consequently, many of the proposed alternatives are economic in nature. It was suggested that the 75% cost-share rate would be adequate incentive for most horse owners. But, it would still be difficult for many cattle farmers to participate at this rate. Rental payments on land taken out of production were generally viewed as strong incentives. The rental payment associated with CREP ($80/acre) was viewed by some as being a fair price, but was considered by many to be inadequate, particularly if the land could be used for hay or for horses. Some cattle farmers indicated that this was not adequate compensation for grazing land either, since this may be the only available pasture during dry conditions. While the SL-6B option was generally viewed as a less attractive alternative to the other practices, given that fencing may still be required at some point in time, it has the advantage of being less complicated in terms of implementation. It was suggested that a 50% cost-share on this practice would attract participants who might otherwise not consider any of the options. Maintenance of the fence line is seen as a significant deterrent, which needs to be offset by rental payments or some form of support (monetary or volunteer labor). The 25% tax credit for maintenance costs was viewed as helpful, but inadequate. Finally, manure management for horse owners was viewed as a significant problem, since horse owners often do not have adequate land area for spreading it. The implication was that, depending on the location and size of the manure storage area, it could be essentially a direct deposition problem.

Alternative Funding/Support Sources

Several alternative sources of funding and other support were identified by the AWG. These included:

- Supplementing state cost-share funds with 319 funds
- Low-cost insurance for repairing flood-damaged fences
- Conservation easements
- Volunteers to assist with maintenance
- Support associated with trout waters
- Fund raiser(s)

Since state cost-share money for agricultural BMPs is still available in this area of the state, it was suggested that the 319 money that potentially becomes available upon completion of this IP should be used to supplement existing state cost-share. If this is possible, the 319 money could be used to establish a rental payment where SL-6 or WP-2 practices are installed, or to increase the incentive for installation. There was also interest in pursuing a low-cost insurance option for offsetting the risks associated with flood damage to fencing. Farm Bureau was suggested as a group who could be contacted regarding this item. Since there is interest in additional monetary incentives to support both installation and maintenance of BMPs, conservation easements for buffer land, where the landowner is paid a percentage of the land value to leave it undisturbed, may be viable options. There are various groups who have offered similar easements in the past and should be contacted regarding this project. Volunteer labor for installation and maintenance of practices was seen as another option for encouraging participation. Potential sources of volunteers included programs at Virginia Universities (*e.g.*, Virginia Tech and James Madison University). Another route for obtaining additional support is establishing parts of Catoctin Creek as trout waters. According to some members of the AWG, Catoctin Creek does have potential to support trout. Establishing Catoctin as a trout fishery could make assistance available from trout fishing groups, such as Trout Unlimited. These groups may be able to supply financial assistance for protecting streams and/or volunteer labor for repairing/maintaining fences. Finally, it was suggested that, given the level of philanthropy in the county, a fund raiser(s) may be a viable option for raising money to support implementation.

Additional Observations

Some livestock owners will be willing to participate in implementation with the existing programs, however to achieve full implementation it will probably be necessary to increase the incentives. Also, education will be a key component. The Extension Service can cooperate in providing education, regarding the advantages of implementing grazing systems and alternative water supplies. It was also noted that while beef producers would have a difficult time passing the extra costs on to their customers, larger horse operations probably could pass on some of the costs to customers. Additionally, participation could

be used as a marketing tool – "Board your horse here. We are a *green* farm, protecting Catoctin Creek for future generations."

Catoctin Creek Water Quality Implementation Plan

Environmental Working Group

Report to the Steering Committee

Working Group Members

Mike Shelor, Virginia Department of Conservation and Recreation
Bryant Thomas, Virginia Department of Environmental Quality
Jim Christian, Loudoun Soil & Water Conservation District
Mark Moszak, Loudoun County Administration
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April 14, 2004

Catoctin Creek Water Quality Implementation Plan
Environmental Working Group
Report to the Steering Committee

The goals of the Environmental Working Group (EWG) were to

1) Identify funding sources/partnerships that will promote implementation,
2) Identify complimentary monitoring programs, and
3) Review implementation strategies from an environmental perspective.

The EWG has held two meetings; the first meeting took place on November 19, 2003 with 9 members of the EWG present. The second meeting took place on January 22, 2004 with 4 members present. The members focused primarily on educational efforts and plans for monitoring. Additionally, the EWG reviewed progress with the implementation plan (IP) development. The following summarizes the discussion:

Education

Education was viewed as a critical component to the implementation plan. The need for an education coordinator was suggested, possibly a paid part-time position for someone who works out of his home, possibly someone who has done district type work. The coordinator could work specifically on the Catoctin Watershed IP or have countywide responsibilities. Some suggestions for responsibilities could be organizing local citizens to get involved in order to provide monitoring, cleanup, education, restoration, education, and writing grants for funding. Fairfax County was mentioned as a good model as they have a coordinator position and a strong citizen base.

Monitoring

While DEQ will be monitoring at stations in each impaired stream segment to assess compliance with the state standard, a more comprehensive monitoring plan was desired. Such a monitoring plan would include establishing baseline conditions, monitoring to gage progress during implementation, and assessment monitoring to establish final results. It was suggested that a targeted monitoring program linked to targeted implementation in a small drainage area would be helpful in establishing legitimacy of the project. It was suggested that the county, Watershed Watch, LSWCD, and DEQ should make a collaborative effort with regard to monitoring. One of the members, Darrell Schwalm of the Loudoun Watershed Watch, submitted a Monitoring Plan to support the Catoctin Creek IP (attached). If approved by the steering committee and DCR, it could be included in the IP.

Review of Progress To-Date

Initial results of spatial analyses were presented to the EWG. These analyses included identification of homes that did not have an entry in Loudoun County's Pollution Source Database (PSD), and quantification of streams with potential livestock access. The PSD lists, among other things, locations of septic systems. The intended result of this analysis was to narrow the search for straight pipes, by eliminating from the search homes that are known to have properly functioning septic systems. There was some concern voiced that the sites listed in the PSD do not necessarily indicate that a septic system is functioning properly. The analysis of streams with potential livestock access examined only perennial streams (not intermittent), as the direct deposition issue is of greatest concern during low flow, when intermittent streams are likely to be dry. Concern was expressed that more of the smaller (intermittent) tributaries may need to be addressed in the plan.

In identifying funding sources and needs, the following categories were identified:

- Implementation Practices
- Technical Assistance
- Education
- Monitoring

The EWG plans to have an additional meeting to discuss the educational plan further and review IP progress.

Catoctin TMDL Implementation Plan

Environmental Workgroup

TMDL Validation-Monitoring Design Materials

Submitted by:

Loudoun Watershed Watch

Purpose

EPA provides grant funds to states under Section 319 of the Clean Water Act to control nonpoint pollution sources. EPA guidelines1 to award these grants require that Total Maximum Daily Load (TMDL) Implementation Plans include a monitoring component to validate the effectiveness of the implementation efforts. A validation assessment is designed to document the effectiveness of the best management practices (BMPs) that have been installed to control nonpoint pollution and improve water quality. DEQ has responsibility to assess TMDL implementation, and will do this when remedial controls have been installed. These monitoring design materials provided by LWW will focus on local agency and citizen monitoring.

Water Quality Monitoring Guidelines

Guidelines for the water quality monitoring component of TMDL Implementation Plans are provided by DEQ and DCR2. These guidelines require that progress toward end goals be assessed during the implementation process through continued water quality monitoring. The guidelines address: (1) a schedule for monitoring, (2) location of monitoring stations, (3) organizations responsible for monitoring, and (4) monitoring procedures.

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1 EPA, "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003."

2 VADEQ and VADCR, "Guidance Manual for Total Maximum Daily Load Implementation Plans," July 2003.

Three types of data are included in this validation-monitoring plan.

- **Baseline Data** – The purpose of TMDL validation monitoring is to document whether the water quality has change from impaired to supporting. To accomplish this, a baseline needs to be established against which future progress to reduce pollutants throughout the Catoctin watersheds can be measured. Information on current water quality conditions is needed to set this baseline. In addition baseline data is needed in establishing measurable goals and water quality milestones. Monitoring data developed by DEQ that led to the impairment and the TMDL provides a good foundation of baseline data at the impaired segments of the watershed. This includes data from one trend station and several ambient watershed (AW) stations. However, DEQ did not conduct comprehensive studies of the water quality throughout the watersheds to determine which sections are impaired and which meet water quality standards. DEQ's data also do not include stream survey, habitat, or aquatic life data that characterize conditions in the watersheds. Therefore, existing DEQ data cannot be relied upon solely to provide an adequately baseline to validate the effectiveness of the TMDL Implementation Plan. Additional baseline data is needed from supplemental monitoring stations. These additional data do not need to meet DEQ "approved data" requirements regarding collection, analytical, and QA/QC protocols since they will not be used to establish or delist impairments.

- **Trend Data** – The implementation of BMPs will be accomplished in stages using the targeted method. Targeting the areas in the watershed with the greatest pollution loads will allow the greatest improvement in water quality to be achieved in the shortest amount of time. Once critical areas are identified, monitoring needs to continue throughout the process to document progress toward goals and to provide a mechanism for evaluating the effectiveness of the implementation actions.

    - **Spatial Monitoring** – Data collected from a spatially distributed monitoring network along a single segment of a stream are needed to identify critical areas and hot spots with heavy pollution loads, and to target implementation strategies. This type of monitoring will require special studies designed by DEQ and conducted by the LSWCD with support from citizen monitoring groups. It will also involve stream walks to help identify agricultural and septic tank hot spots.

    - **Temporal Monitoring** – DEQ has one trend station in the Catoctin watershed that will be sampled on a regular basis. Five additional AW stations will be sampled at six-year intervals with twelve samples collected over a two-year period. This level of monitoring will not be sufficient to track progress in restoring water quality throughout the watershed. Supplemental trend data is needed at key sites and at DEQ sites during the off year period. Data collected at stations within the impaired watershed on a fixed-frequency basis will improve the overall picture of the impairment and track progress on restoring water quality.

Local agency and citizen monitoring to identify hot spots and track progress do not need to meet DEQ requirements for "approved data" regarding collection, analytical, and QA/QC protocols since they will not be used to establish or delist impairments.

- **Validation Data** – DEQ guidelines3 provide that an impairment can be remove when one or two years of data from the same monitoring station that caused the original impairment and subsequent impairments show that water quality standards are being met. The impairments in the Catoctin watershed listed in 2002 were based upon data from five monitoring stations – one in Catoctin Creek, two in North Fork Catoctin Creek, and two in South Fork Catoctin Creek. Data for delisting an impaired stream will be collected by DEQ and will meet their collection, analytical, and QA/QC protocols.

Role of Local Monitoring

Local data provided by Loudoun County Agencies and citizen stream monitoring organizations to supplemental DEQ monitoring data under the Catoctin watershed TMDL Implementation Plan will serve four important needs.

- **Critical Pollution Areas** – Detailed water quality data are needed to identify hot spots and areas most heavily impacted by pollution in order to develop a staged implementation approach that will result in the greatest return in water quality improvement. This is consistent with findings in DEQ's TMDL report that additional monitoring that targets restoration projects "is critical to implementation development."4 DEQ relies upon local agency and citizen monitoring to collect these data.

- **Monitor Adequacy of Water Pollution Load Model** – Load requirement for nonpoint pollution are based upon models and not comprehensive field studies. Baseline and tend monitoring data are needed to assess the adequacy of the model assumptions and parameters. If field data show the implemented management controls based on the model are not effective, recommendations on redesigning the management controls will be considered by DEQ.

- **Track Improvements in Water Quality Throughout Watershed** – DEQ/DCR guidelines recognize that it is important to consider future TMDL needs for a watershed when establishing a monitoring plan. County and citizen data can help identify threatened areas in portions of the watershed not monitored by DEQ for appropriate follow-up by DEQ. Trend monitoring will track progress in these areas.

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3 DEQ, "Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report," November 3, 2003.
4 DEQ, "Fecal Coliform TMDL Development for Four Catoctin Creek Impairments, Virginia," March 2002, p. xv.

- **Provide Avenue for Citizen Involvement in TMDL Implementation Process** – Citizen monitoring will help keep County Agencies and citizen stream monitoring organizations involved in the TMDL Implementation Plan process. Trend data can be used to track progress and keep the public informed. Aquatic life and stream habitat monitoring data will help document that restoration projects that keep livestock out of streams and restore natural riparian buffers benefit overall stream health.

Siting

DEQ, Loudoun County Soil and Water Conservation District (LSWCD), Loudoun Wildlife Conservancy (LWC), and North Fork Goose Creek Watershed Association (NFGC) will conduct monitoring.

- **Spatial Monitoring Stations** – The spatial monitoring stations needed to develop targeted implementation goals will be developed by DEQ in collaboration with LSWCD and Loudoun Watershed Watch.

- **Temporal Monitoring Stations** -- The temporal monitoring plan will require some new stations to be monitored by one of the local groups. These stations are designated as "local" in the plan.

    - **DEQ Stations** – DEQ has eight monitoring stations in the watershed that will be used by DEQ to assess TMDL implementation. However, seven of these stations are for ambient watershed monitoring (AW) and will only be sampled on 12 occasions over a six-year period. The next sampling in Catoctin will likely occur "in the fiscal year following the actual installation of BMPs or a similar event-triggering target set by DEQ and DCR TMDL staff."5 Therefore, local data are needed at or near these stations to monitor progress on a more continuous basis.

    - **Benthic Monitoring Stations** – In 2004 benthic impairment on the South Fork Catoctin Creek in and downstream of Purcellville will be added to the impairments in the Catoctin watershed. At least two benthic monitoring stations, one in the impairment and one downstream in the non-impaired portion, are needed to assess progress in restoring stream health for aquatic life. In addition, benthic monitoring by DEQ, LSWCD, LWC, and NFGC will continue at several other locations in the watershed in order to document aquatic life conditions throughout the watershed.

    - **Monitoring Stations in Unimpaired Segments** – There are two tributaries to Catoctin Creek that do not have impairments – Milltown Creek and an unnamed tributary a short distance downstream from

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DEQ, "Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report," November 3, 2003, p. 47.

Milltown Creek. DEQ has established new ambient monitoring stations near the mouth of each tributary. Monitoring at these stations are included in the TMDL IP monitoring plan in order to track the contribution of these waters to the downstream impairment in the Catoctin mainstem.

The designated temporal monitoring stations for the TMDL Implementation Plan are listed in **Table 1.** This list distinguishes stations that are in impaired segments (yellow background) from stations in unimpaired portions of the watershed (green background). The list of impaired streams includes segments that will likely be newly listed by DEQ in 2004.

Table A.1 List of TMDL Implementation Plan Temporal Monitoring Stations for the Catoctin Watershed -- 2004.

Stream Name	Cause[1]	Boundaries of Impaired Segment	TMDL Monitoring Station[2]
Catoctin Creek Mainstem	FC	7.2 mile segment from its mouth at the Potomac River upstream to the confluence with Milltown Creek	**DEQ** -- Bacteria and benthic trend site 1ACAX004.57 at Rt. 668
Milltown Creek	NA	NA	**DEQ** - AW station 1AMIH001.98 at Rt. 673 **Local** - Establish a bacti and benthic trend site near the mouth of Milltown Creek at DEQ site.
Unnamed Tributary	NA	NA	**DEQ** - AW station 1AXJT002.22 off Rt. 681 **Local** - Establish bacti and benthic trend near mouth at DEQ site.
North Fork Catoctin Creek	FC	4.1 mile segment from the confluence with Catoctin Creek upstream to a point 0.2 miles downstream of the Rt. 287 bridge	**DEQ** - AW 1ANCO00.42 site at Rt. 681 **Local** - Establish bacti and benthic trend site at DEQ site. **LWC** - Maintain benthic site #1 at mouth of stream
North Fork Catoctin Creek	FC	North Fork Catoctin Creek from the impaired segment starting at stream mile 4.1 to its headwaters	**LSWCD** - Maintain bacti and benthic Site #10 at Rt. 287 (Wheatland Farm) **DEQ** – AW site 1ANOC009.37 at Rt. 718. **LSWCD** - Maintain bacti and benthic Site #11 at Rt. 719
South Fork Catoctin	FC	17.3 miles from the mouth at Catoctin Creek upstream to the headwaters	**DEQ** - AW 1ASOC001.66 at Rt. 698 **Local** - Establish bacti and benthic trend station at DEQ AW site at Rt. 698 **LSWCD** – Maintain bacti and benthic Site #9 at Rt. 711 **DEQ** – AW site 1ASOC007.06 at Rt. 738.

Stream Name	Cause[1]	Boundaries of Impaired Segment	TMDL Monitoring Station[2]
			Local -- Establish bacti trend station at Rt. 611
South Fork Catoctin Creek	Benthic	South Fork Catoctin Creek should be designated as impaired for aquatic life from Rt. 287 upstream to Rt. 690.	**DEQ** – Benthic 1ASCO13.05 at Rt. 7 bypass **LWC** – Maintain benthic site #4 at Rt. 611 – Purcellville Nature Park

[1] Causes of Impairments: FC = Fecal Coliform Bacteria; Benthic – Aquatic Life; NA – Does not apply
[2] AW = Ambient Watershed station; Local = to be sampled by local agency or citizen group

Parameters

- **Bacteria** – The impairments in the Catoctin watershed are based upon fecal pollution. Monitoring for *E. coli* organisms is to be used to assess the success of TMDL implementation. Water quality restoration will require improved Best Management Practices (BMPs) in (1) riparian buffers in order to keep livestock out of streams and (2) residential areas to better control stormwater runoff. These controls should decreased bacteriological levels in the streams.

- **Stream Health** – BMPs that reduce fecal wastes in streams will also result in improved protect of stream banks from erosion caused by livestock. Stream health will be improved as a result of reduced sediments, low levels of nutrients, good benthic macroinvertebrate communities, and improved stream habitat conditions. Measuring and tracking these stream health parameters will help validate TMDL implementation and document the benefits from the restoration. The stream health parameters involve tests that can be conducted by county agencies and citizen monitoring groups to supplement DEQ monitoring. The parameters are listed in **Table 2**.

Table A.2 Minimum Sampling Parameters for Trend Sampling Stations.

Parameter	Sampling Protocol	Analytical Protoco	Frequency
Water Temperature	Thermometer		Bimonthly
pH	LaMotte Kit	LaMotte Kit	Bimonthly
DO	LaMotte Kit	LaMotte Kit	Bimonthly
Turbidity	LaMotte Kit	LaMotte Kit	Bimonthly
Water Flow	?	?	Bimonthly
Nitrates	LaMotte Kit	LaMotte Kit	Bimonthly
Phosphates	LaMotte Kit	LaMotte Kit	Bimonthly
Benthic Macroinvertebrates	LWC/SOS	EPA RBPII	Spring & Fall
Stream Habitat	LWC	EPA RBPII	Yearly

Parameter	Sampling Protocol	Analytical Protoco	Frequency
E. coli Bacteria		EasyGel	Bimonthly

Frequency

Trend assessments require that samples be collected under as many different conditions as resources allow. An important consideration is providing enough samples to understanding variability. The TMDL model indicates that periods of low flow in the summer-fall months are the most unfavorable conditions for bacteriological water quality. In order to produce the needed information, trend stations should be sampled for a minimum of five years.

The implementation plan adopts DEQ's recommended frequency for sampling trend stations which is:

- bimonthly (6 times per year) for chemical and bacteriological parameters;
- yearly for stream habitat; and
- twice-yearly for biological parameters.

In addition, bacteriological samples will be taken under unfavorable conditions as local resources permit.

If local resources do not permit this level of sampling for at least five consecutive years, trend stations will be sampled for at least two years out of every six-year period following the model established by DEQ in 2002. These samples will be taken in years not sampled by DEQ.

Data Analysis

Trend data used to validate TMDL Implementation will allow a broad range of statistical analyses.

- Trend data can be analyzed using basic statistical summaries including:
  - Averages to show values typical of the data set;
  - Correlations to show the degree of differences between data sets; and
  - Comparisons with various reference conditions including water quality standards, informal guidelines established by federal or state authorities, and actual results from county or regional reference sites.

- Habitat and biological conditions can be analyzed using a multimetrics approach and either a reference stream or streams or the new Virginia Biological Index (VBI) being developed by DEQ in 2003.

Quality Assurance/Quality Control (QA/QC)

Quality assurance measures need to be compatible with the capabilities of county authorities and citizen watershed organizations. QA/QC parameters will include the following:

- Written, detailed protocol comparable with DEQ guidelines;
- Training for monitors;
- Data quality objectives as provided in **Table 3;**
- Equipment inspection and maintenance;
- 10% level of field equipment blanks for bacteriological water samples;
- 50% level of field duplicate samples for bacteriological water samples;
- 10% level of field observation of benthic monitoring by project coordinator; and
- 10% level of lab analysis of preserved field benthic macroinvertebrate samples.

The recommended QA/QC objectives for the sampling program are summarized in **Table 3.**

Table A.3 Quality Objectives for TMDL Implementation Monitoring in Catoctin Creek.

Monitoring Parameter	Quality Objectives
Chemical and Physical	90% completeness on data collection sheet
Bacteriological	90% completeness on data collection sheet
Benthic Macroinvertebrate Sample	80% precision in collecting representative sample 90% accuracy in ID 90% accurate of count 90% completeness on data sheet
Other parameters and meta data	90% completeness on data sheet

State/County/Citizen Role

Expanding monitoring to support TMDL implementation will require additional resources from each of the parties committed to restoring water quality in Loudoun County. It is recommended that each party contribute the following for TMDL implementation:

- **State –**
  - DEQ and DCR establish TMDL Implementation plans that include a DEQ, local agency, and citizen validation monitoring component;
  - DEQ collaborate to develop a spatial monitoring plan to identify critical areas for a staged implementation plan; and
  - DEQ/DCR use county and citizen assessment data in their tracking of TMDL implementation progress and their assessment of the adequacy of the TMDL model.
- **County –**
  - Loudoun County Soil and Water Conservation District (LSWCD) play the lead role in stream monitoring to provide supplemental TMDL spatial and temporal monitoring data; and
  - Loudoun County provides additional funding to LSWCD to increase resources for stream monitoring, data compilation and data analysis, and technical support to citizen monitoring programs.
- **Citizen –**
  - Loudoun Watershed Watch collaborates with DEQ to develop a spatial monitoring program to develop a staged implementation plan.
  - Loudoun Wildlife Conservancy and North Fork Goose Creek Watershed Association provide stream monitoring data collection to help validate TMDL implementation; and
  - Loudoun Watershed Watch provides outreach and education to develop additional citizen, stream stewardship groups and to recruit citizen stream monitors.

Catoctin Creek Water Quality Implementation Plan Government Working Group Report to the Steering Committee

Working Group Members

Marc Aveni, VA Dept. of Conservation & Recreation
Kate Bennett, VA Dept. of Environmental Quality
Jim Christian, Loudoun Soil & Water Conservation District
Todd Danielson, Loudoun County Sewer Authority
Jerry Franklin, Loudoun County Environmental Health
Mary Hashemi, Loudoun County Planning
Warren Howell, Loudoun County Education
Marie Janson, Environmental Protection Agency
Stuart Lehman, Environmental Protection Agency
Pat McIlvaine, Loudoun Soil & Water Conservation District
Mark Moszak, Loudoun County Administration
Glen Rubis, Loudoun County Building & Development
David Ward, Loudoun County General Services
Larry Wilkinson, Natural Resources Conservation Service

Facilitator
Charlie Lunsford, VA Dept. of Conservation & Recreation

March 22, 2004

Catoctin Creek Water Quality Implementation Plan
Government Working Group
Report to the Steering Committee

The Government Working Group's (GWG) function was to evaluate what resources the various federal, state and local agencies can provide to assist with implementing the Catoctin Creek Water Quality Implementation Plan. This evaluation included determining the role of government agencies in the process, identifying funding sources and technical resources available, and considering regulatory controls in place that could induce actions to improve water quality in the Catoctin Creek watershed.

The GWG held two meetings, the first meeting took place on November 18, 2003 with 15 members of the GWG present followed by a second meeting on January 22, 2004 with 9 members present. The members identified government programs that address on-site sewage disposal and provide assistance to agriculture producers in Loudoun County. These two areas were targeted since the nonpoint source load allocations that must be met for the fecal coliform TMDLs for the Upper South Fork, Lower South Fork, North Fork, and mainstem of Catoctin Creek pertain to reductions to direct nonpoint sources. These include straight pipes and livestock access to the stream. The following summarizes the discussion:

- The Natural Resources Conservation Service (NRCS) provides financial and technical assistance through several programs mandated by the Farm Bill. These include the Conservation Reserve and Enhancement Program (CREP), Environmental Quality Incentives Program (EQIP), and the Wildlife Incentive Program (WHIP). Area projects compete for funding with projects across the state as a result of a ranking process based mainly on environmental benefits.

- The Loudoun Soil and Water Conservation District provides financial and technical assistance to farmers through the Virginia Agricultural BMP Cost-Share and Tax Credit Programs. Many of the BMPs that are cost-shared by the state at 50% to 75% are also funded through federal programs.

- The local Agricultural Marketing Office provides business plans for agricultural producers as well as horse operations and wineries. It was acknowledged that Loudoun County has a significant number of horses. This office works with non-traditional framers, landowners with 25 – 30 acres, and leaves the technical details to the District and NRCS. This office has a lot of contact with the farm community in the Catoctin Creek watershed.

- Loudoun County can assist with the implementation plan development including the Planning Department assisting with public outreach (*e.g.*, notifying residents) and mapping of straight pipes. The County has expanding it's water resource monitoring program, and if resources and funding are available to the County's Water Resources Monitoring Program water quality sampling may be conducted at the Loudoun County/USGS cooperative stream gaging stations, if they are not already sampled by the Department of Environmental Quality (DEQ). This type of information could assist with monitoring implementation progress over time.

- The DEQ is currently on a two-year intensive monitoring cycle in the Catoctin Creek watershed and then will rotate off the monitoring stations for four years.

- The Health Department can offer assistance on locating straight pipes.

The GWG identified legal and regulatory controls that are currently in place that could facilitate participation in the implementation project, these include the following:

- The Virginia Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 et seq provides a regulatory means to eliminate straight pipes.

- The Agricultural Stewardship Act (ASA) which became effective April 1, 1997 is administered and enforced by the Virginia Department of Agriculture (VDACS). Complaints alleging that a specific agricultural activity is causing or will cause water pollution go to the Commissioner of VDACS. If a compliant meets the criteria for investigation the Commissioner's Office contacts the local Soil and Water Conservation District about investigating the compliant. If the District declines, VDACS' staff conducts the investigation. If the investigation determines that there is a problem, the farmer is given 60 days to develop a corrective plan. The Department of Conservation and Recreation along with DEQ have proposed to the Virginia Watershed Planning and Permitting Task Force that TMDL implementation move from a voluntary phase (up to 5 years) into a compliance phase (years 6-10) with more emphasis on regulatory controls such as ASA with reduced financial incentives from state assistance programs.

- A couple of local ordinances the River Stream Corridor Overlay District, Catoctin Creek Scenic River and stormwater were also identified. The specific policy for the Rivers and Stream Corridor Overlay District (RSCOD) as it applies to agriculture and

silviculture uses is found in the Revised General Plan, page 5-10, Policy 18 as follows:

> "The County will only allow development and uses in the RSCOD that will support or enhance the biological integrity and health of the river and stream corridor. Permitted uses will be required to have minimal adverse effects on wildlife, aquatic life, and their habitats; riparian forests, wetlands, and historic and archaeological sites; and will be required to complement or enhance the hydrologic processes of the river and stream corridors—including flood protection and water quality. Uses will be limited to:
>
> > j. Agricultural activities, but not structures, - including crop planting and harvesting, and grazing (subject to appropriate best management practice requirements).
> >
> > k. Silviculture – as required to care for forests and not commercial forestry (limited to forest preservation and tree planting; limited tree clearing and clearing of invasive species, tree trimming and pruning; and removal of individual trees; subject to appropriate best management practice requirements."

The Revised General Plan indicates that the above RSCOD standards/permitted uses also apply to the Catoctin Creek Scenic River (which is defined as the Catoctin Creek from Waterford to the Potomac River). This is described in the following policy (Revised General Plan, page 5-11, Policy 1): "The County will protect Scenic Rivers and the Potomac River by defining a protection area as a 300-foot no-build buffer or the RSCOD, whichever is greater. Development potential may be transferred from the no-build buffer according to density transfer guidelines provided by this Plan. The RSCOD performance standards, best management practice requirements and list of permitted uses will apply to the no–build buffer."

- The stormwater ordinance establishes a stormwater management program, which will include the design, development, improvement, operation, inspection, maintenance and oversight of the stormwater management system. Loudoun County is subject to Phase II of the Federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES) permit program for stormwater discharges administered by the Virginia Department of Environmental Quality through a General Virginia Pollutant Discharge Elimination System (VPDES)

Permit Regulation for Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems in the Commonwealth of Virginia (9VAC 25-750-10 et seq.). The ordinance addresses violations and enforcement related to the unlawful illicit discharge through the stormwater management system.

- The Chesapeake Bay Preservation Act is optional and Loudoun County has not yet adopted it. This is described further in the following policy (Revised General Plan, Policy 7, p. 5-9) "The County will consider adoption of the environmental regulations of the Chesapeake Bay Preservation Act (Bay Act). The County will seek to achieve those objectives of the Bay Act that are in the best interest of the County, and will actively participate in water quality initiatives to protect and improve regional water quality."

The GWG compiled a list of potential funding resources for the Catoctin Creek implementation project along with various technical resources that are available locally to assist with developing the implementation plan and assisting with the implementation project (see attachment).

Several recommendations that were provided by the GWG, include:

- Consideration be given to the use of a phased incentive-approach with the agricultural community, with producers who sign up for cost-share assistance early receiving a higher percentage.
- Use of demonstration farms at the start-up of the implementation project to "show-case" BMPs that need to be implemented in the watershed.

CATOCTIN CREEK WATER QUALITY IMPLEMENTATION PLAN

RESIDENTIAL WORKING GROUP

REPORT TO THE STEERING COMMITTEE

WORKING GROUP MEMBERS

George Humphries, Chairman
Bob Anderson
Victor Arnold-Bik
John Grigsby
Steve Heyl
Heather Humphries
John Mazza
Paul Protic
David Ward

FACILITATORS
Robert E. Lee
Gary Switzer

March 25, 2004

Catoctin Creek Water Quality Implementation Plan
Residential Working Group
Report to the Steering Committee

The Residential Working Group (RWG) brings to the Steering Committee a number of recommendations and concerns regarding the means to reduce the Fecal Coliform loading to the Catoctin Creek. They are based on a review of the Total Maximum Daily Load report, information the Steering Committee supplied, information derived thru Map Tech, Inc., and our experience living in the watershed.

Summary of Concerns

First and foremost, residents expressed concern that their children played in the stream on a regular basis, especially in the summer. At the same time they were unaware of any sicknesses, thereby giving them serious cause to question what the TMDL data implies. It is difficult to appreciate and understand the meaning of "fecal coliform impairment." The results should be in terms of the number of illnesses that can be expected (typically illnesses per 1000 people). The Fecal Coliform standards for whole body contact were set many years ago based upon a couple of health studies of bathing beaches that were done for total coliform and refined for only fecal. The U.S. Environmental Protection Agency currently has proposed revisions to their water quality standards – Water Quality Criteria for Bacteria for Recreational Waters (**Attachment 1**). The Criteria would allow a state to select or choose criteria based on illness rates that run from 8 illnesses per 1000 people to 14 illnesses per 1000 people. The proposed criteria will measure either Enterococci or E. coli. The Geometric Mean Density at 14 illnesses per 1000 has a magnitude of approximately 4.35 times that for 8 illnesses per 1000. In addition the single sample maximum allowable density for infrequently used full body contact at 14 illnesses per 1000 people is almost 20 times the geometric mean for 8 illnesses per thousand. In as much as Catoctin Creek is not a bathing beach and more likely falls into a category of infrequently used full body contact (full body contact is unlikely) there may be greater flexibility than exists today from a numbers standpoint with regard to what is acceptably safe. A detail review of those samples that divided wildlife, human and livestock indicates that the human portion violated current standards in only 5 of the 68 samples and using the EPA's criteria for E. Coli against the 10/15/01 storm event the illness level raises from 8 (current normal) to 12 per 1000. This is an illness rate of 1.2%. Based on this information, it can be concluded that it may be difficult to find failing systems or straight pipes due to the dilution.

It is also noted that the Department of Environmental Quality revised the state standards 9 VAC 25-260-5 et seq. to use E.coli, (126 geometric mean and 235 single sample maximum) for fresh water upon having 12 data points or after June 2008, but did not consider the latitude available by the EPA guidelines. In other words these standards are representative of the safe standard for "Primary Contact Recreation" defined as "any water-based form of recreation, the practice of which has a high probability for total body immersion or ingestion of water (examples include but are not limited to swimming, water skiing, canoeing and kayaking)."

Second, it is our understanding that the wildlife and livestock sources would have to improve in order to meet the standard. It would appear that unless all three contributors can show a means to reach the standard, and that firm commitments to do so are established, that any expenditure of public funds to achieve only part of the answer would not be cost effective. This is especially true if the stream ends up with a different use designation.

Third, due to the difficulty anticipated in finding these systems, the potential that due to wildlife or livestock the standard will not be met, it is recommended that no added effort beyond the current normal processes of home turnover, reported failures, and development be initiated that would cause any increase in the tax burden. Volunteer groups should be used where available such as the Boy Scouts and Keep Loudoun Beautiful.

Committee Goals

The Steering Committee requested that the RWG develop a plan that will (1) identify and eliminate straight pipes of wastewater from dwellings and businesses, and other failing onsite wastewater treatment systems, (2) recognize difficulties faced by landowners in correcting these problems, (3) identify potential means of funding corrections, (4) determine how to get landowners to come forward when there is fear of regulatory action and unknown costs, (5) determine technical assistance needed, and (6) educational tools that are most likely to help. The RWG added a 7th area "determine the cost to the taxpayer."

Opinions and Recommendations

The members of the RWG expressed that although they had the concerns expressed above, they all wanted to see the Creek as clean as could be and hoped it could be cleaned up so that it will meet water quality standards. In addressing the request for a plan, the RWG went through a process of brainstorming potential solutions for the seven areas, refining and combining solutions and then multi-voting on the solutions to determine which were best. The following is the results of that effort.

1. The best way by far to identify where straight pipes are located is for people to follow the stream to locate the straight pipes (walk, canoe, horse, etc.).
2. The greatest limitation that keeps homeowners from correcting the problem is funding the corrections. Many individuals who are on older systems are also on fixed incomes. Sewage correction can lead to a bathroom and well need also. The RWG identified two other limitations that should be considered along with the funding constraint. People don't believe there is a problem as addressed above; and people don't want government telling them what to do

especially when the cost is placed on them and there is no clear-cut problem. Many farmers don't want anything to do with government and may also have agricultural issues compounding the impact on them.

3. The best way to overcome homeowner's fears on correcting the problem is through a non-governmental work group such as Loudoun Watershed Watch and civic groups such Taylorstown Citizens Association. In addition, education, amnesty from prosecution, and letting them know that financial assistance is available will all help to overcome their fears.
4. It was the opinion of the RWG that funding would not drive results and that new funding should not be proposed. If the other barriers (Basis for real problem, multiple solution with livestock and wildlife, and government intervention) were eliminated there were two potential ways to address funding by
    a. Providing a loan for 100% of the assistance needed to fix the problem and reduce the required payback by 20% a year (requires a lien on the property for 5 years). Therefore, if a person stays in the home for 5 years the loan becomes a grant (could cost up to $1,080,000), and
    b. Provide base funding (equivalent to 100% of a 4 Bed Room septic and drainfield installation) to anyone with straight pipe who comes forward in the first year. Reduce it to 67% the second year and 33% the third year. After 3 years use enforcement and penalties (Scare). Provide low interest loans for any portion of systems that must go beyond a septic due to soil and site conditions. [ave cost $10,000 - $12,000 X 8 = $80,000 - $96,000] Provide rehabilitation funding up to base amount for failed systems within 50 feet of creek. Reductions would be as above in second and third year with enforcement in the forth or beyond. [$10,000 X 15 = $150,000].
5. It was concluded that the general public would not want to see any additional funding imposed on them to correct these problems when the barriers existed. A loan, as described in 4 above, would be an acceptable alternative as well as use of the current funding available today.
6. The best ways to educate homeowners are to
    a. Post signs that the creek is polluted (not impaired)
    b. Use word of mouth by phone trees and email trees, and
    c. By mailings to the residents

    The use of flyers was also recommended but not as high as they are easily trashed.
7. The RWG indicated that some of the things to be considered prior to educating the homeowner and in the process of educating the homeowner are
    a. Determine if the other sources can be sufficiently reduced to meet water quality standards
    b. Conduct additional sampling of the stream to give a more conclusive indication of where the human sources are located as well as the impact on the public health and the environment.
    c. Put language in common terms *i.e.,* polluted versus impaired.
    d. Attune the messages to the customer – Homeowner with problem vs. homeowner without problem (taxpayer) vs. homeowner who uses the creek for recreation.
8. It was noted that the map analysis of parcels with potential straight pipes developed by MapTech did not appear to be well supported and that the analysis should not be use without further scrutiny. The analysis appears to rely too heavily on the premise of searching for "holes" in the GIS data, that is parcels near creeks which a dwelling, but no septic field data. This objective is

hindered by the fact that there are inherent omissions and flaws with the GIS data and that the Health Department is currently rebuilding the "pollution source" layer of septic tanks.

The RWG believes that protecting our environment and continuing to focus on cleaner water by collaborating with voluntary organizations, landowners, all sectors of government while correspondingly encouraging novel inexpensive approaches will meet the environmental challenges of tomorrow. We look forward to working with the Steering Committee and proceeding in a manner that will enable us to achieve positive results for all the residents of the Catoctin Creek Basin and for all who cherish Virginia's creeks, streams, rivers and lakes.

Attachment 1 (From http://www.epa.gov/ost/standards/bacteria/bacteria.pdf)

Public Review Draft
May 2002

Appendix C: Sample Calculations of *E. Coli*/Enterococci Water Quality Criteria Associated with Different Risk Levels

Table B.1 EPA's Recommended 1986 Water Quality Criteria for Bacteria

Indicator	Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density			
			Designated Beach Area 75% C.L.*	Moderate Full Body Contact Recreation 82% C.L.	Lightly Used Full Body Contact 90% C.L.	Infrequently Used Full Body Contact 95% C.L.
freshwater						
enterococci	8	33	62	78	107	151
E. coli	8	126	235	298	410	576
marine water						
enterococci	19	35	104	158	276	501

*C.L. = confidence level. While more appropriately referred to as "percentiles", these values were originally described as "confidence levels" in EPA's 1986 criteria document.
Source: EPA, 1986.

Regression Equations Used to Calculate Geometric Mean Density:

Freshwater

E. coli: log (geometric mean) = (0.1064 x illness rate) + 1.249

Enterococci: log (geometric mean) = (0.1064 x illness rate) + 0.668

Marine Water

Enterococci: log (geometric mean) = (0.0827 x illness rate) - 0.0164

Equations Used to Calculate Single Sample Maximum Values:

Log (SSM) = (Log (Geometric Mean Value)) + ((Confidence Level Factor) x (Log Standard Deviation))

Confidence Level Factors: 75% = 0.68
82% = 0.94
90% = 1.28
95% = 1.65

Log Standard Deviation: Freshwater = 0.4 Marine Water = 0.7

Water Quality Criteria for Bacteria for Fresh Recreational Waters
Enterococci Criteria

Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density			
		Designated Beach Area 75% C.L.	Moderate Full Body Contact Recreation 82% C.L.	Lightly Used Full Body Contact 90% C.L.	Infrequently Used Full Body Contact 95% C.L.
8	33	62	78	107	151
9	42	79	100	137	193
10	54	100	128	175	246
11	69	128	163	224	315
12	88	164	208	286	402
13	112	209	266	365	514
14	144	267	340	467	656

E. coli Criteria

Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density			
		Designated Beach Area 75% C.L.	Moderate Full Body Contact Recreation 82% C.L.	Lightly Used Full Body Contact 90% C.L.	Infrequently Used Full Body Contact 95% C.L.
8	126	235	487	669	576
9	206	300	381	524	736
10	206	383	487	669	941
11	263	490	622	855	1202
12	336	626	795	1092	1536
13	429	799	1016	1396	1962
14	548	1021	1298	1783	2507

APPENDIX B

Loudoun Watershed Watch Monitoring and Education Plans

CATOCTIN TMDL VALIDATION MONITORING PLAN

Citizen Monitoring Component

Submitted by:

Loudoun Watershed Watch

Introduction

Stream monitoring is an important component of Total Maximum Daily Load (TMDL) Implementation Plans. Traditionally, Virginia has relied upon the Virginia Department of Environmental Quality (DEQ) to provide stream monitoring data to validate the TMDL model and assess the effectiveness of the Implementation Plan. DEQ also has a continuing responsibility to assess water quality and to identify impaired stream segments. They use citizen monitoring data to help identify areas with observed effects that merit DEQ follow-up.

In addition to DEQ, there are two active citizen stream monitoring organizations and an umbrella Loudoun Watershed Watch organization in Loudoun County that can provide monitoring data. These citizen groups seek to be part of the TMDL Implementation Plan (IP) monitoring program by providing additional validation assessment monitoring data that will help assess the effectiveness of the TMDL Implementation Plan in accomplishing its goals. This Citizen Monitoring Component prepared by Loudoun Watershed Watch (LWW) outlines the role that citizen monitors are prepared to play in validation assessment.[6]

There are four important needs that citizen stream monitoring organizations can meet to help assure the success of the Catoctin watershed TMDL Implementation Plan.

- **Critical Pollution Areas** – Detailed water quality data are needed to confirm and document hot spots and areas most heavily impacted by pollution in order to develop a staged implementation approach that will result in the greatest return in water quality improvement. This is consistent with findings in DEQ's TMDL report that additional monitoring that targets restoration projects "is critical to implementation development."[7] DEQ relies upon local citizen monitoring to collect these data.

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6 Originally LWW sought to establish a collaborative relationship with the Loudoun County Soil and Water Conservation District to implement a stream monitoring validation assessment program. However, at their 5/5/04 Board Meeting, LSWCD decided to focus their resources on Best Management Practices (BMP) installation efforts and not stream monitoring.

7 DEQ, "Fecal Coliform TMDL Development for Four Catoctin Creek Impairments, Virginia," March 2002, p. xv.

- **Monitor Adequacy of Water Pollution Load Model** – Load requirement for nonpoint pollution are based upon models and not comprehensive field studies. Sufficient tend monitoring data are needed to assess the adequacy of the model assumptions and parameters. If field data show the implemented management controls based on the model are not effective, recommendations on redesigning the management controls will be considered by DCR.

- **Track Improvements in Water Quality Throughout Watershed** – DEQ/DCR guidelines recognize that it is important to consider future TMDL needs for a watershed when establishing a monitoring plan. Citizen assessment monitoring data can help identify threatened areas in portions of the watershed not monitored by DEQ for appropriate follow-up by DEQ. Trend monitoring will track progress in these areas.

- **Provide Avenue for Citizen Involvement in TMDL Implementation Process** – Traditionally, citizen monitoring groups have taken on the role of citizen watch-dog rather than citizen collaborator. However, a properly supported and funded citizen monitoring program in Catoctin will help place local citizens and local environmental stewardship organizations in a collaborative role in the TMDL Implementation Plan process. Trend data can be used to track progress and keep the public informed.

Legal Requirements

EPA provides grant funds to states under Section 319 of the Clean Water Act to control nonpoint pollution sources. EPA guidelines[8] to award these grants require that TMDL Implementation Plans include a monitoring component to validate the effectiveness of the implementation efforts. A validation assessment is designed to document the effectiveness of the best management practices (BMPs) that have been installed to control nonpoint pollution and improve water quality. Virginia DEQ has responsibility to assess TMDL implementation, and will do this when remedial controls have been installed.

TMDL Water Quality Monitoring Guidelines

Guidelines for the water quality validation assessment component of TMDL Implementation Plans are provided by DEQ and DCR[9]. These guidelines require that progress toward end goals be assessed during the implementation process through continued water quality monitoring. The guidelines address: (1) a schedule for monitoring, (2) location of monitoring stations, (3) organizations responsible for monitoring, and (4) monitoring procedures.

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8 EPA, "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003."

9 VADEQ and VADCR, "Guidance Manual for Total Maximum Daily Load Implementation Plans," July 2003.

Under these guidelines, DCR has set rules that delineate the scope of monitoring that they will support.

- Monitoring under the TMDL IP will be limited to the impairments approved at the time the TMDL was finalized.
    - The benthic impairment in the South Fork Catoctin and the segments in the mainstem, North Fork Catoctin, and Milltown Creek with observed benthic effects are not part of the fecal TMDL and not within the scope of the Catoctin TMDL IP.
    - The water quality in the other 77% of the Catoctin watershed not assessed by DEQ is outside the scope of the TMDL IP monitoring plan and is not relevant to the IP.
- Any future impairment that impact stream segments in the same watershed but in different portions from the impairments in the original TMDL are to be addressed under separate TMDL's and IP's at a future date.

The rules that DCR has established are based on four assumptions:

- The TMDL model has adequately characterized the water quality in the portion of the watershed impacting on the impaired segments;
- The TMDL model has adequately characterized the nonpoint pollution loads that are responsible for the degraded water quality and additional BST monitoring is not necessary;
- The TMDL model database provides sufficient information to identify pollution hot spots that can be used to establish a staged implementation plan; and

Monitoring at the five existing DEQ stations in the impaired segments in the watershed will provide sufficient data to validate the TMDL model and assess the effectiveness of the TMDL IP.

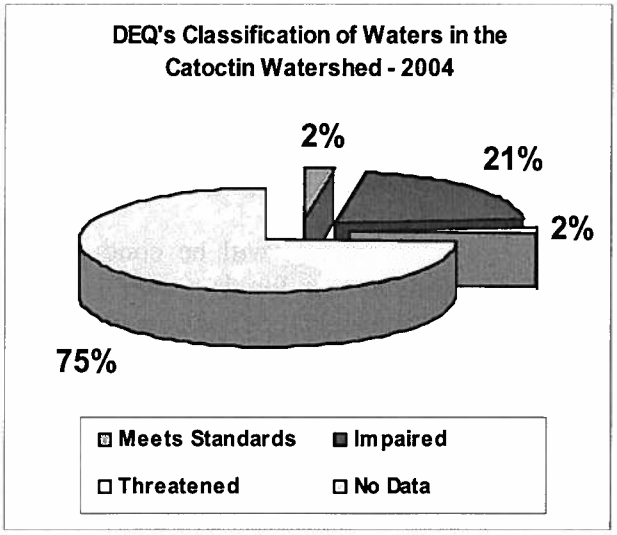
Scope of Citizen Monitoring

The DCR/DEQ guidelines and the rules regarding the scope of monitoring are necessary to help DCR and DEQ comply with a court ordered timetable for completing over 1000 TMDLs in the state by 2010. New impairments established after the 1998 court order will be addressed after the original impairments. Regrettably, this may require DEQ and DCR to return to a watershed a second time to develop another TMDL and another TMDL IP. An example is the benthic impairment established by DEQ in 2004 on the South Fork Catoctin Creek.

LWW believes that every effort should be made to address all known problems in the Catoctin Watershed at one time. Implementation of one TMDL may take up to 10 years, and two TMDL IP's would likely take twice that period. Therefore, LWW is willing to provide two types of monitoring data:

- Data within the scope of the current TMDL IP and supported by DCR; and
- Data outside the scope of the DCR guidelines that will be supported by other grant funds that LWW will seek to obtain.

LWW believes it is important to provide data outside the scope of the current impairments in the Catoctin watershed because most of the watershed has not been assessed by DEQ. There are five impairments that vary in length from 2.45 river-miles to 13.91 river-miles (entire length of the South Fork Catoctin Creek). These impairments represent 21% of the total river-miles in the watershed. Two % of the waters meet standards, and 77% of the watershed has not been assessed by DEQ because they have no data. In addition, there is a known benthic impairment and other areas with observed effects that require DEQ follow-up assessments.



These data outside the scope of the TMDL IP will be used by LWW to identify any problem areas in unassessed portions of the watershed, and to test the assumptions upon which the DCR approved IP monitoring plan are based. Any data on problem areas will be referred to DEQ for assessment. LWW will then work with DEQ and DCR to determine whether remedial actions can be taken under the current TMDL IP to address any new impairments.

Types of Monitoring Data

The implementation of BMPs to reduce nonpoint pollution impacts and restore water quality will be accomplished in stages using the **targeted method**. Targeting the areas in the watershed with the greatest pollution loads will allow the greatest improvement in water quality to be achieved in the shortest amount of time. Stream monitoring data needed to support the targeted method are as follows.

1. **Field Survey** -- A Field Survey or stream walk conducted as part of a watershed survey is a starting point in the development of TMDL Implementation Plans because it provides basic information on the watershed that can be used to help determine which areas or issues need to receive attention. The information can be used to establish monitoring priorities that most efficiently use monitoring resources, and identify stream segments where best management practices will address the most critical needs. The results can also be used to develop community education and awareness programs and materials.

   Field surveys are needed as part of the Catoctin TMDL IP because the original bacterial source tracking (BST) done by MapTech, Inc. during the TMDL study was very limited. The TMDL report concluded that it was sufficient only to "provide insight into the likely sources of fecal contamination," and to "aid in distributing fecal loads from different sources during model calibration." The MapTech, Inc. data will not be sufficient for identifying hot spots because of the short time-frame of the MapTech, Inc. BST study and the subsequent small number of observations taken.

   A Field Survey will be conducted on as much of impacted streams as possible. Considerations for determining which stream segments should receive the highest priority for Field Surveys includes:

   - Stream segments that contain known problem areas that might be a high priority for some corrective action;
   - Stream segments that contain special resource areas such as parks and public access; and
   - Stream segments that contain threats to human and aquatic life uses of the water.

The activities associated with a Field Survey are summarized in Table B.1. A Field Survey Form is provided below.

Table B.1 Summary of Parameters for Conducting a Field Survey.

Field Survey Activities	Parameters and Methods Applied
Survey the stream, riparian, and watershe characteristics and conditions including: • Habitat assessment • NPS and erosion assessment • Stream channel cross section	• Preferred protocols include: • Visual assessment based upon EPA RBP • Watershed Field Inventory (Adopt-A Stream) • EPA BioRecon • COG RSAT* • CWP Riparian Improvement Trackin (RIP)**

*Galli, J. 1996. Final Technical Memorandum: Rapid Stream Assessment Technique (RSAT) Field Methods. Washington Metropolitan Council of Governments (COG).

**Center for Watershed Protection (CWP). 1998. "Rapid Watershed Planning Handbook." Ellicott City: Center for Watershed Protection.

2. Spatial Monitoring – Data collected from a spatially distributed monitoring network along a single segment of a stream are needed to confirm and document critical areas and hot spots with heavy pollution loads, and to help target implementation strategies. This type of monitoring will be conducted during stream walks to help identify agricultural, stormwater, and septic tank hot spots. Citizen monitoring groups on an as needed basis will conduct special follow-up studies designed with the help of DEQ.

3. **Temporal Monitoring** – Stream monitoring will be used to document progress toward achieving the goals and for evaluating the effectiveness of the implementation actions. DEQ has one trend station in the Catoctin watershed that will be sampled on a regular basis. Five additional AW stations will be sampled at six-year intervals with twelve samples collected over a two-year period. This level of monitoring will not be sufficient to track progress in restoring water quality in the impairments. Supplemental trend data is needed at DEQ sites, especially during the off year periods. Data collected at stations within the impaired watershed on a fixed-frequency basis will improve the overall picture of the impairment and help track progress on restoring water quality.

   - **Unapproved Data --** Citizen monitoring to identify hot spots and track progress do not necessarily need to meet DEQ requirements for "approved data" regarding collection, analytical, and QA/QC protocols since they will not be used to establish or delist impairments.

- **DEQ Validation Monitoring Data** – DEQ guidelines[10] provide that an impairment can be remove when one or two years of data from the same monitoring station that caused the original impairment and subsequent impairments show that water quality standards are being met. The impairments in the Catoctin watershed listed in 2002 were based upon data from five monitoring stations – one in Catoctin Creek, two in North Fork Catoctin Creek, and two in South Fork Catoctin Creek. In 2004 two additional impairments, one in North Fork and one in South Fork Catoctin, were added. Data for delisting these impaired stream segments will be collected by DEQ and will meet their collection, analytical, and QA/QC protocols. Final validation data collection by DEQ is not part of this plan.

Siting of Citizen Monitoring Stations

Loudoun Wildlife Conservancy (LWC) and North Fork Goose Creek Watershed Association (NFGC) will conduct the citizen monitoring. The monitoring stations are as follows.

Spatial Monitoring Stations – The spatial monitoring stations needed to confirm and document targeted implementation goals will be established by LWW during their field surveys. Any follow-up special studies will be designed with the help of DEQ.

Temporal Monitoring Stations -- The designated temporal monitoring stations for the TMDL Implementation Plan are listed in Table B.2. DEQ has six monitoring stations in the watershed that will be used by DEQ to assess TMDL implementation. One is a trend station that is sampled monthly. The other five stations are for ambient watershed monitoring (AW) and will only be sampled on 12 occasions over a six-year period. The next sampling in Catoctin will likely occur "in the fiscal year following the actual installation of BMPs or a similar event-triggering target set by DEQ and DCR TMDL staff."[11] Therefore, citizen monitoring data are needed at these stations to monitor progress on a more continuous basis. Additional monitoring stations are needed in the Purcellville portion of the South Fork Catoctin Creek in order to better assess the impacts of stormwater from the town and agricultural activities upstream of the town.

- **Benthic Monitoring Stations** -- The benthic impairment on the South Fork Catoctin Creek in Purcellville will be monitored by citizen groups outside the scope of the TMDL IP monitoring plan to assess the impact that the fecal TMDL IP has on restoring stream health for aquatic life. In addition, benthic monitoring by DEQ, LWC, and NFGC will continue at several other locations in the watershed in order to document aquatic life conditions throughout the watershed.

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10 DEQ, "Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report," November 3, 2003.
11 DEQ, "Water Quality Assessment Guidance Manual for Y2004 305(b)/303(d) Integrated Water Quality Report," November 3, 2003, p. 47.

- **Monitoring Stations in Unimpaired Segments** – There are two tributaries to Catoctin Creek that do not have impairments: Milltown Creek and an unnamed tributary a short distance downstream from Milltown Creek. DEQ has established new ambient monitoring stations near the mouth of each tributary. These stations will also be monitored by citizen groups outside the scope of the TMDL IP monitoring plan in order to track any contribution of these waters to the downstream impairment in the Catoctin mainstem.

Table B.2 List of TMDL Implementation Plan Temporal Monitoring Stations for the Catoctin Watershed -- 2004.

Stream Name	Cause	Boundaries of Impaired Segment	Monitoring Station[1]
Catoctin Creek Mainstem	FC	7.2 mile segment from its mouth at the Potomac River upstream to the confluence with Milltown Creek	1. **DEQ** – Maintain trend site 1ACAX004.57 at Rt. 668
North Fork Catoctin Creek	FC	4.1 mile segment from the confluence with Catoctin Creek upstream to a point 0.2 miles downstream of the Rt. 287 bridge	2. **Local/DEQ** - Provide continuous sampling at DEQ's AW 1ANCO00.42 site at Rt. 681.
North Fork Catoctin Creek	FC	North Fork Catoctin Creek from the impaired segment starting at stream mile 4.1 to its headwaters	3. **Local/DEQ** – Provide continuous sampling at AW site 1ANOC009.37 at Rt. 718.
South Fork Catoctin	FC	17.3 miles from the mouth at Catoctin Creek upstream to the headwaters	4. **Local/DEQ** - Provide continuous sampling at DEQ's AW 1ASOC001.66 at Rt. 698. 5. **Local/DEQ** – Provide continuous sampling at DEQ's AW site 1ASOC007.06 at Rt. 738. 6. **Local** – Establish trend station at Hirst Rd crossing below Purcellville 7. **Local** – Provide continuous sampling at DEQ's AW site 1ASOC012.38 at Rt. 690.

[1] AW = Ambient Watershed station; Local = to be sampled by local citizen group

Parameters

Bacteria – All but one impairment in the Catoctin watershed are based upon fecal pollution. Monitoring for *E. coli* organisms is to be used to assess the success of the fecal TMDL implementation. Water quality restoration will require improved Best Management Practices (BMPs) in (1) riparian buffers in order to keep livestock out of streams and (2) residential areas to better control failing septic systems and straight pipes. These controls should decreased bacteriological levels in the streams. In addition, standard physical, chemical, and nutrient parameters will be tested to provide sufficient meta data for proper interpretation of sample results. The parameters are listed in Table B.3.

- **DEQ** – DEQ samples will be analyzed at state laboratories using the membrane filter technique for *E. coli* bacteria.
- **Local** – Samples collected by citizen monitoring groups will be analyzed by LWC for *E. coli* using the Coliscan Easygel methodology.

Table B.3 Sampling Parameters for Trend Sampling Stations.

Parameter	Sampling Protocol	Analytical Protoco	Frequency
Water Temperature	Thermometer		Biweekly
pH	LaMotte Kit	LaMotte Kit	Biweekly
DO	LaMotte Kit	LaMotte Kit	Biweekly
Turbidity	LaMotte Kit	LaMotte Kit	Biweekly
Nitrates	LaMotte Kit	LaMotte Kit	Biweekly
Phosphates	LaMotte Kit	LaMotte Kit	Biweekly
E. coli Bacteria	Coliscan	Coliscan	Biweekly

Frequency

Field Survey and Spatial Data – Field survey and spatial data is to be collected during the first 12 months. Follow-up surveys and special study sampling will be conducted on an as needed basis.

Trend Data -- Trend assessments require that samples be collected under as many different conditions as resources allow. An important consideration is providing enough samples to understanding variability. The TMDL model indicates that periods of low flow in the summer-fall months are the most unfavorable conditions for bacteriological water quality. In order to produce the needed information, trend stations should be sampled for a minimum of five years.

- DEQ's recommended frequency for sampling trend stations is biweekly (24 times per year) for chemical and bacteriological parameters.
- In addition, bacteriological samples will be taken under unfavorable, storm event conditions.

Data Analysis

Trend data used to validate TMDL Implementation will allow a broad range of statistical analyses. They include:

- Averages to show values typical of the data set;
- Correlations to show the degree of differences between data sets; and
- Comparisons with various reference conditions including water quality standards, informal guidelines established by federal or state authorities, and actual results from county or regional reference sites.

Quality Assurance/Quality Control (QA/QC)

Quality assurance measures need to be compatible with the capabilities of citizen watershed organizations. QA/QC parameters will include the following:

- Written, detailed protocol comparable with DEQ guidelines;
- Training for monitors;
- Data quality objectives as provided in Table B.4;

- Equipment inspection and maintenance;
- 10% level of field equipment blanks for bacteriological water samples; and
- 100% level of field duplicate samples for bacteriological water samples analyzed by citizens using Coliscan Easygel.

Table B.4 Quality Objectives for TMDL Implementation Monitoring in Catoctin Creek.

Monitoring Parameter	Quality Objectives
Chemical and Physical	90% completeness on data collection sheet
Bacteriological	90% completeness on data collection sheet
Other parameters and meta data	90% completeness on data sheet

Projected Costs Associated With a Citizen Monitoring and Educational Program

Funding is needed for a citizen's monitoring program if the Catoctin TMDL IP is to be successful implemented. LWW is the only county citizen-based organization prepared and motivated to provide a monitoring program to support the TMDL IP. The program will need to include a part-time position to provide coordination, technical support, and field collection of data because of the needed scope of the program. Table B.5 provides a summary of projected costs. Under this approach, all bacteriological samples will be collected and analyzed by citizens. This will substantially reduce the projected costs compared to paying a consulting firm or hiring government employees.

Table B.5 Projected Costs for Monitoring Program Provided by Loudoun Watershed Watch.

Year	Number Samples [1] Spat/Trnd/SpSt	Equipment/ Materials	Data/ Progress Reports	Program Coordination/ Technical Assistant	Annual Cost
1	50/150/0	$1400	$250	$25,000	$26,650
2	0/150/50	$1100	$250	$12,500	$13,850
3	0/150/50	$1100	$250	$12,500	$13,850
4	0/150/50	$1100	$250	$12,500	$13,850
5	0/150/50	$1100	$250	$12,500	$13,850
Total	**50/750 / 200**	**$5800**	**$1250**	**$75,000**	**$82,050**

[1] Spat = spatial sampling; Trnd = trend sampling; and SpSt = Special Studies.

Cost Basis:

- **Number of Samples: 1st Year:** Conduct spatial sampling, and trend sampling at 6 *E. coli* bacteriological stations biweekly; **2nd-5th Years**: Sample at 6 stations 25 times/year, and conduct special studies.

- **Equipment/Materials**: Includes chemical test kits, bacteriological sampling equipment, and materials including a used incubator during the first year.

    - **Bacteriological Tests**: Based upon using Coliscan Easygel procedure @ $3/sample (including QA duplicate test) (200 samples/yr @ $3/sample).

    - **Chemical and Nutrient Tests**: Based on using LaMotte Chemical test kits ($500).

    - **Used Incubator**: $300

- **Data and Progress Reports**: Cost for color-printing a yearly progress report to stakeholders and for educational purposes.

- **Technical Support/Coordination**: 1st Year: Based upon $25/hour, 20 hours/week, 50 weeks/year (1/2 FTE) for field survey, spatial monitoring, and trend monitoring; **2nd –5th year**: Based upon $25/hour, 10 hours/week, 50 weeks/year (1/2 FTE) for special studies and trend monitoring.

LOUDOUN STREAM MONITORING PROGRAM

STREAM BIO-RECON FIELD DATA FORM

Project

Date:_____ Time:_____

Watershed: _____ Stream: _____ Specific Location: _____

Data Collectors' Names: _____

WEATHER CONDITIONS

Rain Conditions Past 48 Hours: ☐ Little/None ☐ Light ☐ Moderate ☐ Heavy # Days since heavy rain: _____

Stream Flow Conditions: ☐ High ☐ Medium ☐ Low ☐ Drought Air Temperature ____ °F ____ °C Water Temperature ____ °F ____ °C

pH _____ Turbidity: _____ NTU's **or** ☐ High ☐ Medium ☐ Low ☐ Clear

WATERSHED LAND FEATURES AND NONPOINT POLLUTION

Estimate **watershed features** and identify **NPS impacts** in watershed within ¼ mile upstream and adjacent to the site. For "Land Use Profile," record information as a percent. For "NPS Impacts," **check each parameter** with "**1**" if not present or little impact, "**2**" if moderate impact, and "**3**" if any parameter has potential high impact on the stream and/or monitoring site.

WATERSHED FEATURES:

%	Forested Uplands	%	Pasture/crops/open lands	%	Wetlands
%	Commercial/Industrial	%	Low intensity residential	%	High intensity residential

NONPOINT POLLUTION SOURCE IMPACTS:

Nonpoint Pollution: ☐ No evidence ☐ Some potential sources ☐ Obvious sources

1 2 3		1 2 3		1 2 3	
☐ ☐ ☐	**Residential/Commercial** Single-family housing	☐ ☐ ☐	Multifamily housing	☐ ☐ ☐	Commercial/institutional
☐ ☐ ☐	**Roads** -- Paved roads or bridges	☐ ☐ ☐	Unpaved roads	☐ ☐ ☐	Cleared right-of-ways
☐ ☐ ☐	**Construction underway on:** Housing development	☐ ☐ ☐	Commercial development	☐ ☐ ☐	Road or bridge construction/repair
☐ ☐ ☐	**Agricultural** – Active cropland	☐ ☐ ☐	Grazing land or animal holding areas	☐ ☐ ☐	Other:
☐ ☐ ☐	**Recreational -- Golfing**	☐ ☐ ☐	Camping	☐ ☐ ☐	Other:
☐ ☐ ☐	**Other -- Trash dumping**	☐ ☐ ☐	Landfills/wetland encroachment	☐ ☐ ☐	Storm drains/storm water runoff

Local Watershed Erosion: ☐ None ☐ Moderate ☐ Heavy

STREAMBED COMPOSITION OF RIFFLE

% Silt (mud)	% Sand	%Gravel (1/4-2")	%Cobble (2-10")	% Boulders (>10")

ORGANIC SUBSTRATE COMPOSITION OF POOL/RUN

% Detritus	% Muck-Mud	% Root Masses

STREAM HABITAT ASSESSMENT DATA

Estimated **average** stream width _____ ft. Estimated stream depth in riffle #1 _____ ft. & riffle #2 _____ft. Estimated stream depth in pool or run _____ ft.

Habitat Parameter/Score	Optimal 20 – 19 – 18 – 1 7- 16	Good 15 – 14 – 13 – 12 - 11	Marginal 10 – 9 – 8 – 7 - 6	Poor 5 – 4 – 3 – 2 – 1 - 0
Epifaunal Substrate/ Available Cover **Score** ☐	>70% of substrate favorable for insect communities; mix of snags, submerged logs, undercut banks, cobble or other stable habitat to allow full colonization potential.	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat to maintain populations; additional substrate in form of newfall.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	<20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
Embeddedness Score ☐	Fine sediment surrounds and fills 0-25% of living spaces around gravel, cobble, & boulders. Plume of sediment almost nonexistent. Rocks look as if placed on streambed.	Find sediment fills in 25-50% of living spaces around gravel, cobble, & boulders. Sides of rocks have partial "cemented in" look. Plume is small to moderate.	Find sediment surrounds and fills in 50-75% of living spaces around and between gravel, cobble, & boulders. Sides of rocks have a "cemented in" look. Plume is moderate to extensive.	Find sediment surrounds and fills in >75% of living spaces around and between gravel, cobble, & boulders. Sides of rocks have a "cemented in" look. Sediment plume is extensive.

Velocity/Depth Regime Score ☐	All four velocity/depth regimes present – slow-deep, slow-shallow, fast-deep, fast-shallow – and slow is <0.3 m/s and deep is >o.5 m/s	Only 3 of 4 regimes present (if fast-shallow is missing, score lower than if mission other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
Sediment Deposition Score ☐	Less than 5% of bottom affected by scouring and/or deposition; islands and point bars not enlarging	5-30% of bottom affected; scour at constrictions and where grades steepen; slight deposition in pools and/or bars	30-50% of bottom affected; deposits and/or scour at obstructions, constrictions, and bends; moderate deposition of pools and new bars prevalent	>50% of bottom affected; pools almost absent due to deposition; heavy deposition of fine material; new bars developing
Channel Flow Score ☐	Water reaches base of both lower banks; and minimal amount of channel substrate is exposed.	Water fills >75% of available channel; or <25% of channel substrate exposed.	Water fills 25-75% of available channel; and/or riffle substrates mostly exposed.	Very little water in channel, and mostly present as standing pools.
Channel Alteration Score ☐	Minimal impact from stream straightening, artificial embankments, dams, bridge abutments.	Some stream straightening, artificial embankments, dams usually in areas of bridges. No evidence of recent channel alteration.	Artificial embankments extensive and present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Bank shored with gabion or cement; over 80% of the stream site straightened and disrupted. Habitat greatly altered or removed.

Frequency of Riffles (or bends) Score ☐	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of stream <7:1 (generally 5-7); variety of habitat is good.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by stream width is between 15-25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is a ratio of >25.

Left and Right Orientation – Face upstream

Parameter/Score L Bank R Bank	**Optimal** 10 – 9	**Good** 8 – 7 – 6	**Marginal** 5 – 4 – 3	**Poor** 2 – 1 – 0
Bank Stability ☐ ☐	Banks stable; minimal evidence of erosion or bank failure; little potential for future problems; <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; bank sloughing; >60% with bank scars.
Bank Vegetation Protection ☐ ☐	>90% of bank surfaces and immediate riparian zone covered by naturally growing trees, shrubs, and perennial plants; vegetation not disturbed	70-90% of bank surfaces covered by natural vegetation; some disruption evident; >1/2 of natural plant height remaining	50-70% of bank covered by vegetation; disruption obvious; patches of bare soil or low cut vegetation; <1/2 of natural plant height remaining.	<50% of bank surfaces covered by vegetation; high level of disruption evident; bare soil or low cut vegetation extensive

Riparian Zone ☐ ☐	Width of riparian zone > 54 feet; human activity has not impacted zone	Width of zone between 36-54'; minimal human impact on zone	Width of zone between 18-36'; considerable human impact on zone	Width of zone <18'; little or no riparian zone due to human activity/alterations
Total **Score** ☐	**Habitat Assessment Score: (Sum of Individual Scores) _____ %** (>90% = Excellent; 75-89% = Good; 60-74% = Marginal; <60% = Poor)			

STREAM PROFILE

Bank Height: Left _____ Right _____ **Bank Angle**: Left ____ Right ____ **Top Stream Bank Width**: _____ **Stream Bottom Width**: _____ **Bank Flood Height**: _____ **Stream Depth**:_____ _____

STREAM PROFILE SKETCH – Include measurements

STREAM CORRIDOR PROBLEM IDENTIFICATION

Map Location: _____ **Picture No.** _____

Dominant Vegetation Adjacent to Stream _____

Concern: Inadequate Buffer (IB) / Severe Erosion (ER) / Cattle Access (CA) / Horse Access (HA) / Pipe/Outfall (PO) / Sewer / Debris Dam / Trash

Severity (10 high – 1):_____ **Mitigation Potential**: Yes / No **Reasonable Access**: Yes / No

Ownership: Public/ Private / Park

Inadequate Buffer: Buffer width: Left _____ Right ____ **Length or Extent of IB** _____ **Length or Extent of CA or HA** _____

Severe Erosion: Bank Height: Right _____ Left ____ Bank Flood Height ____ Bank Angle Left _____ Right _____ Bottom Stream Width _____

Pipe/Outfall: Diameter _____ Flow: Yes / No **Crossing or Outfall Type:** Sewer / Agriculture Drainage / Stormwater / Unknown / Other

Retrofit Potential: Yes / No / NA **Adjacent Land Use**: Residential (high / medium / low) / Forest / Pasture / Crop / Commercial / Industrial / Other

Notes:

CATOCTIN TMDL COMMUNITY OUTREACH AND EDUCATION PLAN

Submitted by:

Loudoun Watershed Watch

Introduction

Cleaning up the Catoctin Creek watershed and preventing further degradation from nonpoint pollution will have high costs as well as huge public benefits. Educating county officials and the public about these benefits will be a key step to getting community support for TMDL implementation. Reducing nonpoint pollution loads by installing BMP is voluntary on the part of landowners, and motivation based upon a sense of community responsibility will be a key factor. The cost of cleanup still represents only a fraction of the benefits the public will receive. Cleanup means that stream corridors will be protected with best stormwater management practices and best agriculture practices. These practices will recharge our ground water aquifers, make our streams and rivers safe for public use, and support enhanced aquatic life. Water is our most precious resource, and the benefit of clean water is life itself.

Educational Strategy

The Council of State Governments in their Fall 2003, quarterly publication, "the environmental communiqué of the states," provides ten suggestions for creating effective stream TMDLs. One suggestion deals with stakeholder education. The report argues that "peer pressure produces results faster than state edicts." It also argues that when implementation is delegated to local interests, it is important to "place a premium on local sociology to effect change." Providing information within the community on the effectiveness of BMPs, relative costs of participation, and the importance of good faith local efforts "seems more effective to induce changes in the status quo than correspondence from state agencies."

This Community Outreach and Education Plan proposed by Loudoun Watershed Watch adopts this strategy by focusing on building a community sense of value in the Catoctin stream resources. Once the resource has value to the community, then a community expectation can develop that the stream should be protected and made safe for community use. Peer pressure can then develop within the community regarding the responsibilities of those individuals whose use of the streams degrades the water quality.

This is not the only educational initiative needed to effect changes. Educational efforts are also need to target landowners who need to provide the BMPs that will keep nonpoint

pollution out of the streams and restore the water quality. This is a separate although concurrent educational component that will be undertaken by the Loudoun County Soil and Water Conservation Service and other agricultural organizations. These landowner-targeted initiatives are not covered in this document.

Community Benefits From Clean Water

An example of the ways the community benefits from clean water was recently discussed in a paper titled, "Paving Our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought," prepared by American Rivers, the Natural Resource Defense Council, and Smart Growth America. They report that:

> *The EPA has found that changes to the hydrology of rivers are second only to the effects of agriculture in the degradation of river systems. The long-term needs of rivers and the long-term demands of humans are best served by a continual supply of healthy, clean water. Freshwater and its associated fish, wildlife, plants, and habitats provide many goods and services to humanity. The benefits fall into three broad categories: (1) direct use by humans for drinking, and other household needs, irrigation, and industrial processes; (2) benefits themselves dependent on freshwater such as fish, shellfish, waterfowl, and other wildlife; and (3) "in place" benefits, such as recreation, transportation, hydropower, flood control, water quality control, and the enjoyment of the outdoors.*
>
> *While the value of all services provided by freshwater systems on earth is difficult at best to quantify, studies suggest that it ranges around several trillions of dollars annually, a significant proportion of the gross world product. For instances, American anglers alone spend roughly $24 billion annually on their sport, generating $69 billion for the nation's economy. . . But while we can calculate some of the benefits of freshwater systems to people, the value of clean and healthy drinking water to humanity is inestimable. (p. 16-17)*

Community Education that Focuses on Benefits -- Catoctin Creek is already a scenic river because of its spectacular scenery. Unfortunately, this has not been emphasized in the County, and few citizens know of the beauty of the creek. The Catoctin TMDL IP should include a proactive community outreach and educational initiative organized by local watershed groups that emphasize the scenic attributes and public recreational opportunities in the Catoctin Creek watershed. DCR and DEQ should work with LWW to develop such an education program that advises the public of these benefits.

Community Outreach and Education Activities

The specific outreach and educational activities recommended include the following.

- **Friends of Catoctin Creek** – LWW will work with community groups and individuals to organize a Friends of Catoctin Creek citizen group. There is already much interest in the community because of the activities of the Keep Loudoun Beautiful organization and scouts. Such a citizen's group can help initiate stream restoration projects, participate in stream monitoring, develop educational materials, and support stream clean-up projects.

- **Catoctin Watershed Day** – LWW will work with streamside property owners, various community groups, and regional organizations to organize a program to take place annually in late April at Taylorstown Bridge on the lower Catoctin Creek. The event will coordinate with the annual stream trash clean up by the local Boy Scout troop and the Keep Loudoun Beautiful organization. Department of Game and Inland Fisheries (DGIF) will be invited to give a fish shocking demonstration and to stock the stream with bass. The local Trout Unlimited chapter will be invited to give a demonstration on fly-fishing for bass. DEQ will be invited to provide a demonstration of water quality monitoring and the public health of recreational water use. A regional canoe group will be invited to have a canoeing and kayaking event on the river (perhaps the 1st Annual Catoctin Canoe Race). Loudoun County Soil and Water Conservation District will be invited to set up a display of agricultural BMPs and conduct a tour of BMP's on nearby riverside properties. Loudoun Wildlife Conservancy will be invited to provide a demonstration of stream monitoring and benthic macroinvertebrates. Audubon Naturalist Society will be invited to conduct a stream walk highlighting what needs to be done to protect water quality. There will also be a barbecue lunch and music for participants.

- **Catoctin Watershed Web Page** – LWW will develop a Catoctin TMDL web page as part of the LWW website. The page will include educational materials on the TMDL and the implementation plan, stream monitoring results, and how stakeholders can get involved in cleaning up Catoctin Creek.

- **Catoctin Watershed Email Newsletter** – LWW will provide a monthly email newsletter to stakeholders that includes materials relevant to water pollution and stream restoration.

- **Catoctin Clean Water Poster** – LWW will work with DCR, Loudoun Parks and Recreation, and a local graphic arts designer to develop a poster about clean water and Catoctin Creek that can be displayed in local business establishments to promote clean water for this scenic river and provided to stakeholders at local events.

- **Report of the Water Quality of the Catoctin Watershed** – LWW will prepare an annual report for stakeholders that profiles the water quality in the Catoctin watershed. The report will include information from the Catoctin TMDL and the IP,

as well as graphic analyses of water quality data. The report will be updated yearly using monitoring data from the TMDL IP.

- **Watershed Display at Local Events** – LWW will provide a display at local fairs and events promoting clean water and recreation uses in the Catoctin Watershed. This will include the development of handout materials on the TMDL IP, and information on how citizens can support the restoration of good water quality.

Projected Costs for a Community Outreach and Educational Program

Funding is need for a community focused outreach and educational program if the Catoctin TMDL IP is to be successful. LWW is the only local watershed organization prepared to commit to providing an outreach and educational program to support the TMDL IP. The program will need to include a part-time paid coordinator to develop educational materials, and provide organization and technical support for the educational activities because of the needed scope of the program. Table B.6 provides a summary of projected costs.

Table B.6 Projected Costs for Education Program Provided by Loudoun Watershed Watch.

Year	Educational Materials	Program Coordination	Annual Cost
1	$7,000	$5,000	$12,000
2	$2,000	$5,000	$7,000
3	$2,000	$5,000	$7,000
4	$2,000	$5,000	$7,000
5	$2,000	$5,000	$7,000
Total	**$15.000**	**$25,000**	**$40,000**

Cost Assumptions:

- **Educational Materials**: Includes printing educational materials, yearly report on water quality, Catoctin Stream Poster (@ $5000) during 1st year, educational handouts, Annual Catoctin Stream Day Event, Catoctin Watershed Website

materials ($65/hr for website maintenance and updates), monthly email newsletter, and display materials for public events.

- **Program Coordination**: Based upon $25/hour, 8 hours/week, 25 weeks/year.