# Holman's Creek Watershed Restoration Plan

**[Benthic and Fecal Bacteria TMDLs]**


**Submitted to**
**The Stakeholders of**
**Holman's Creek Watershed**

Prepared by:

Department of Conservation and Recreation and
The Holman's Creek Citizens Watershed Committee

&

In cooperation with the Department of Environmental Quality

**July 17, 2004**

## Acknowledgements

The Commonwealth of Virginia would like to recognize the efforts of those who by contributing their time and effort helped produce this plan.

The citizens of Holman's Creek Watershed

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## Executive Summary

**Background**

Holman's Creek does not meet the Clean Water Act (CWA) national goal of "fishable or swimmable" standards. It is on the Priority List of impaired waters due to elevated fecal coliform levels and adversely affected benthic aquatic organisms (*bottom dwelling creek insects and organisms*). Holman's Creek is a 11,988 acre drainage area (72 percent of land is agricultural and 26 percent is forested) or watershed is listed as an impaired Virginia water body. Holman's Creek Watershed is mainly located in Swiss cheese type geology with many caves, and sinkholes known as karst topography. Therefore, a strong component of the clean up project relies on the one-on-one persuasion of homeowners that the karst terrain in which they live requires vigilant care of local wells, springs, ponds, and septic systems for preservation of family drinking supplies and community health.

**HOLMANS CREEK RESTORATION/TMDL IMPLEMENTATION PLAN**

Key Components of this plan are: 1) Review of the TMDL Development Study; 2) Description of Water Quality Monitoring; 3) Process for Public Participation; 4) Assessment of Needs; 5) Cost Analysis and; 6) Implementation Schedule and Funding Sources.

**1) Review of the TMDL Development Study**

- All livestock must be excluded from the stream;
- All failing systems and straight pipes must be identified and corrected;
- Reduce sediment run-off by 31 percent overall;
- Reduce human controlled fecal sources in Stage I and re-assess if water quality has been attained.

**2) Description of Water Quality Monitoring**

There has been monitoring at 12 fixed sampling sites throughout Holman's Creek. Three of these have been maintained by VADEQ and 9 have been bacterial source tracking sites by James Madison University.

**3) Process for Public Participation**

Public participation took two forums: 1) Two general public meetings, and 2) Watershed targeted meetings (i.e. watershed steering committee to direct the overall process). This entire implementation process is based upon developing favorable partnerships with residents of Holman's Creek. Developing a sense of comfort and trust with our citizens will both increase participation and insure successful water quality improvements.

**4) Assessment of Needs**

Below are the estimated control measures needed for implementation for agricultural and residential programs;

**Agriculture Programs**

- 53 miles Fencing (25 ft buffer)
  Including 69 Sinkholes fenced *(16,000 ft)*

- 138 Full Exclusion Livestock Systems
- 569 Acres of Conservation Tillage annually
- 660 Acres of Cover Crops annually
- 55 Hardened Crossings
- 7 technical man-years with 2.5 admin. support

**Residential Programs**

- 25 Septic System Installations
- 25 Septic System Repairs
- 200 Septic System pump-outs
- 25 Alternative Waste Treatment System Installations
- 2.5 man-years Residential Technical Assistance with .5 man-years Administrative Technical Assistance

**5) Cost Analysis**

The total estimated cost to implement the TMDLs developed for Holman's Creek watershed is $5,550,110. Of which $4.23 million is estimated to install control measures that will ensure full livestock exclusion from streams and sinkholes. Another $137,125 is estimated for further sediment reduction efforts. It is estimated that $602,500 is needed for residential septic system best management practices and another $580,000 for technical and administrative assistance. Also implementation measures will be assisted with local Soil and Water Conservation District Programs, State Department of Conservation and Recreation cost share or tax credit programs, federal U.S. Department of Agriculture conservation programs and other organizations (i.e. Southeast RCAP and VADEQ revolving loan program).

**6) Implementation Schedule**

It is estimated that on the ground implementation of BMPs would start in the summer of 2004. A five-year intensive effort is planned to coincide with anticipated funding through VDCR from EPA Section 319 funds. It is assumed that 20% of the total implementation will occur each year of the five-year schedule and hopeful full attainment of water quality standards within 10 years or by the summer of 2014.

## Introduction

TMDL is an acronym for Total Maximum Daily Load, which is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standard. If the water body surpasses the water quality standard 10% of the time or more during an assessment period, the water body is placed on the Commonwealth of Virginia's 303(d) List of Impaired Waters. Holman's Creek was placed on this list because of violations of the fecal coliform (FC) bacteria water quality standard. Additionally, Holman's was listed as voilating the General Standard benthic water quality standard. After this listing, FC and benthic TMDL studies were developed for Holman's Creek in 2001 and 2003 respectively. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act 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 TMDL Implementation Plan, a framework was established for reducing FC and sediment levels and achieving the water quality goals for which TMDL allocations were developed. With successful completion of the implementation plan, 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 implementation plan will improve the localities chances for obtaining monetary assistance during implementation.

It has been documented time and again the detrimental affects of bacteria in food and water supplies. For example, May 2000, in Walkerton, Ontario a town of approximately 5000 people, there were seven confirmed deaths with four other deaths under investigation, and over 2000 poisonings all attributed to drinking water polluted by *E. coli* Type 0157:H7 (Raine, 2000)(Miller, 2000). 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 probably 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 percent of cattle shed the bacteria at any given time. *E. coli* is a type of fecal coliform bacteria commonly found in intestines of humans and animals. August 8, 1994 VDH was notified of campers and counselors at a Shenandoah Valley summer camp developing bloody diarrhea. *E. coli* 0157:H7 was confirmed as the causative agent. 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 were exposed to the bacteria while swimming in the lake and a two year old hospitalized almost died as a result of the exposure (Roanoke Times, 1997). 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, 1998). June 6, 2000, Crystal Spring, Roanoke Virginia's second largest water source was shut down by Virginia Department of Health for *E. coli* contamination (Roanoke Times, 2000).

Isolated cases? No. Throughout the U.S., the Center for Disease Control estimates at least 73,000 cases of illnesses and 61 deaths per year caused by this one fecal coliform pathogen (i.e. *E. coli* 0157:H7 bacteria) (CDC, 1995 and 2001). Other fecal coliform pathogens (e.g. *E. coli* 0111) are responsible for similar illnesses. In addition, other bacterial and viral pathogens are indicated by the presence of fecal coliforms. Whether the source of contamination is human or livestock 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. Water quality standards are society's implementation of legislative measures resulting from an assessment of the acceptable risks.

Key components of the implementation plan are discussed in the following sections:

- Review of the TMDL Development Study;
- Description of Water Quality Monitoring;
- Process for Public Participation;
- Assessment of Needs; and
- Cost / Benefit Analysis, and Implementation.

## Review of TMDL Studies

Holman's Creek is part of the North Fork of the Shenandoah River watershed, located in Rockingham and Shenandoah Counties, Virginia. Holman's Creek is located approximately 5 miles to the north by northwest of the town of New Market. Holman's Creek is approximately 11,988 acres of which forested (26%) and agricultural (72%) land uses dominate (Figure 1 and Table 1).

Summary of the TMDL development included:

- All livestock must be excluded from streams;
- All failing septic systems and straight pipes must be identified and corrected;
- Reduce wildlife direct deposition in Holman's Creek by 90%;
- Substantial (31% overall) land-based NPS sediment load reductions are needed; and
- Anthropogenic FC sources will be addressed in stage I of the implementation plan, setting aside any reduction of wildlife. The VADEQ will re-assess streams after stage I to determine if the water quality standards have been attained.

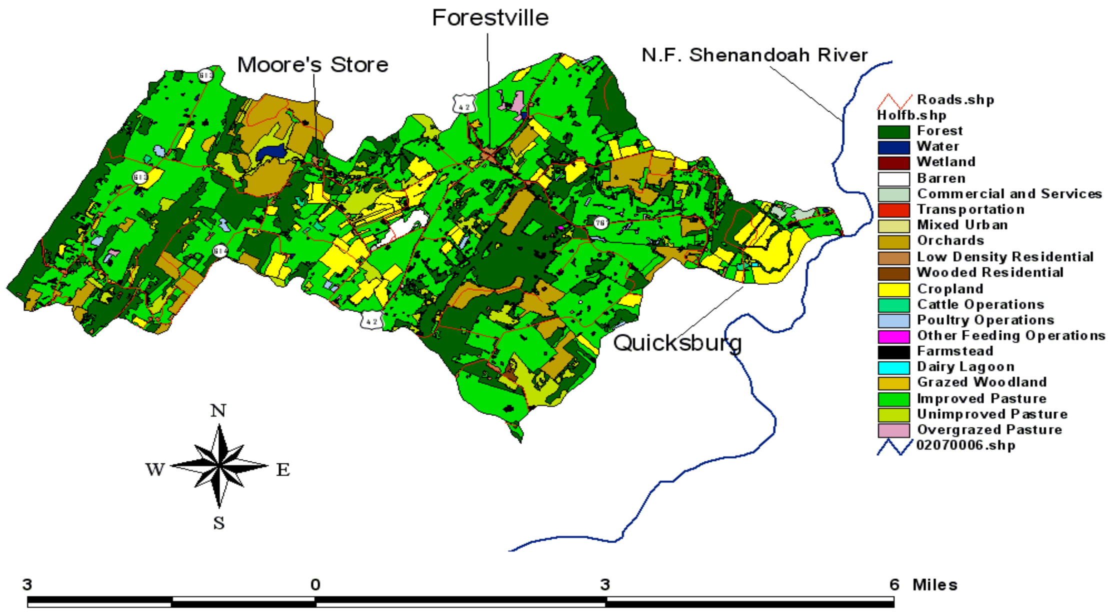
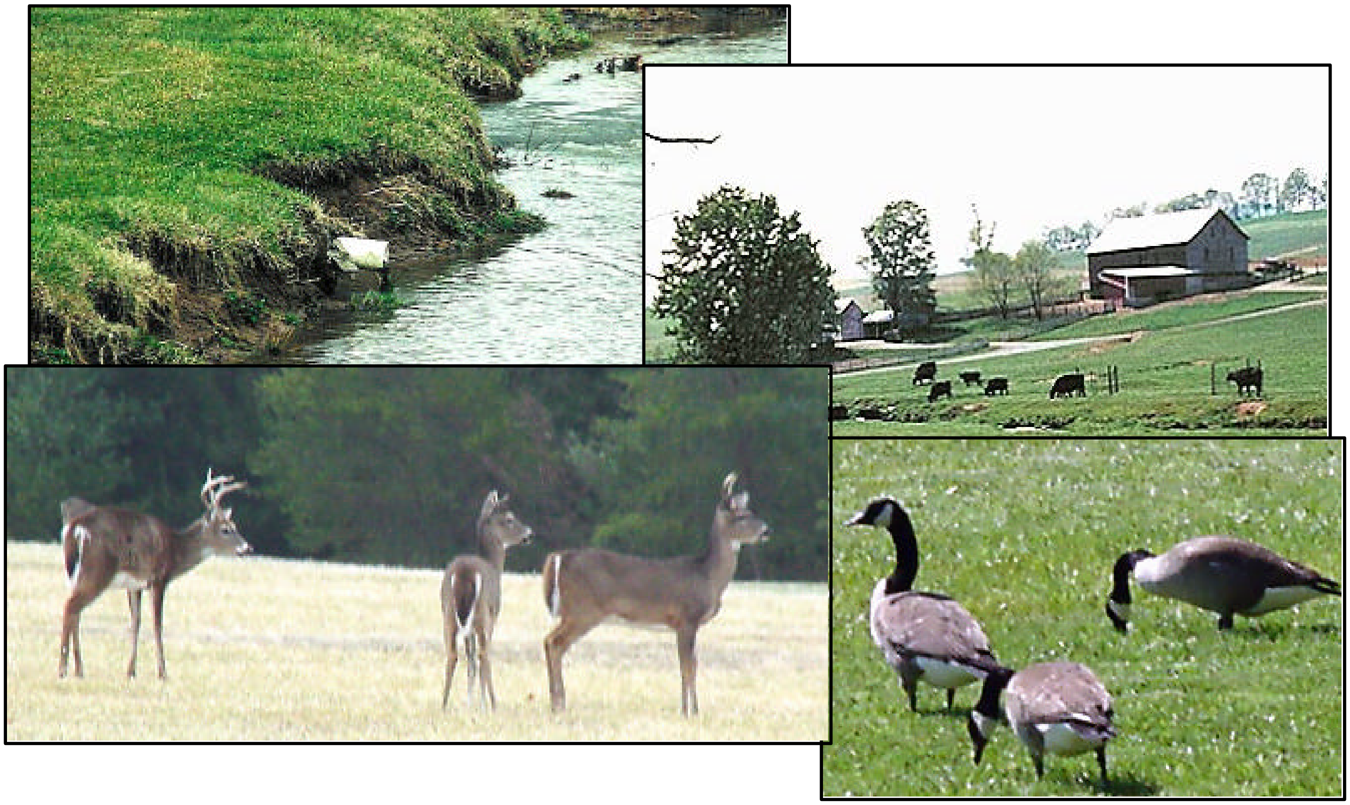



**Figure 1** **Land uses in the Holman's Creek watershed.**

**Table 1** **Land uses in the Holman's Creek watershed**

| **Land Use Description** | **Acres** | **Percent of Total** |
|---|---|---|
| Forest | 3100 | 25.86 |
| Water | 48 | .4 |
| Wetlands | 4 | .03 |
| Barren | 56 | .47 |
| Commercial & Services | 33 | .28 |
| Transportation | 32 | .27 |
| Orchards, vineyards | 1130 | 9.43 |
| Low density residential | 106 | .88 |
| Wooded residential | 14 | .12 |
| Cropland | 924 | 7.71 |
| Cattle operations | 21 | .18 |
| Poultry operations | 58 | .48 |
| Farmstead | 115 | .96 |
| Grazed woodland | 24 | .20 |
| Improved Pasture | 5642 | 47.06 |
| Unimproved Pasture | 646 | 5.39 |
| Overgrazed Pasture | 30 | .25 |
| Other | 4 | .03 |
| **Total** | **11988** | **100** |



## Description of Water Quality Monitoring

Monitoring has occurred at 12 fixed sampling sites throughout Holman's Creek with 3 of these sites maintained by VADEQ. The station nearest the confluence of Holman's Creek with the North Fork of the Shenandoah River is the DEQ ambient monitoring station the 2 upstream stations are biological (benthic) stations (Figure 2). The remaining 9 stations were selected by Dr. Bruce Wiggins of JMU for bacteria source tracking (BST) and were designed to help refine the spatial distribution of bacteria sources. BST using the Antibiotic Resistance Analysis method, yielding the percentage of isolates classified as human, livestock, and wildlife from the stream samples taken. Monitoring indicated significant contributions of fecal coliform from livestock, human, and wildlife sources. Both VADEQ and Dr. Wiggins are continuing to monitor Holman's Creek and hopefully will be able to document water quality improvements as implementation proceeds.

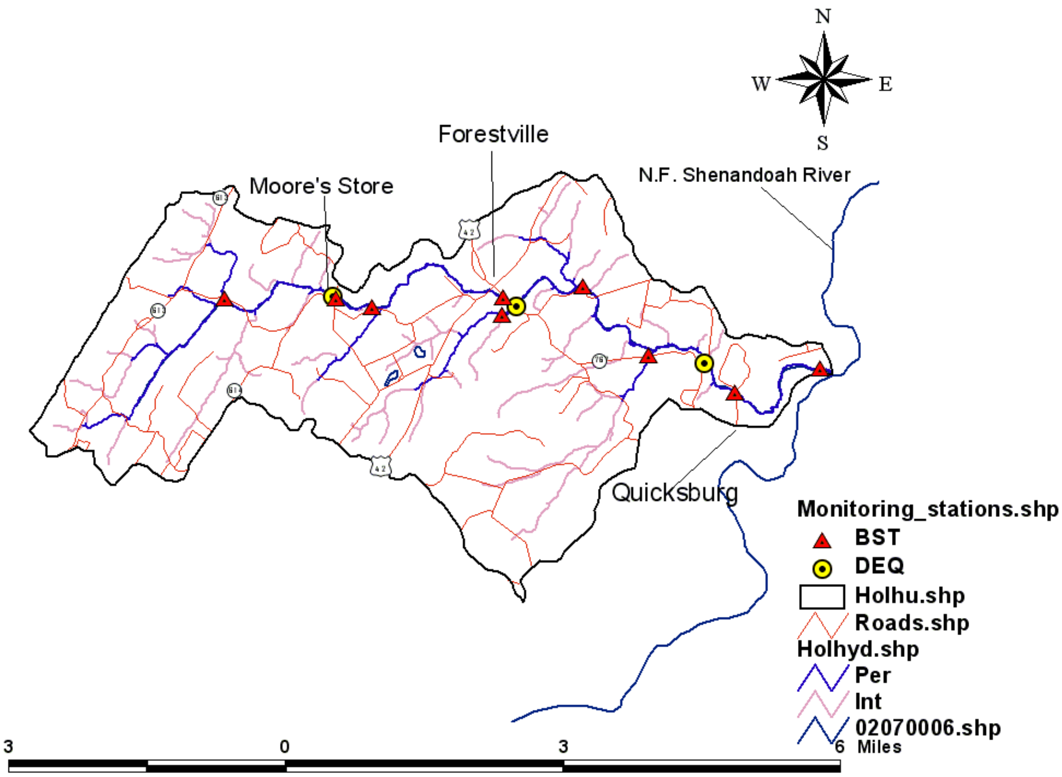



**Figure 2 Monitoring stations within Holman's Creek Watershed.**

## Process for Public Participation

The actions and commitments described in this document are drawn together through input from citizens of the watersheds, the Holman's Creek Citizens Watershed Committee (HCCWC), Shenandoah County government, Virginia Department of Conservation and Recreation (VADCR), Virginia Department of Environmental Quality (VADEQ), Virginia Department of Health (VDH), Virginia Cooperative Extension Service (VACES), Natural Resources Conservation Service (NRCS), Lord Fairfax Soil and Water Conservation District (LFSWCD), Shenandoah Valley Soil and Water Conservation District (SVSWCD), Virginia Department of Agriculture and Consumer Services (VDACS), and the Shenandoah County Farm Bureau Association. Every citizen and interested party in the watersheds is encouraged to become involved in this initiative and contribute what they are able to help restore the water quality and aquatic health of the stream. Public participation took place on two levels. First, two 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. steering committee) and to present the draft plan. Second, a steering committee was formed with representation from the HCCWC, VADCR, VADEQ, VDH, Shenandoah County Farm Bureau Association, LFSWCD, and the SVSWCD. Over 500 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and governmental interests from across the watershed.

Throughout the public participation process, major emphasis was placed on discussing best management practices (BMP) specifications, location of control measures, education, technical assistance, and funding. The steering committee agreed that potential control measures identified through the implementation plan process should be practical, cost-effective, equitable, and based on the best science and research available. Implementation of the identified control measures should be administered in a timely manner to efficiently and economically target problem areas through stages.

All members of the steering committee agreed that education is 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. For the agricultural community, small workshops and farm visits may be needed to accomplish this. During workshops and farm visit, an informational packet could be handed out defining the TMDL and what it means to the farmer, options each farmer has for funding sources (e.g. voluntary, cost-share, and tax credit) with requirements of each and list of components with cost (e.g. alternative watering systems). For residential issues, small community meetings similar to small workshops proposed for the agricultural community and one on one contact were recommended for educating homeowners about septic system maintenance. It was generally recognized that homeowners are unaware of the need for regular septic system maintenance. A technician dealing with residential issues should contact homeowners about septic system maintenance issues and schedule pump-outs. After identification of failing septic systems or straight pipes the technician would explain options available for correcting the problems and for funding sources. Notices using all media outlets will be posted regarding septic systems (e.g. a reminder to pump-out septic tank every 3-5 years). An educational packet will 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 video of septic maintenance and repair, would be useful in communicating the problem and needs to the public.

Traditionally, funding for residential issues have fallen on the landowner and funding for agricultural practices has been both voluntary and through the state's cost-share program. In addition to traditional sources of funding, approximately $1.5 million in 319 funding will be available this year for implementation in areas of the Commonwealth that have an approved implementation plan. A great deal of the implementation for agricultural practices in watershed is expected to be by participation in state and federal cost-share programs. Suggestions to stimulate implementation included:

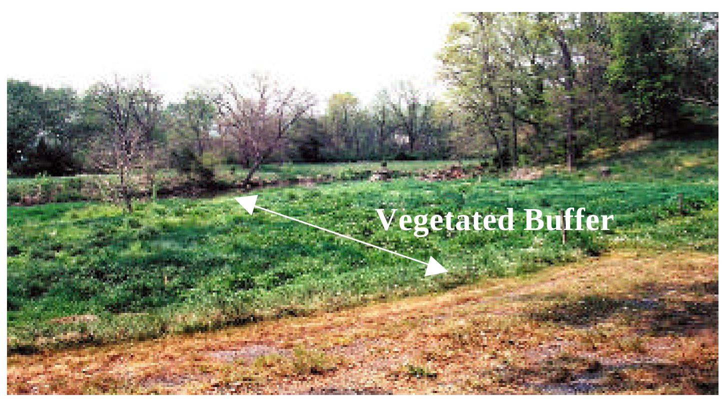
1. Provide educational materials to homeowners and landowners on the importance of water quality and what it means to them personally.
2. Outreach must occur on multiple levels to include local media, mailings, and one on one contact.
3. Provide educational materials to homeowners and landowners on the nature of karst topography in the watershed and the relationship of this geology to water quality of the stream and their drinking water, and ground and surface water quality interactions.

4. That everyone is part of the water quality problem and everyone working together is the solution to improving water quality in the watershed.
5. Continue the septic program currently underway to include a pump-out component.

## Assessment of Needs

The quantity of control measures required during implementation was determined through spatial analyses of land use, stream-network, elevation, and soils maps/data along with regionally appropriate data archived in the DCR Agricultural BMP Database and TMDL development documents. The map layers and archived data were combined to establish estimates of control measures required overall, in each watershed, and in each subwatershed. Additionally, input from local agency representatives were used to modify the analyses. Estimates of control practices needed for full implementation in the watershed are listed in Table 2.


There are approximately 12 miles of perennial stream and 18 miles of intermittent stream in the watershed. After accounting for the existing installed streamside fencing. The total length of fencing required for perennial and intermittent streams combined is approximately 53 miles. Associated with the streamside fencing through pasture are 138 full livestock exclusion systems consisting of streamside fencing, cross fencing and watering source. Streamside fencing of cropland will not require a full livestock exclusion system; instead, it is assumed that temporary poly-wire will be used to restrict livestock from entering stream if cropland is utilized for grazing. Since this practice occurs irregularly in Holman's Creek watershed the extent and cost of this practice was not estimated.




In order to address the land reductions of sediment needed in Holman's Creek Watershed, the benefit of including a 25 ft. buffer with streamside fencing was calculated. Given that reductions were not sufficient to meet total TMDL sediment reduction goals, additional control measures will need to be implemented to obtain land-based reductions of sediment. If water quality goals are not met after full livestock stream and sink hole exclusion is accomplished in Holman's Creek land reductions can be addressed through installation of loafing lot management systems, manure incorporation in soil, installation or expansion of animal waste control facilities, pasture management, conversion of pasture to hayland, and export of waste. A cover crop on 660 cropland acres and conservation tillage practices on 569 acres annually should account for sediment reduction needed from cropland. And in combination with the livestock exclusion systems should meet the total sediment reductions required by the sediment TMDL.

**Table 2 Estimation of average control measures with unit cost needed during implementation for agricultural and residential programs in Holman's Creek Watersheds.**

| Control Measure | Unit | Estimated Units Needed | Average Cost / Unit ($) |
|---|---|---|---|
| *Agricultural Program:* | | | |
| Full Exclusion System | system | 138 | 29,147 |
| Hardened Crossing | system | 55 | 3,000 |
| Sinkhole fencing | linear ft | 16,000 | 2.25 |
| Conservation Tillage | ac/yr | 569 | 25 |
| Cover Crops | ac/yr | 660 | 20 |
| Technical Assistance | man-year | 7 | 50,000 |
| Administrative Assistance | man-year | 2.5 | 35,000 |
| *Residential Program:* | | | |
| Septic System (replacement) | system | 25 | 5,000 |
| Alternative Septic System | system | 25 | 16,000 |
| Septic System (repair) | system | 25 | 1,500 |
| Septic System pump-out | system | 200 | 200 |
| Technical Assistance | man-year | 2.5 | 50,000 |
| Administrative Assistance | man-year | 0.5 | 35,000 |

In addition to the reduction achieved from buffers installed with streamside fencing in Holman's Creek, FC reductions on pasture will be achieved through improved pasture management. It is anticipated that intensive pasture management could achieve specified FC and sediment reductions. Based on NRCS data approximately 64 sinkholes exist in pastureland. Assuming an average of 300 linear feet of fencing being required to exclude livestock from each of these features it would require an additional 19,200 linear feet of fencing.


The number and location of failing septic systems were based on numbers estimated by the Steering Committee. Correspondingly, for Holman's Creek, 100% of the failed septic systems distributed between subwatersheds must be identified and fixed during implementation. Significant progress toward this goal has already been completed via the Water Quality Improvement Act projects conducted in the watershed. To date 39 failing systems have been replaced. Based on assumptions outlined in the TMDL, no straight pipes in Holman's Creek Watershed are believed to exist. However, the steering committee believes this not to be a valid assumption and if any are found they must be corrected to be in compliance with state code.

To determine the number of man-years necessary for agricultural technical assistance during implementation, members of the Steering Committee estimated the total practices needed to be installed per year during implementation. As a result, 7 technical man-years and 2.5 administrative man-years are needed to provide agricultural technical assistance through 5 years of implementation. Members of the Steering Committee estimated that 2.5 technical man-year and a half administrative man-year would be required to provide residential technical assistance and educational outreach tasks identified during plan development. The number of man-years needed to provide technical assistance during implementation in the watershed is listed in Table 2.

## Cost / Benefit Analysis

Associated cost estimations for systems needed for full livestock exclusion and land-applied reductions were calculated by multiplying the unit cost per the number of units in each subwatershed (Table 2). As depicted in Table 3, the total estimated cost to install control measures that will ensure full livestock exclusion from streams and sinkholes in the watershed is $4.23 million excluding technical assistance. The total cost to install control measures to obtain the land-applied sediment reductions beyond those attained by livestock exclusion in the watershed is estimated at $27,425 annually excluding technical assistance.

**Table 3 Estimated total implementation cost for agricultural BMPs, residential BMPs, and technical assistance in Holman's Creek Watershed.**

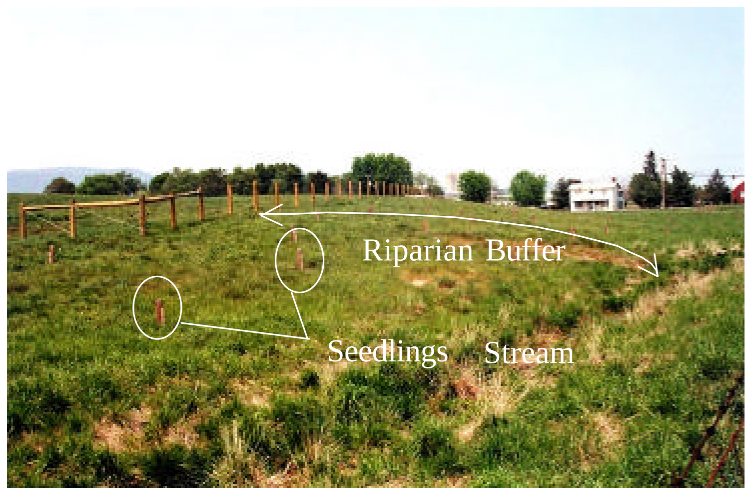
| Control Measure | Estimated Total Cost (in million $) |
|---|---|
| Livestock Exclusion BMPs | 4.23 |
| Land-applied BMPs | 0.14 |
| Residential BMPs | 0.60 |
| Technical Assistance | |
| *Agricultural Programs* | 0.44 |
| *Residential Programs* | 0.14 |
| Total | 5.55 |

Cost estimations to fix failed septic systems and replace identified straight pipes were based on the combination of drainfield repair, maintenance, new septic systems, or alternative waste treatment systems. Without site surveys at each location where system repair/replacement/installation is required, it is difficult to determine the proportion of sites needing alternative systems. In this light, it

Peat Moss Filtering System

was assumed that sites were evenly split between needing standard systems (i.e. septic systems or drainfield repair) and alternative systems (e.g. peat moss filter systems). The total cost estimated for repair/replacement/installation of private sewage systems was $602,500.

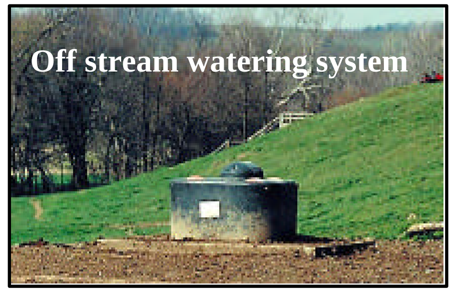
It was determined in previous TMDL implementation planning efforts that it would require $50,000 and $35,000 to support the salary, benefits, travel, and training of one technical man-year and administrative man-year, respectively. With quantification analysis yielding a need for 7 technical man-years and 2.5 administrative man-years, the total cost to provide agricultural technical assistance during implementation is expected to be $437,500 (Table 3). For residential technical assistance, approximately $142,500 is needed to support 2.5 technical man-years and half an administrative man-year. (Table 3)



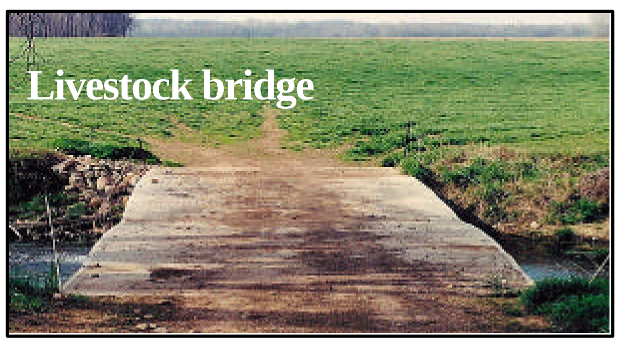

The primary benefit of implementation is cleaner waters in Virginia. Specifically, fecal contamination and sediment concentrations in Holman's Creek will be reduced to meet water quality standards. Since the Holman's Creek watershed is heavily influenced by karst topography it is likely throughout the watershed that drinking water wells water quality would improve. 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 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 standard (Benthic) in these waters. The vegetated buffers that are established will also serve to reduce sediment and nutrient transport to the stream from upslope locations. In areas where pasture management is improved through implementation of grazing-land-protection BMPs, soil and nutrient losses should be reduced, 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, intensive pasture management, improved nutrient management, and private sewage system maintenance will each provide economic benefits.

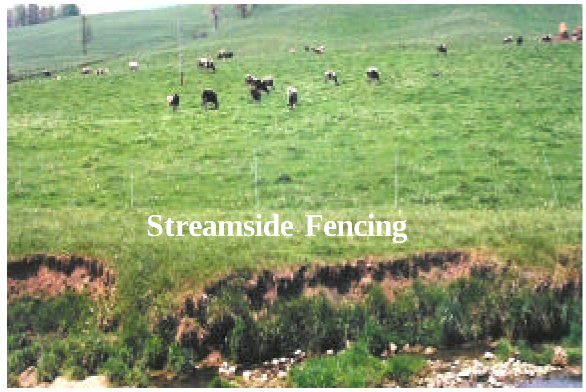



A clean water source has been shown to improve weight gain and milk production in cattle. Fresh clean water is essential for livestock with healthy cattle consuming, on a daily basis, close to 10% of their body weight during winter and 15% of their body weight in summer. Many livestock illnesses can be spread through contaminated water supplies. For instance, coccidia can be delivered through feed, water and haircoat contamination with manure (VACES, 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 (VACES, 1998). 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 VACES (1998) reports that mastitis currently costs producers $100 per cow in reduced quantity and quality of milk produced. On a larger scale, mastitis costs the U.S. dairy industry about $1.7-2 billion annually or 11% of total U.S. milk production. While the spread of mastitis through a dairy heard 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. Implementation 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 livestock stocking rates by 30 - 40%, and consequently, improve the profitability of the operation. With feed costs typically responsible for 70-80% of the cost of growing or maintaining an animal, and pastures providing feed at a cost of .01-.02 cents/lb of total digestible nutrients (TDN) compared to .04-.06 cents/lb TDN for hay, increasing the amount of time that cattle are fed on pasture is clearly a financial benefit to producers (VACES, 1996). Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal. In addition to reducing costs to producers, intensive pasture management can boost profits, by allowing higher stocking rates and increasing the amount of gain per acre. A side benefit is that cattle are more closely confined allowing for quicker checking and handling.

The implementation of nutrient management and soil conservation plans in conjunction with cover crops and conservation tillage should reduce levels of sediment in the streams of Holman's Creek watershed. Cover crops and conservation tillage practices can significantly reduce the amount of topsoil lost to erosion thereby keeping the soil in the field were it can be utilized for production of crops during the growing season. Additionally, increased interception and infiltration of rainfall by the cover crop and crop residue from conservation tillage will reduce runoff volumes and consequently soil and nutrient losses to surface waters. By doing so, the environment and downstream water supplies will be protected from sediment. In general, many of the agricultural BMPs being recommended 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 with it. In terms of economic benefits to homeowners, an improved understanding of private sewage systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. The average septic system will last 20-25 years or longer if properly maintained. Proper maintenance includes; knowing the location of the system components and protecting them by not driving or parking on top of them, and not planting trees where roots could damage the system, keeping hazardous chemicals (including water softening chemicals) out of the system, and pumping out the septic tank every 3 to 5 years. The cost of proper maintenance, 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. Replacing outhouses and having properly functioning and maintained septic system can enhance property values in the watershed.

## Implementation

Potential funding sources available during implementation were identified during plan development. Detailed description of each source can be obtained from the LFSWCD, VADCR, NRCS, VACES, and VADEQ. Sources include:

- 319 Incremental Funds
- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program

- Virginia Agricultural Best Management Practices Loan Program
- Virginia Water Quality Improvement Fund
- 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 (Southeast RCAP)

Progress toward end goals will be assessed during implementation through tracking of control measure installations by VADCR and continued water quality monitoring by VADEQ and JMU. It is recommended that continued water quality monitoring be made based on the existing monitoring network and spatial distribution of the staged implementation plan. Water quality analysis should include fecal coliform/*E. coli* enumerations, and BST analysis. BST may provide an indication of the effectiveness of specific groups of control measures, specifically agricultural and residential.

Implementation is scheduled to begin in July 2004 after which four milestones need to be met within the next ten years (Figure 4). The first milestone will be two years after implementation begins, whereby 40% of the livestock exclusion systems and 40% of the residential control measures will be installed with a 3% expected reduction in exceedances of geometric mean water quality standard (Table 4). After four years from the start of implementation, 80% of the livestock exclusion systems will be installed resulting in a 15% anticipated reduction in exceedances. After the fifth year, all control measures to reduce the direct and land-applied NPS loads will be installed in order to meet the third milestone of 100% full implementation and 0% to 7% exceedance of the water quality standard. The final milestone will be delisting of the impaired segments from the Commonwealth of Virginia's 303(d) List of Impaired Waters, which is anticipated to occur by 2014. Based on meeting the above milestones, a five-year implementation plan outline was formulated as depicted in Tables 5 and 6.

**Table 4 Estimation of fecal coliform geometric mean water quality standard violations, percent implementation, and date at each milestone in Holman's Creek watershed.**

| Milestone | Holman's Creek (% violation) | Implementation (%) | Target Date |
|---|---|---|---|
| Existing | 99 | 0 | 7/1/04 |
| 1 | 97 | 40 | 7/1/06 |
| 2 | 85 | 80 | 7/1/08 |
| 3 | 0 | 100 | 7/1/09 |

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, monitoring results, and survey responses. Monitored data collected prior to and during the TMDL development process was used together with spatial analysis and modeling results to identify subwatersheds where initial implementation resources would result in the greatest return in water quality improvement. If feasible, effort should be made to concentrate resources first in subwatersheds HC-3 and HC-4 (Figure 3). It was assumed that failed septic systems in close proximity to a stream would have a larger impact on water quality than a system upland. Therefore, efforts should be made to identify and contact residents within 300 feet of a stream first during implementation to address septic system failures.

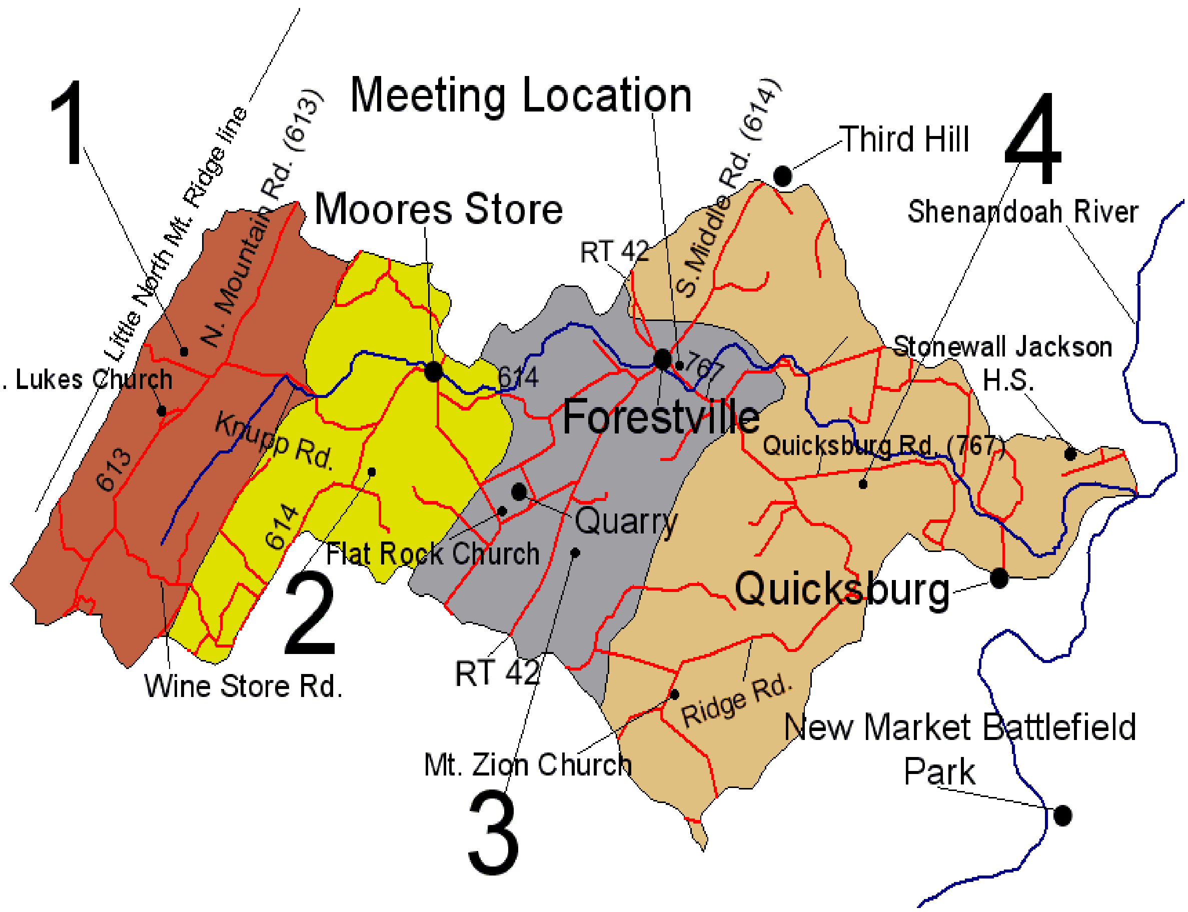



**Figure 3 Holman's Creek Subwatersheds.**

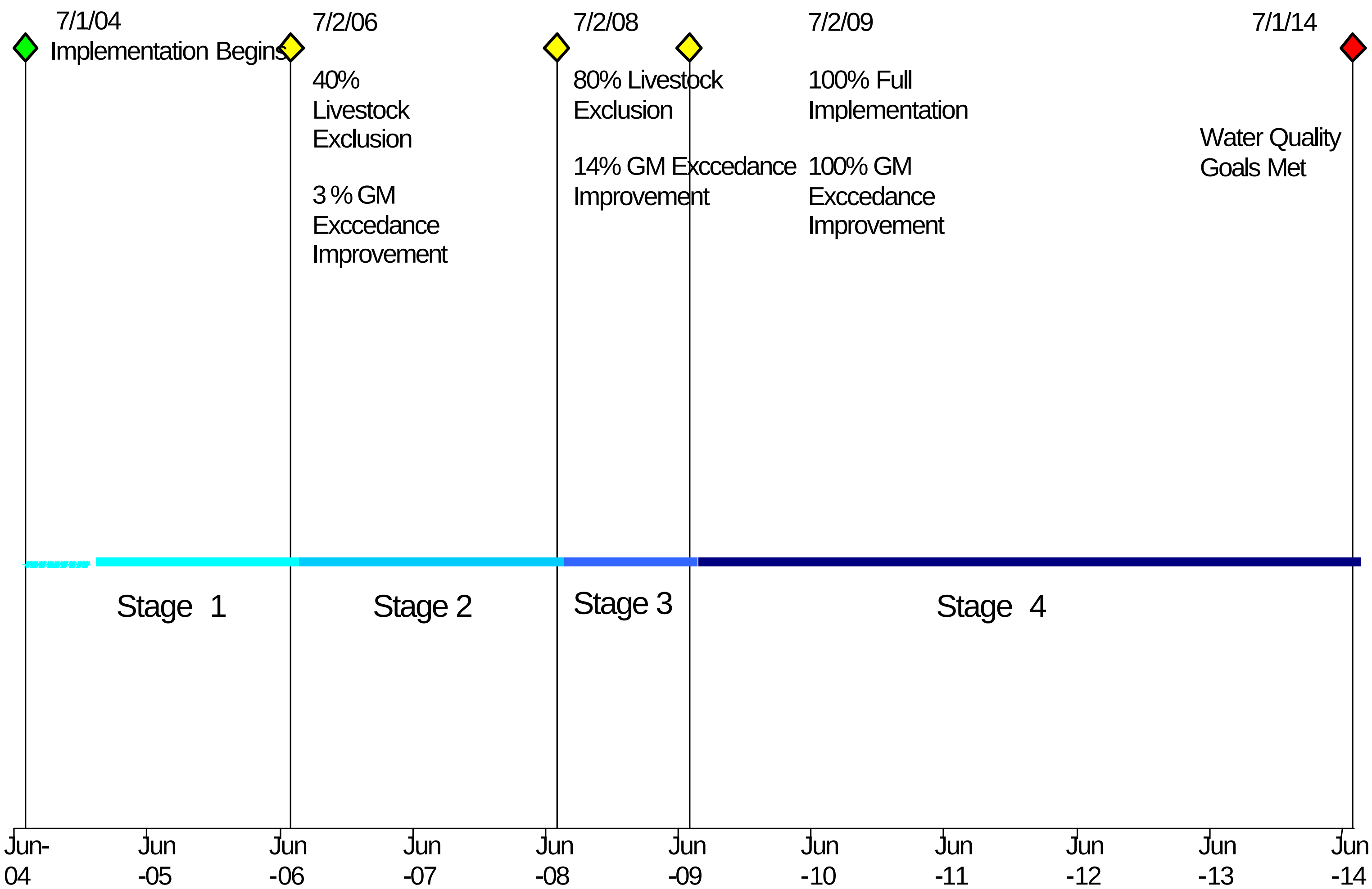



**Figure 4 Implementation milestones for Holman's Creek watershed.**

**Table 5 Percentage of practices to be installed addressing livestock exclusion, land-applied reductions, failed septic systems, and straight pipes with amount of technical assistance needed in Holman's Creek Watershed.**

| Date | Livestock Exclusion | Land-Applied | Failed Septic | Agricultural Technical Assistance | | Residential Technical Assistance | |
|---|---|---|---|---|---|---|---|
| | | | | *Technical* | *Administrative* | *Technical* | *Administrative* |
| (year) | (%) | (%) | (%) | (MAN-YEARS) | (MAN-YEARS) | (MAN-YEARS) | (MAN-YEARS) |
| 1 | 20 | 20 | 20 | 1.4 | 0.5 | 0.5 | 0.1 |
| 2 | 20 | 20 | 20 | 1.4 | 0.5 | 0.5 | 0.1 |
| 3 | 20 | 20 | 20 | 1.4 | 0.5 | 0.5 | 0.1 |
| 4 | 20 | 20 | 20 | 1.4 | 0.5 | 0.5 | 0.1 |
| 5 | 20 | 20 | 20 | 1.4 | 0.5 | 0.5 | 0.1 |
| *Total* | *100* | *100* | *100* | *7* | *2.5* | *2.5* | *0.5* |

**Table 6 Cost associated with percentage of practices installed addressing livestock exclusion, land-applied reductions, failed septic systems, and straight pipes and technical assistance needed in Holman's Creek Watershed.**

| Date | Livestock Exclusion | Land-Applied | Failed Septic & Straight Pipes | Agricultural Technical Assistance | | Residential Technical Assistance | | Total Cost Per Year |
|---|---|---|---|---|---|---|---|---|
| | | | | *Technical* | *Administrative* | *Technical* | *Administrative* | |
| (year) | ($) | ($) | ($) | ($) | ($) | ($) | ($) | ($) |
| 1 | 846,097 | 27,425 | 120,500 | 70,000 | 17,500 | 25,000 | 3,500 | 1,110,022 |
| 2 | 846,097 | 27,425 | 120,500 | 70,000 | 17,500 | 25,000 | 3,500 | 1,110,022 |
| 3 | 846,097 | 27,425 | 120,500 | 70,000 | 17,500 | 25,000 | 3,500 | 1,110,022 |
| 4 | 846,097 | 27,425 | 120,500 | 70,000 | 17,500 | 25,000 | 3,500 | 1,110,022 |
| 5 | 846,097 | 27,425 | 120,500 | 70,000 | 17,500 | 25,000 | 3,500 | 1,110,022 |
| *Total* | *4,230,485* | *137,125* | *602,500* | *350,000* | *87,500* | *125,000* | *17,500* | *5,550,110* |

## Stakeholder’s Roles and Responsibilities

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 and environmental programs must first acknowledge there is a water quality problem and then make changes in our operations, programs, and legislation to address these pollutants.

The USEPA has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act (CWA). However, administration and enforcement of such programs falls largely to the states. 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 include: Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Agriculture and Consumer Services, and Virginia Department of Health.

VADEQ has responsibility for monitoring the waters to determine compliance with state standards, and for requiring permitted, point source dischargers to maintain loads within permit limits. They have the regulatory authority to levy fines and take legal action against those in violation of permits. 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 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. One such program is Virginia’s Erosion and Sediment Control Law. Under this provision, a person must have an approved erosion and sediment control plan and a certification that the plan will be implemented before they can obtain a building permit. However, most VADCR programs dealing with agricultural NPS pollution historically have 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 that VADCR does not have regulatory authority over the majority of issues addressed here except for the Erosion and Sediment Control program.

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

Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken which can include a civil penalty up to $5,000 per day. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, etc. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures. VDACS has only 1 staff member dedicated to enforcing the Agricultural Stewardship Act, and very little funding is available to support water quality sampling. The Agricultural Stewardship Act is entirely complaint driven. As of March of 2003, 215 complaints, of which 41% were founded, had been received statewide since the initiation of the legislation (VDACS 2003).

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

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

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 part of the Clean Water Act was largely ignored by USEPA 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 USEPA was not carrying out the statutes of the CWA began as far back as the 1970's and have continued until the present. In the state of Virginia in 1998, the American Canoe Association and the American Littoral Society filed a complaint against EPA for failure to comply with provisions of §303(d). 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 citizen's wells found them 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). Closer to home, on the Eastern Shore of Virginia, a shellfish farmer sued his neighbor, a tomato grower. The shellfish farmer claimed the agricultural runoff created from the plasticulture operation was carrying pollutants that were destroying his shellfish beds. The suit was settled out of court in favor of the shellfish farm for an undisclosed amount.

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 seeing that Virginia's waters are clean and provide a healthy environment for its citizens. An important first step in correcting the existing water quality problem is recognizing that there is a problem. While it is unreasonable to expect that the natural environment (e.g. streams and rivers) can be made 100% free of risk to human health, it is possible and desirable to make what improvements we can. Virginia's approach to correcting NPS pollution problems has been and continues to be encouragement of participation through education and financial incentives.

## Watershed Planning Integration

Implementation of the TMDLs for Holman's Creek should not occur in a void. The efforts to implement this plan should work hand in glove with the goals of the Shenandoah County and the Commonwealth as a whole. The successful installation of the control measures outlined in this plan should help reach the overall water quality improvement goals and requirements of Shenandoah County specifically:

- Shenandoah County Nutrient Reduction Plan dated 1996
- Article XIA of Shenandoah County Code, Environmental Performance Standards, Section 165-85.1 Stream Buffers
- Section 165-85.2 of County Code, On-site sewage disposal systems
- Section 165-129.1 of County Code, Prohibited uses and activities
- Section 165-135 of County Code, Design Criteria fro utilities and facilities
- Section 165-83 of County Code, Nutrient management plan
- Chapter 87 of County Code, Erosion and Sediment Control

Additionally, implementation of this plan will help the Commonwealth achieve the goals of the Chesapeake Bay Tributary Strategies specifically the strategy for reducing nutrients and sediment to the Shenandoah and Potomac Rivers.

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