Little Dark Run and Robinson River Bacteria Total Maximum Daily Load Implementation Plan

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Submitted: March 31, 2011

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction

The Virginia Total Maximum Daily Load (TMDL) program is a process to improve water quality and restore impaired waters in Virginia. Specifically, TMDL is the maximum amount of pollutant that a waterbody can assimilate without surpassing the state water quality standards for protection of the five beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, and aquatic life.

Little Dark Run, Upper Robinson River, and Lower Robinson River were initially placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters in 1994, 2002, and 2004 for exceedances of the bacteria standard, respectively. After these listings, a TMDL study was conducted to identify bacteria sources in the watersheds. After a TMDL study is complete and approved by the United States Environmental Protection Agency, 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". To comply with this state requirement, a TMDL implementation plan was developed to reduce bacteria levels to attain water quality standards allowing delisting of streams from the Section 303(d) List of Impaired Waters. The TMDL implementation plan describes control measures, which can include the use of better treatment technology and the installation of best management practices, to be implemented in a staged process.

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

- **Review of TMDL Development Study**
- **Public Participation**
- **Implementation Actions**
- **Measurable Goals and Milestones for Attaining Water Quality Standards**
- **Stakeholder's Roles and Responsibilities**
- **Integration with Other Watershed Plans**
- **Potential Funding Sources**

Review of TMDL Study

Impairment description, water quality monitoring, watershed description, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on implementation plan development. Conditions outlined in the TMDL development study to address the bacteria impairments in these watersheds include:

- Exclusion of most/all livestock including horses from streams is necessary;
- Substantial land-based NPS load reductions are called for on pasture and cropland;
- All straight pipes and failing septic systems need to be identified and corrected;
- Implicit in the requirement to correct straight pipes and failing septic systems is the requirement to maintain all properly functioning septic systems;

- Reductions to pet bacteria loads on residential land use are necessary; and
- Implicit in the requirement for no point source bacteria load adjustment is the requirement for point sources to maintain permit compliance.

Public Participation

The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Madison and Culpeper Counties government; Town of Culpeper; Culpeper Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Environmental Quality; Virginia Department of Health; Virginia Cooperative Extension; Virginia Outdoors Foundation; Virginia Department of Forestry; Natural Resources Conservation Service; Blue Ridge Foothills Conservancy; Piedmont Environmental Council; Rapidan Better Housing; Rappahannock-Rapidan Regional Commission; and Blue Ridge Environmental Solutions, Inc.

Public participation took place during implementation plan development 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, three working groups were formed: Agricultural, Residential, and Governmental. Third, a Steering Committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; Madison and Culpeper Counties government; Culpeper Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Environmental Quality; Virginia Department of Health; Virginia Cooperative Extension; Natural Resources Conservation Service; Rappahannock-Rapidan Regional Commission; and Blue Ridge Environmental Solutions, Inc. to guide the development of the implementation plan. Over 500 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level.

Implementation Actions

The quantity of control measures, or BMPs, required during implementation was determined through spatial analyses of land use, stream-network, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the Virginia Department of Conservation and Recreation Agricultural BMP Database and TMDL document. Bacteria load reductions on land uses were determined through modeling alternative implementation scenarios, defining percentage of land use area or unit amount treated by control measure, then applying related reduction efficiency to the associated load. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses.

Associated cost estimations for each implementation action were calculated by multiplying the average unit cost per the number of units. Focusing on Stage I (*i.e.*, removal of impairments from impaired waters list) costs, the total agricultural corrective action costs equal $16.49 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems during Stage I totals $4.94 million. The cost to implement the first steps of the pet waste reduction actions totals an estimated

seven thousand dollars. Cost to install vegetated buffers, rain gardens, and infiltration trenches during Stage I equal $1.04 million. The total costs to provide assistance in the agricultural and residential programs during Stage I implementation are expected to be $2.34 million and $1.66 million, respectively. The total Stage I implementation cost including technical assistance is $26.48 million with the agricultural cost being $18.83 million and residential cost $7.65 million.

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the Little Dark Run and Robinson River impairments will be reduced to meet water quality standards, benefiting human and livestock herd health, stakeholder economy, and improve the aquatic community. An important objective of the implementation plan is to foster continued economic vitality and strength.

Measurable Goals and Milestones for Attaining Water Quality Standards

The end goals of implementation are restored water quality in the impaired waters and subsequent de-listing of streams from the List of Impaired Waters. Progress toward end goals will be assessed during implementation through tracking of control measure installations. The Virginia Department of Environmental Quality will continue to assess water quality through its monitoring program. Implementation will be assessed based on reducing exceedances of the bacteria water quality standard, thereby improving water quality. Implementation of control measures is scheduled for 15 years and will be assessed in two stages. Stage I is based on meeting source allocations that translate to an instantaneous standard exceedance rate of 10.5% or less resulting in de-listing of streams. The Stage II goal is based on implementing source allocations to meet the specified TMDL goal, 0% exceedance of water quality standards.

Implementation in years one through twelve for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, and cropland conversion. BMPs installed in years thirteen through fifteen are based on additional treatment of bacteria load not treated during Stage I from pasture and cropland using improved pasture management, manure / biosolids incorporation into soil, and retention ponds. Implementation in years one through twelve for residential bacteria loads focuses on performing septic tank pump-outs, identification and removal of straight pipes, repairing or replacing failed septic systems, instituting pet waste control program, installation of pet waste enzyme digesting composters, installation of a confined canine unit waste treatment system, and vegetated buffer installation. Rain garden and infiltration trench installations will be concentrated in years eleven through fifteen if needed.

Stakeholder's Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Successful implementation depends on stakeholders taking responsibility for their role in the process, and the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. 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.

The Culpeper Soil and Water Conservation District will provide agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: Virginia Department of Environmental Quality; Virginia Department of Conservation and Recreation; Virginia Department of Health; Virginia Department of Agriculture and Consumer Services; Virginia Department of Game and Inland Fisheries; Virginia Department of Forestry; Virginia Cooperative Extension; and Virginia Outdoor Foundation. The Natural Resources Conservation Service will provide cost-share funds and technical assistance.

Integration with Other Watershed Plans

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include but are not limited to Chesapeake Bay Watershed Implementation Plan, TMDLs, Roundtables, Water Quality Management Plans, Erosion and Sediment Control Regulations, Stormwater Management Program, Source Water Assessment Program, and local comprehensive plans. Financial and technical resources may be maximized for implementation by coordinating and expanding the planning and implementation activities of these on-going watershed projects or programs.
Current initiatives within Madison and Culpeper Counties to be integrated with the Little Dark Run and Robinson River TMDL IP include:

- Madison and Culpeper Counties Comprehensive Plans
- Town of Madison Comprehensive Plan
- Upper Hazel River Bacteria TMDL IP
- CSWCD Septic Program
- Blue Ridge Foothills Conservancy Strategic Plan
- Madison County Asset Management Project
- Chesapeake Bay Watershed Implementation Plan
- Piedmont Environmental Council Strategic Plan
- Friends of the Rappahannock Strategic Plan
- Rappahannock River Basin Commission

Potential Funding Sources

Potential funding sources available during implementation were identified in the course of plan development. Detailed description of each source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the Culpeper Soil and Water Conservation District; Virginia Department of Conservation and Recreation; Virginia Department of Health; Virginia Department of Environmental Quality; Virginia Department of Game and Inland Fisheries; Virginia Cooperative Extension; Virginia Outdoors Foundation; and Natural Resources Conservation Service.

INTRODUCTION

The Virginia Total Maximum Daily Load (TMDL) program is a process to improve water quality and restore impaired waters in Virginia. Specifically, TMDL is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standards for protection of the five beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, and aquatic life. If the water body surpasses the water quality criteria during an assessment period, Section 303(d) of the Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a TMDL for each pollutant.

Little Dark Run, Upper Robinson River, and Lower Robinson Riverwere initially placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters in 1994, 2002, and 2004 for exceedance of the bacteria standard respectively. After these listings, a TMDL study was conducted in 2005 to identify bacteria sources in the watersheds and set limits on the amount of bacteria these rivers can tolerate and still maintain support of the Recreational Use.

Little Dark Run

A TMDL IP was developed to reduce bacteria levels to attain water quality standards allowing delisting of impaired waters from the Section 303(d) List. The TMDL IP describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process. Local support and successful completion of the implementation plan will enable restoration of the impaired water while enhancing the value of this important resource for the Commonwealth. Opportunities for Madison and Culpeper Counties, local agencies, and watershed residents to obtain funding will improve with an approved IP.

This public document is an abbreviated version of the technical document, which can be obtained by contacting the Virginia Department of Conservation and Recreation (VADCR) office.

STATE AND FEDERAL REQUIREMENTS FOR IMPLEMENTATION PLANS

In developing this implementation plan, both state and federal requirements and recommendations were followed. Virginia's 1997 WQMIRA directs the State Water Control Board (SWCB) to "develop and implement a plan to achieve fully supporting status for impaired waters" (§62.1-44.19:4 through 19:8 of the Code of Virginia). WQMIRA establishes that the implementation plan shall include the date of expected achievement of water quality objectives, measurable goals, corrective actions necessary and the associated costs, benefits, and environmental impacts of addressing the impairments.

Section 303(d) of the CWA and current USEPA regulations do not require the development of implementation strategies. USEPA 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 description of the implementation actions and management measures, timeline for implementing these measures, legal or regulatory controls, time required to attain water quality standards, monitoring plan, and milestones for attaining water quality standards.

Lower Robinson River

USEPA develops guidelines that describe the process and criteria to be used to award CWA Section 319 nonpoint source grants to States. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the nine elements that must be included in the IP to meet the Section 319 requirements.

Once developed, Virginia Department of Environmental Quality (VADEQ) will present the IP to the SWCB for approval as the plan for implementing pollutant allocations and reductions contained in the TMDL. In addition, VADEQ will request the plan be included in the appropriate Water Quality Management Plan (WQMP), in accordance with the CWA's Section 303(e) and Virginia's Public Participation Guidelines for Water Quality Management Planning.

REVIEW OF TMDL DEVELOPMENT STUDY

Bacteria TMDLs for the Little Dark Run, Upper Robinson River, and Lower Robinson River watersheds were completed in August 2005 with subsequent approval by USEPA in December 2005. The TMDL development document can be obtained at the VADEQ office in Woodbridge, VA or via the Internet at www.deq.virginia.gov. Impairment description, water quality monitoring, watershed description, source assessment, water quality modeling, and allocated reductions were reviewed to determine implications of TMDL and modeling procedures on IP development.

Straight Pipe

The Robinson River watershed, comprising National Watershed Boundary Datasets (NWBD) RA31-RA36, is located in Madison and Culpeper Counties, Virginia in the Rapidan River basin (Figure 1). Upper Robinson River watershed of approximately 30,890 acres is comprised of forest (84%), pasture/cropland (15%), and residential (1%) land uses. The Little Dark Run watershed area is approximately 2,340 acres with forest (59%) as the primary land use followed by pasture/cropland (29%), and residential (12%) land uses. Roughly 91,100 acres in the Lower Robinson River watershed consists of forest (65%), pasture/cropland (34%), and residential (1%) land uses (Figure 2).

Failed Septic System

Potential sources of fecal coliform bacteria include both point source and nonpoint source (NPS) contributions. Nonpoint sources include: wildlife, grazing livestock, land application of manure and biosolids, urban/residential runoff, failed and malfunctioning septic systems, and uncontrolled discharges (straight pipes). Conditions outlined in the TMDL development study to address the bacteria impairments in the Little Dark Run, Upper Robinson River, and Lower Robinson River watersheds include:

- ★ Exclusion of most/all livestock including horses from streams is necessary;
- ★ Substantial land-based NPS load reductions are called for on pasture and cropland;
- ★ All straight pipes and failing septic systems need to be identified and corrected;
- ★ Implicit in the requirement to correct straight pipes and failing septic systems is the requirement to maintain all properly functioning septic systems;
- ★ Reductions to pet bacteria loads on residential land use are necessary; and
- ★ Implicit in the requirement for no point source bacteria load adjustment is the requirement for point sources to maintain permit compliance.

Figure 1. Little Dark Run and Robinson River watershed location.

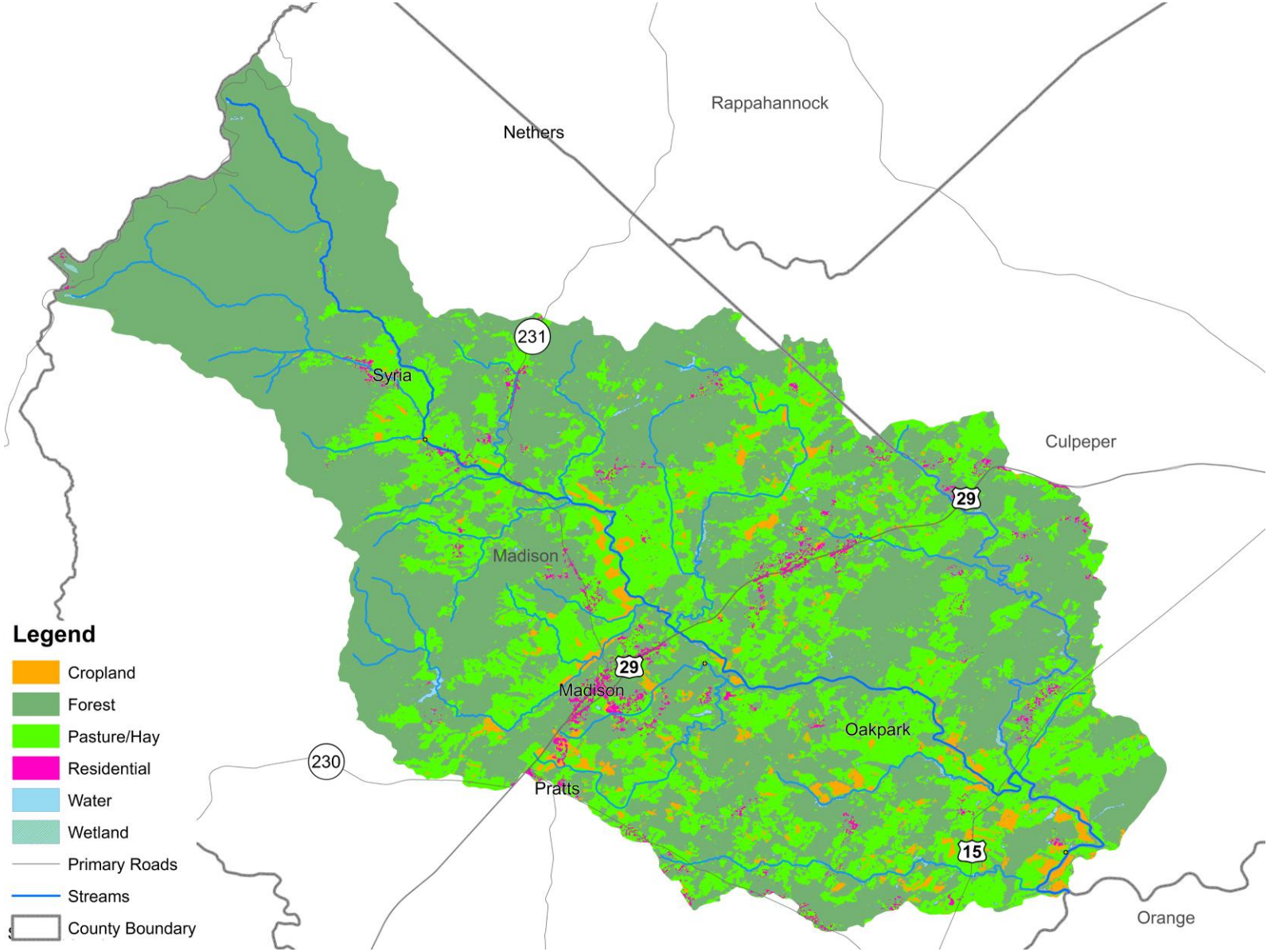

Figure 2. Land uses in the Little Dark Run and Robinson River watersheds.

PUBLIC PARTICIPATION

Process

The actions and commitments compiled in this document are formulated through input from citizens of the watershed; Madison and Culpeper Counties government; Culpeper Soil and Water Conservation District (CSWCD); Virginia Department of Conservation and Recreation (VADCR); Virginia Department of Environmental Quality (VADEQ); Virginia Department of Health (VDH); Virginia Cooperative Extension (VCE); Virginia Outdoors Foundation (VOF); Virginia Department of Forestry (VADOF); Natural Resources Conservation Service (NRCS); Blue Ridge Foothills Conservancy (BRFC); Piedmont Environmental Council (PEC); Rapidan Better Housing (RBH); Rappahannock-Rapidan Regional Commission (RRRC); and Blue Ridge Environmental Solutions, Inc. (BRES). Every citizen and interested party in the watershed is encouraged to put the IP into action and contribute what he or she is able to help restore the health of these waterbodies.

Public participation took place during IP development 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, three working groups were formed: Agricultural, Residential, and Governmental. Third, a Steering Committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; Madison and Culpeper Counties government; CSWCD; VADCR; VADEQ; VDH; VCE; NRCS; RRRC; and BRES to guide the development of the implementation plan. Over 500 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level (Table 1).

Livestock Stream Access

Pastured Livestock

Land Application

Table 1. Meetings held during the TMDL IP development process.

Date	Meeting Type	Location	Attendance	Time (hr)
06/15/10	Public Meeting	Madison County Volunteer Fire Company	48	1
06/15/10	Agricultural Working Group	Madison County Volunteer Fire Company	21	1
06/15/10	Residential Working Group	Madison County Volunteer Fire Company	18	1
08/18/10	Governmental Working Group	Madison County Volunteer Fire Company	19	2
10/26/10	Agricultural Working Group	Madison County Volunteer Fire Company	15	2
10/26/10	Residential Working Group	Madison County Volunteer Fire Company	5	2
11/30/10	Steering Committee	Madison County Volunteer Fire Company	17	2
01/06/10	Public Meeting	Madison County Volunteer Fire Company	70	2

Agricultural Working Group Summary

The Agricultural Working Group (AWG) consisted predominantly of beef and dairy producers throughout the watershed. Representatives from organizations that serve this community and will have a role in implementation were also included (*e.g.*, CSWCD, NRCS, and VADCR). The AWG is confident that current BMPs eligible for cost-share in TMDL areas and proposed recommendations will provide the necessary incentive for producers and landowners to implement required BMPs to meet specified reductions to direct stream, pasture, and cropland bacteria loads. Challenges, recommendations, and keys for success discussed in the meetings included:

- ★ Several issues were raised regarding water quality monitoring performed by the Virginia Department of Environmental Quality (VADEQ), these included: sampling frequency, data validity, correlation to flow conditions, and monitoring in Shenandoah National Park. Suggestions for providing additional water quality monitoring included citizen monitoring or a monitoring project financed with grant funds.

Alternative Water

- ★ Primarily beef and dairy operations exist in these watersheds. According to attendees, beef numbers reported in TMDL seemed high in Upper Robinson River and Little Dark Run. Sufficient liquid manure storage and landuse is available for producers to collect and spread collected manure according to nutrient management plan. It was indicated that some beef operations were confining animals a portion of the year; therefore, an initial recommendation to include the "Animal Waste Control Facility (VA

Agricultural Practice Number WP-4)" practice in the water quality improvement plan was made. It was determined later that additional animal waste storage is not needed. Majority of agricultural to residential landuse conversion has occurred on southern portion of watershed along Route 29 and Route 15 corridors.

- ★ Concerns regarding livestock exclusion systems included: non-native vegetation species growth, not practical in flood-prone areas and would be wiped out quite frequently in some areas of watershed, and fencing amount that would be needed to eliminate access to the braided stream network throughout fields in Upper Robinson River.
- ★ Based on view that cows will choose a watering trough over stream, thus decreasing time spent in stream, an initial strategy in the Upper Robinson River watershed could be to install watering troughs without stream exclusion fencing.
- ★ Liability associated with BMP maintenance was discussed. Specifically, farmers are required to repair/replace damaged fence after each flood occurrence or re-plant permanent vegetative cover if it dies out and assume all associated costs. A shorter time frame for commitment to the program, possibly five years instead of 10, may ease this burden. In TMDL areas, farmers are eligible for cost-share funds to assist with the repair/replacement if the practice is still in life span, and funding is available. Also there is a 25% tax credit for their out of pocket costs, WP-2D. A suggested recommendation to include supplemental cost-share for fence repair/replacement when fencing is destroyed by flood was made. The WP-2T practice also provides $.50 per linear foot of stream fencing as an incentive payment to assist with stream fencing maintenance. Pursuing a grant to fund BMP maintenance costs would be beneficial
- ★ Constraints to BMP implementation indicated by group include – BMP maintenance and replacement cost, fence maintenance in flood prone areas, and belief that producers need to spend money on BMPs when confidence in water quality monitoring data and extent of contamination is lacking.
- ★ PEC announced the availability of some funding for livestock exclusion fencing for the next six months. Funds remaining from a grant for BMPs on the Upper Hazel River may be used to supplement the cost share program administered by the CSWCD. It was noted that a 90% cap on financial assistance including funding from local sources and grants was VADCR's policy; producers must provide a 10% match.
- ★ Applicable educational /outreach methods that work well in the area include: personal communication through phone and site visits; farmer-to-farmer interaction; CSWCD and Farm Service Agency newsletters; field tours conducted by CSWCD; educational events conducted by Virginia Cooperative Extension; Cattleman's and Dairymen's Association events; information booth at Madison County Fair; and Madison Eagle articles.

Residential Working Group Summary

The Residential Working Group (RWG); consisting of watershed residents and CSWCD, VDH, VADCR, VADEQ, and RRRC personnel; focused on means to educate and involve public with regard to

implementing corrective actions to replace straight pipes, correct failing septic systems, and manage pet waste. Challenges, recommendations, and keys for success discussed in the meeting included:

- To help identify potential bacteria sources in Upper Robinson River, water quality sampling near Lindsay Lane in Criglersville was requested to VADEQ.
- Problematic on-site sewage disposal system (OSDS) areas include those adjacent to floodplains or characterized by shallow-to-rock, low permeability soils.

- Although not required in Madison County, VDH strongly recommends pumping of septic systems every five years.
- Improper management of sewage (*i.e.*, straight pipes, failing septic systems) is subject to enforcement; all other practices are voluntary. VDH regulations require full code compliance for septic systems when a property is sold. VDH has legal ability to cite landowners, but prefers to work with offenders in a supportive manner to correct the problem.
- Develop and implement educational/outreach program to provide information on the design, function, and maintenance of the all septic system types - traditional and alternative.
- Newcomers from localities with public sewers need to understand septic system functions and limitations.
- Promote pet waste digesting composters as a cost-share program for residential properties.
- Encourage the installation of collection kiosks on walking trails, in public parks, and in neighborhood common areas. Encourage the use of biodegradable bags for pet waste clean-up.
- Consider development of a comprehensive and effective pet waste management ordinance.
- Develop educational materials to encourage home owners' associations, veterinarians, kennels, hunt clubs and pet stores to practice and promote proper pet waste management.
- Promote available funding and technical assistance through newspapers, bulk mailings, websites, local environmental groups, CSWCD, VCE, Farm Bureau, Old Rag Master Naturalists, PEC, etc. CSWCD has had success working with Farm Bureau to notify property owners of older farm houses about funding opportunities to repair or replace failing septic systems and remove straight pipes.
- Historic funding sources include limited funding from Madison County, Rapidan Better Housing, and the Community Block Grant program.
- It is anticipated that corrective action, education and maintenance will be an on-going need, even if the streams are removed from the impaired waters list.

Governmental Working Group Summary

The Governmental Working Group (GWG) consisting of representatives from Madison and Culpeper Counties, CSWCD, VADCR, VADEQ, VDH, VOF, RBH, RRRC, and BRES personnel, focused on funding sources, technical assistance needs, regulatory controls, and lead agencies responsible for implementation. Key topics and recommendations included:

- ★ It is estimated that the cattle count has decreased significantly in the Little Dark Run watershed area since the TMDL study was completed in 2005.
- ★ There has been significant increase in streamside fencing and water trough installation in the Hebron Valley (Lower Robinson River watershed).
- ★ Due to braided streams in the Upper Robinson River watershed, streamside fencing is not seen as a practical solution as it would greatly reduce the amount of pasture and be too expensive. Water trough installation alone, without stream exclusion, is not cost-shared; however, the state does offer a 25% tax credit toward the producer's cost of installation.
- ★ Cost-share for stream fencing is from 50% to 85%, based on options. With a reduced stream exclusion buffer of 10 feet, a producer can receive 50% coat-share on the watering system, grazing components, and stream fencing.
- ★ The Madison Sewage Treatment Plant empties into a tributary of Little Dark Run. It operates under a VADEQ permit and is in compliance with all permit requirements.
- ★ Currently, there are no sewer taps available; any approved new construction would require a permit for an individual septic system. There are no plans to expand the existing sewage treatment facility.
- ★ Areas where there may be problems with failing septic systems are along the Rapidan and Madison County line and the Criglersville area where homes are older.
- ★ Madison and Culpeper Counties do not have a septic system pump-out requirement.
- ★ Currently, there are no detailed records, including permit types and dates, on septic systems in Madison County. Permits issued before 1982 were based on sewage disposal rather than treatment.

Alternative On-site Sewage Disposal System

- ★ A comprehensive review of tax maps and door-to-door surveys could identify older homes that might have systems in need of repair or replacement. Contact with identified property owners could facilitate the distribution of technical information and system repair programs. Citizen groups could be more successful than a government agency in collecting meaningful survey data.

- Approximately 30 alternative on-site sewage treatment systems have been installed in Madison County in the last year. Maintenance contracts with semi-annual testing are required for all alternative waste treatment facilities.
- New residents and perspective buyers appear to be more informed regarding septic system function and maintenance than long term residents. Educational outreach should be focused on long time county residents.
- Pet waste management needs include: develop educational/outreach program enlisting support of homeowners associations, veterinary clinics, boarding facilities, hunt clubs and pet supply stores to distribute educational information and promote responsible pet waste management; promote installation of enzyme waste composters; and implement proper waste management practices at all confined canine facilities by promoting Fauquier County SPCA's pet waste management program as a model to emulate. Utilize grant funds to upgrade an existing facility.
- Potential funding sources include: federal and state cost-share programs, Rapidan Better Housing, Virginia Outdoors Foundation, private funding through PEC for stream exclusion fencing, and incentive payment programs may be available to Madison County in the future through private sources similar to those used in Rappahannock County
- Promote the inclusion of LID requirements within the County Ordinances. Culpeper County has an ordinance on how many animals units per acre allowed but Madison does not.
- Many educational outreach programs are available to address agricultural concerns; the focus of new programs should be residential.
- Small acreage horse farms were identified as educational outreach opportunities and models for management as promoted by Prince William SWCD
- Rappahannock County's "Cow College" could be replicated to provide information for Culpeper and Madison large animal owners.
- Madison County has recently completed a resource inventory/green infrastructure assessment.
- An overview of VOF's programs included: over 10,000 acres in Madison County are currently under conservation easements; GIS analysis of the watersheds indicates a significant opportunity for conservation easements; income tax credit of 40% of appraised value that can then be sold to any Virginia taxpayer (currently $0.80 on the $1.00 with at $106 million dollar cap); all programs are voluntary with no regulatory aspect to them; priority is given to easements that protect water quality.
- VADEQ will continue to monitor these streams in accordance with the ambient water quality monitoring program and increased monitoring was recommended to create a greater baseline for the IP. Robinson River is well monitored with two trend stations, historical data, and biological monitoring. Contact Silver Citizens Group in Culpeper, high school students, college students or Eagle Scouts to develop a volunteer monitoring program.
- Proposed roles and responsibilities for agencies included:

- **Madison and Culpeper Counties:** administer the counties erosion and sediment control program, provide mapping assistance, and update ordinances to promote conservation efforts.
- **CSWCD:** provide agricultural cost-share funds, administer and provide technical assistance for agricultural and residential programs.
- **VDH:** help develop education material and track installation, location and maintenance of all septic systems, including alternative systems
- **RRRC:** develop and distribute pet waste management educational materials
- **VADEQ:** provide ambient monitoring and assist with citizen monitoring
- **NRCS, VCE,** and **VADOF**: provide education/technical assistance and funding

Steering Committee Summary

The Steering Committee consisted of representatives from the AWG, RWG, and GWG; Madison and Culpeper Counties; CSWCD; VADCR; VADEQ; VDH; VCE; NRCS; RRRC; PEC; BRFC; and BRES. Steering Committee evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, created implementation goals and milestones, reviewed monitoring plan, discussed potential funding resources available, revised implementation plan document, and evaluated materials for final public meeting. The Steering Committee will periodically revisit implementation progress and suggest plan revisions as needed.

IMPLEMENTATION ACTIONS

An assessment was conducted to quantify actions and cost for two implementation stages. Actions and cost that translate to an instantaneous standard exceedance rate of 10.5% or less, resulting in removal of these streams from the List of Impaired Waters were quantified. This is referred to as the Stage I implementation goal. The Stage II implementation goal is TMDL source allocation attainment. Estimated units presented in Tables 2 and 3 depict the Stage I and Stage II goals. Potential control measures, their associated costs and efficiencies, and potential funding sources were identified through review of the TMDL, input from working groups, and literature review. Control measures were assessed based on cost, availability of existing funds, reasonable assurance of implementation, and water quality impacts. Measures that can be promoted through existing programs were identified, as well as those not currently supported by existing programs and their potential funding sources. The assurance of implementation of specific control measures was assessed through discussion with the working groups and Steering Committee.

Agricultural Implementation Needs

Removing livestock from the stream corridor was identified as the primary control measure to reduce the livestock direct deposition bacteria load. There are approximately 499 miles of perennial streams in the Robinson River watershed. Currently in this watershed, approximately 30 miles of exclusion fencing have been installed. Exclusion fencing necessary to prevent access to perennial streams and meet the stated TMDL reductions was estimated at approximately 281 miles of fence. Figure 3 displays analysis results for the Little Dark Run watershed. This exclusion fencing is translated into a total of 562 exclusion systems to be installed to insure full exclusion of livestock from the streams. In order to provide implementation options to producers, several cost-share programs with varying goals and requirements were included. Based on historical cost-share program participation and working group feedback, total exclusion systems were divided between **Conservation Reserve and Enhancement Program (CREP)**, **Environmental Quality Incentives Program (EQIP)**, **Livestock Exclusion with Riparian Buffers (LE-1T)**, **Livestock Exclusion with Reduced Setback (LE-2T)**, **Small Acreage Grazing System (SL-6AT)**, **and Stream Protection (WP-2T)** (Table 2). In order to address pasture land reductions, the benefit of installing the livestock exclusion systems was coupled with improved pasture management BMPs. Total of 37,250 acres in the watershed would require **Pasture Management** with portions of this acreage improved by the **Pasture and Hayland Planting (NRCS Code 512) and Prescribed Grazing (NRCS Code 528)** BMPs. Given reductions were not

Stream Exclusion Fencing

sufficient to meet TMDL reduction goals, installation of retention ponds may be necessary to treat runoff from this acreage during Stage II of implementation.

Bacteria reduction provided by the dairy liquid manure storage tanks installed in the watersheds was accounted for in the land-applied loads. The AWG decided the primary control measure for cropland bacteria load reduction will be permanent conversion of cropland to pasture and forest land uses. The conversion was divided between **SL-1 Permanent Vegetative Cover and FR-1 Reforestation of Erodible Crop and Pastureland BMPs** based on input from AWG and landuse difference. Additionally, **manure / biosolids incorporation** into soil was needed in the watersheds. Currently in these watersheds, approximately 372 cropland acres have been converted utilizing the SL-1 (297 ac) and FR-1 (75 ac) practices. Converting 325 acres to pasture and 165 acres to forest land uses and incorporating manure / biosolids into soil on approximately 1,363 cropland acres during Stage II satisfied the TMDL goal (Table 2).

GIS analysis of the watersheds indicates a significant opportunity for conservation easements through the Virginia Outdoors Foundation (VOF). Conservation incentives in Madison and Culpeper Counties include the Purchase of Development Rights program, tax credits that can be sold to any Virginia tax payer, and 100% reimbursement for legal, accounting, appraisal fees, etc.

Permanent Vegetative Cover on Cropland

Re-forestation

Table 2. Estimation of control measures with unit cost (average) needed to meet pasture and cropland bacteria load reduction implementation goals during 15-year timeline.

Control Measure	Unit	Average Unit Cost[1] ($)	Estimated Units Needed (#)			
			Upper Robinson River	Little Dark Run	Lower Robinson River	Total
Pasture and Livestock Exclusion						
Livestock Exclusion System (CREP)	System	26,500	6	0	38	**44**
Livestock Exclusion System (EQIP/CBWI)	System	20,600	26	2	182	**210**
Livestock Exclusion System (LE-1T)	System	20,600	33	3	224	**260**
Livestock Exclusion System (SL-6AT)	System	20,600	1	0	3	**4**
Livestock Exclusion System (LE-2T)	System	16,000	4	1	25	**30**
Livestock Exclusion System (WP-2T)	System	13,500	1	0	13	**14**
Improved Pasture Management[2]	Acres-Installed	150	4,250	557	32,443	**37,250**
Retention Ponds	Acres-Treated	2,000	2,125	314	16,546	**18,985**
Cropland						
Permanent Vegetative Cover on Cropland (SL-1)	Acres-Installed	370	15	10	300	**325**
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres-Installed	500	15	10	140	**165**
Manure / Biosolids Incorporation Into Soil	Acres-Installed	25	121	112	1,130	**1,363**
Technical Assistance						
Agricultural – Pasture and Cropland	Full Time Equivalent	65,000/yr				**3 /yr – Stage I** **1 /yr – Stage II**

[1] Unit cost = installation or one-time incentive payment

[2]Improved pasture management comprised of Pasture Management, Pasture and Hayland Planting (512), and Prescribed Grazing (528) BMPs

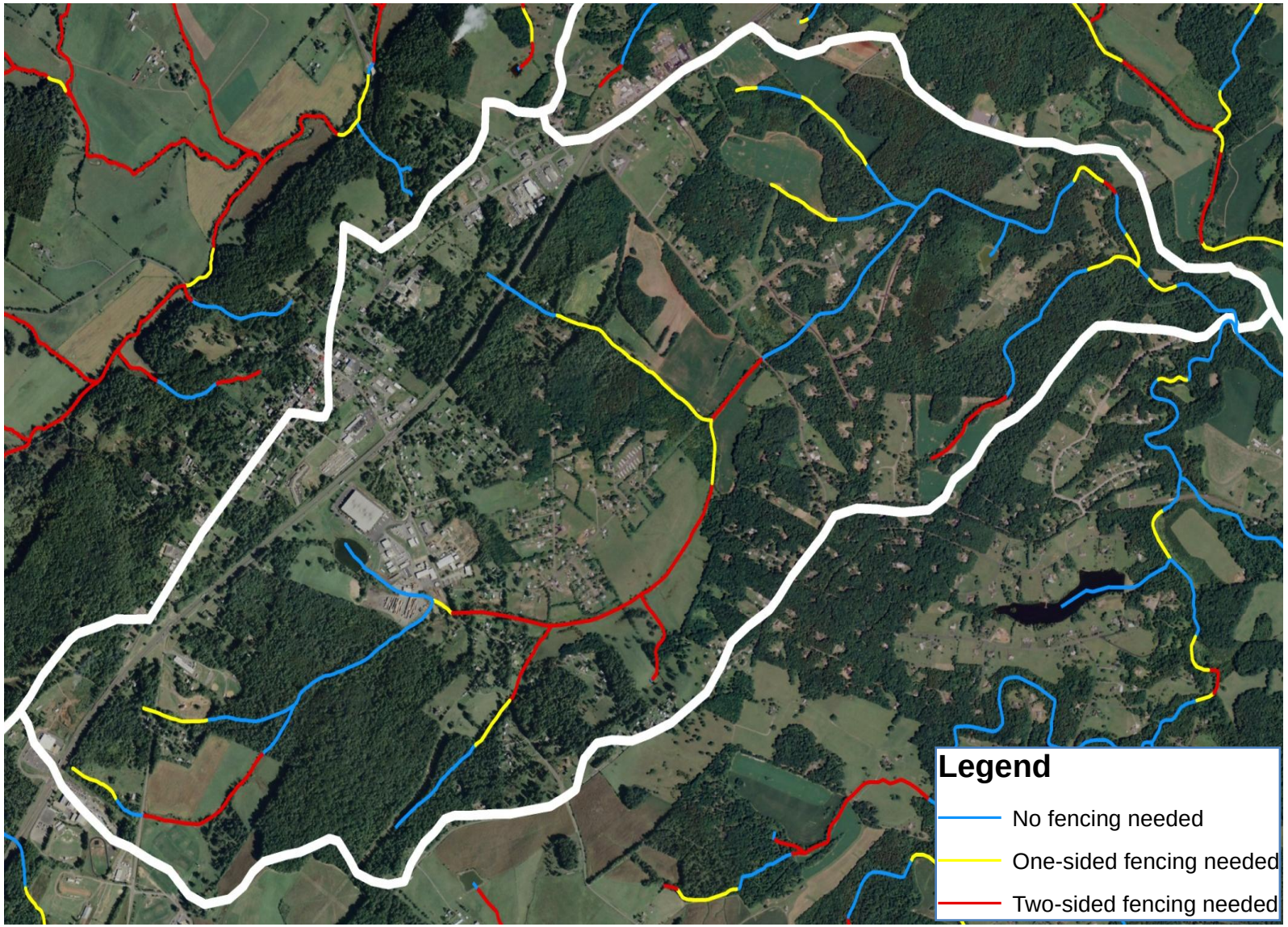

Figure 3. Potential livestock exclusion fencing analysis results for Little Dark Run.

Residential Implementation Needs

Number of straight pipes and failing septic systems to correct during implementation was established during TMDL development. Based on discussion with Virginia Department of Health and RWG, it was assumed that 90% of the straight pipes would be replaced with a conventional septic system and 10% replaced with an alternative on-site sewage disposal system (OSDS). Failing septic systems were assumed to be corrected by repairing the existing septic system (60%), installing a new conventional septic system (30%), or installing a new alternative OSDS (10%). It is estimated that 364 **septic tank pump-outs**, 436 **septic system repairs**, 335 **conventional septic systems**, and 85 **alternative OSDS** are considered necessary to correct straight pipes and failing septic systems during implementation (Table 3).

Septic System Repair

A four-step program was proposed to address pet waste reductions. In the first step, a **pet waste control program** consisting of educational packets, signage, and disposal stations in public areas will be instituted in each watershed. The second step will be installing **pet waste enzyme digesting composters** at 35 residences. The third step will be identification of confined canine units (CCU) and installing approximately three **CCU waste treatment systems** throughout the watersheds. The installation of **vegetated buffers**, **bioretention**, and **infiltration trenches** on residential land use is the fourth step. Components of the four-step program are outlined in Table 3.

Pet Waste Composter

Pet Waste Kiosk

Table 3. Estimation of control measures with unit cost (average) needed to meet residential and straight pipe bacteria load reduction implementation goals during 15-year timeline.

Control Measure	Unit	Unit Cost[1] ($)	Estimated Units Needed (#)			
			Upper Robinson River	Little Dark Run	Lower Robinson River	Total
Failing Septic Systems						
Septic Tank Pump-out	System	260	30	16	318	**364**
Septic System Repair	System	3,200	35	19	382	**436**
New Conventional Septic System	System	6,500	18	10	191	**219**
Alternative On-site Sewage Disposal System	System	15,000	6	3	63	**72**
Straight Pipes						
New Conventional Septic System	System	6,500	50	3	63	**116**
Alternative On-site Sewage Disposal System	System	15,000	6	0	7	**13**
Pet Waste Management						
Pet waste education program	Program	5,000				**1**
Pet waste digesters	System	50	0	10	25	**35**
Confined Canine Unit Waste Treatment System	System	20,000	1	0	2	**3**
Stormwater Runoff Best Management Practices						
Vegetated Buffers	Acres-Installed	400	14	12	16	**42**
Bioretention	Acres-Treated	15,000	6	14	120	**140**
Infiltration Trench	Acres-Treated	11,300	3	6	20	**29**
Technical Assistance						
On-site Sewage Disposal Systems	Full Time Equivalent	65,000/yr				**2 /yr – Years 1-12**
Pet Waste Management	Full Time Equivalent	65,000/yr				**0.25 /yr – Years 1-6**

[1] Unit cost = installation or one-time incentive payment

Other Potential Implementation Needs

Implicit in the TMDL is the need to avoid increased delivery of pollutants from sources that have not been identified as needing a reduction, and from sources that may develop over time. Future residential development was identified as potential sources to deliver bacteria to streams through additional septic systems and pets. Care should be taken to monitor these activities and the impact on water quality. This needs to be carefully considered during permit issuance, site plans, and development.

Retention Pond

Assessment of Technical Assistance Needs

To determine the number of full time equivalents (FTE) considered necessary for agricultural and residential technical assistance during implementation, the average cost-share amount of practices needed to be installed per year during implementation was divided by an average cost-share amount that one FTE can process in a year. Coupling the number of BMPs processed historically and estimates provided by CSWCD and Steering Committee, three agricultural FTE per year and two residential OSDS FTE per year are needed during Stage I of implementation. It was estimated that 0.25 FTE per year are needed for six years to administer the pet waste management program (Tables 2 and 3).

Rotational Grazing System

Cost Analysis

Bioretention (Rain Garden)

Associated unit cost estimations for each implementation action during Stages I and II are shown in Tables 2 and 3. Table 4 focuses on installation and technical assistance costs to implement agricultural and residential programs for implementation Stage I (*i.e.*, removal of impairments from impaired waters list). The total average installation cost for livestock exclusion systems and improved pasture management is $16.35 million. The total installation cost for converting cropland to permanent vegetative cover and forest is estimated at $0.14 million. Accordingly, total agricultural corrective action costs equal $16.49 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems totals $4.94 million. The cost to implement the first two steps of the pet waste reduction process totals an estimated seven thousand dollars. Cost to install vegetated buffers, rain gardens, and infiltration trenches during Stage I equal $1.04 million.

It was determined by the CSWCD, VADCR, VDH, AWG, RWG, GWG, and Steering Committee members that it would require $65,000 to support one technical FTE per year. The total costs to provide assistance in the agricultural and residential programs during Stage I implementation are expected to be $2.34 million and $1.66 million, respectively (Table 4). The total Stage I implementation cost including technical assistance is $26.48 million with the agricultural cost being $18.83 million and residential cost $7.65 million (Table 4).

Table 4. Implementation cost associated with percentage of practices to be installed along with technical assistance addressing agricultural and residential needs in the Little Dark Run, Upper Robinson River, and Lower Robinson River watersheds.

Year	Agricultural				Residential				Total Cost
	Pasture & Livestock Access	Cropland	Technical Assistance	Total	On-site Sewage Disposal System	Pet Waste	Technical Assistance	Total	
	($)	($)	($)	($)	($)	($)	($)	($)	**($)**
1	1,187,300	0	195,000	**1,382,300**	403,500	5,300	146,250	**555,050**	**1,937,350**
2	1,550,300	0	195,000	**1,745,300**	413,200	20,300	146,250	**579,750**	**2,325,050**
3	1,255,000	0	195,000	**1,450,000**	410,300	300	146,250	**556,850**	**2,006,850**
4	1,466,600	0	195,000	**1,661,600**	403,500	20,300	146,250	**570,050**	**2,231,650**
5	1,271,000	0	195,000	**1,466,000**	413,200	300	146,250	**559,750**	**2,025,750**
6	1,534,300	20,300	195,000	**1,749,600**	410,300	22,000	146,250	**578,550**	**2,328,150**
7	1,187,300	20,300	195,000	**1,402,600**	403,500	1,700	130,000	**535,200**	**1,937,800**
8	1,563,800	20,300	195,000	**1,779,100**	413,200	1,700	130,000	**544,900**	**2,324,000**
9	1,275,600	20,300	195,000	**1,490,900**	416,800	1,700	130,000	**548,500**	**2,039,400**
10	1,480,100	20,300	195,000	**1,695,400**	403,500	1,700	130,000	**535,200**	**2,230,600**
11	1,270,800	20,300	195,000	**1,486,100**	419,700	487,200	130,000	**1,036,900**	**2,523,000**
12	1,307,400	20,300	195,000	**1,522,700**	431,800	487,200	130,000	**1,049,000**	**2,571,700**
TOTAL	**16,349,500**	**142,100**	**2,340,000**	**18,831,600**	**4,942,500**	**1,049,700**	**1,657,500**	**7,649,700**	**26,481,300**

Benefit Analysis

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in the Upper Robinson River, Little Dark Run, and Lower Robinson River impairments will be reduced to meet water quality standards. Actions during implementation can improve human and livestock herd health, benefit stakeholder economy, and improve the aquatic community.

Human Health

It is hard to gauge the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from fecal sources, through contact with surface waters, should be reduced considerably. 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.

Livestock Herd Health

A clean water source coupled with exclusionary fencing has been shown to improve weight gain; decrease stress; reduce herd health risks associated with increased exposure to water-transmitted diseases, bacteria, virus and cysts infections; reduce mastitis and foot rot; and decrease herd injuries associated with cattle climbing unstable streambanks, or being stuck in mud.

Economics

An important objective of the IP is to foster continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide 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, along with the expected environmental benefits on-site and downstream. For example, installing a livestock stream exclusion system with an alternative (clean) water source, improving pasture condition, performing sewage system maintenance, and improving aesthetics throughout the watershed can have an economic benefit on the local economy. Additionally, money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP will stimulate the local economy.

Vegetated Buffer (No Mow Zone)

The benefit of a Grazing Land Protection System BMP is improved profit through more efficient utilization and harvest of forage by grazing animals. 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 (VCE, 1996). Several factors contribute to greater profitability: stocking rate can usually be increased by 30% to 50%; high-quality, fresh, and unsoiled vegetative growth available throughout the grazing system increases weight gain per acre; vigor of the pasture sod is improved; and handling and checking grazing animals is easier. More accurate estimates of the amount of forage available, greater uniformity in grazing of pastures, flexibility of harvesting and storing forage not needed for grazing, and extending the length of the grazing season while providing a more uniform quality and quantity of forage throughout the season are important benefits afforded by this system (VCE, 1996).

In terms of economic benefits to homeowners, an improved understanding of private OSDS, 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. In addition, investment in the home is protected with a properly functioning sewage disposal system. A home's value can be decreased up to 40% with a failed septic system (Shepherd, 2006). The average septic system will last 20-25 years 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, not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system.

On-site Sewage Disposal System

Improved aesthetics in public areas (*e.g.*, parks) and surrounding businesses provided by control measures (*e.g.*, pet waste kiosks and bioretention) has the potential to draw local citizens and visitors to these areas. In addition, a healthy waterway has the potential to attract local citizens and visitors for recreation.

Aquatic Community Improved

Stream bank protection provided through exclusion of livestock including horses from streams will improve the aquatic habitat in these streams. Vegetated buffers that are established will also help reduce sediment and nutrient transport to the stream from upslope locations. The installation of improved pasture management systems should also reduce soil and nutrient losses and increase infiltration of precipitation; thereby, decreasing peak flows downstream. Reductions in nutrient and sediment loadings contribute to attainment of nutrient and sediment reduction goals for the Chesapeake Bay TMDL. Local initiatives, such as riparian easements, will additionally be complemented by actions performed during TMDL implementation.

MEASUREABLE GOALS AND MILESTONES FOR ATTAINING WATER QUALITY STANDARDS

The end goals of implementation are:

1) Restored water quality in the impaired waters, and
2) Subsequent de-listing of streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Progress toward end goals will be assessed during implementation through tracking of control measure installations by CSWCD; NRCS; VADCR; VDH; Madison and Culpeper Counties, and RRRC. The VADEQ will continue to assess water quality through its monitoring program. Other monitoring project activities in the watershed (*e.g.* citizen monitoring) will be coordinated to augment the VADEQ monitoring program. Implementation will be assessed based on reducing exceedances of the bacteria water quality standard, thereby improving water quality.

Implementation of control measures is scheduled for 15 years and will be assessed in two stages beginning in January 2011 and lasting to December 2026. Stage I is based on meeting source allocations that translate to an instantaneous standard exceedance rate of 10.5% or less resulting in removal of streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. The Stage II goal is based on implementing source allocations to meet the specified TMDL goal, 0% exceedance of water quality standards. After implementation inception, five milestones will be met in three-year increments until streams are removed from the List of Impaired Waters.

Streambank Buffer Establishment

Implementation in years one through twelve for agricultural source reductions focuses on installing livestock stream exclusion systems, improving pasture management, and cropland conversion (Table 5). BMPs installed in years thirteen through fifteen are based on additional treatment of bacteria load not treated during Stage I from pasture and cropland using improved pasture management, manure / biosolids incorporation into soil, and retention ponds (Table 5). Retention ponds are more costly and are logistically more difficult to design and locate on individual farms. Implementation of residential control measure in years one through twelve focuses on identification and removal of straight pipes, repairing or replacing failed septic systems, instituting pet waste control program, installation of pet waste enzyme digesting composters, installation of a confined canine units (CCU) waste treatment system, and installation of vegetated buffers (Table 5). Vegetated buffer, bioretention, and infiltration trench installations are expected to occur over the last five years (Table 5).

Table 6 lists the cumulative progress towards the TMDL endpoint as implementation milestones are met. Water quality improvement is expected to increase each year. Based on water quality modeling projections, the Upper Robinson River would be in a probable position to be de-listed from the List of Impaired Waters at the second milestone. Little Dark Run and Lower Robinson River would likely be in a de-listing position at the fourth milestone. Considering the dynamics of a stream ecosystem and the inherent difficulties that may arise preventing implementation, the final milestone of TMDL allocation attainment was set at 15 years following implementation commencement.

Riparian Forest Buffer

The process of staged implementation implies targeting of control measures, ensuring optimum utilization of resources. In quantifying agricultural BMPs through the use of aerial photography, land use, and stream network GIS layers, maps were formulated showing potential livestock stream access, pastures, and crop fields. Known problem areas, clusters of older homes, or houses in close proximity to streams known by the VDH will be targeted for on-site sewage disposal system control measures. Steps outlined in pet waste BMP stages results in targeting of source type and resources. Significant exposure to a rain garden and/or infiltration trench project would be attained if installed at high school or shopping centers in watershed.

Table 5. Targeted implementation stages for control measures installation.

Control Measure	Upper Robinson River	Little Dark Run	Lower Robinson River
Pasture and Livestock Exclusion			
Livestock Exclusion System (CREP)	I	I	I
Livestock Exclusion System (EQIP/CBWI)	I	I	I
Livestock Exclusion System (LE-1T)	I	I	I
Livestock Exclusion System (SL-6AT)	I	I	I
Livestock Exclusion System (LE-2T)	I	I	I
Livestock Exclusion System (WP-2T)	I	I	I
Improved Pasture Management	I & II	I & II	I & II
Retention Ponds	II	II	II
Cropland			
Permanent Vegetative Cover on Cropland (SL-1)	I & II	I & II	I & II
Reforestation of Erodible Crop and Pastureland (FR-1)	I & II	I & II	I & II
Manure / Biosolids Incorporation into Soil	II	II	II
Failing Septic Systems			
Septic Tank Pump-out	I	I	I
New Conventional Septic System	I	I	I
Alternative On-site Sewage Disposal System	I	I	I
Septic System Repair	I	I	I
Straight Pipes			
New Conventional Septic System	I	I	I
Alternative On-site Sewage Disposal System	I	I	I
Pet Waste Management			
Pet waste education program	I	I	I
Pet waste digesters	I	I	I
Confined Canine Unit Waste Treatment System	I	I	I
Stormwater Runoff Best Management Practices			
Vegetated Buffers	I & II	I & II	I & II
Bioretention	I & II	I & II	I & II
Infiltration Trench	I & II	I & II	I & II

Stage I = first twelve years of implementation for a 15-year timeline

Stage II = last three years of implementation for a 15-year timeline

Table 6. Cumulative implementation of control measures and water quality milestones.

Control Measure	Unit	Progress Since TMDL Study	Milestone 1 Completed by Jan. 2014	Milestone 2 Completed by Jan. 2017	Milestone 3 Completed by Jan. 2020	Milestone 4 Completed by June 2023	Milestone 5 Completed by June 2026
Pasture							
Livestock Exclusion System (CREP)	System	43	11	22	33	44	44
Livestock Exclusion System (EQIP)	System	N/A	52	104	157	210	210
Livestock Exclusion System (LE-1T)	System	N/A	65	130	195	260	260
Livestock Exclusion System (SL-6AT)	System	N/A	1	2	3	4	4
Livestock Exclusion System (LE-2T)	System	N/A	7	14	21	30	30
Livestock Exclusion System (WP-2T)	System	N/A	3	6	10	14	14
Improved Pasture Management	Acres - Installed	N/A	7,451	16,764	24,215	31,664	37,250
Retention Pond	Acres - Treated	N/A	0	0	0	0	18,985
Cropland							
Permanent Vegetative Cover on Cropland (SL-1)	Acres - Installed	297	0	33	130	228	325
Reforestation of Erodible Crop and Pastureland (FR-1)	Acres - Installed	75	0	17	66	116	165
Manure / Biosolids Incorporation into Soil	Acres - Treated	N/A	0	0	0	0	1,363
On-site Sewage Disposal Systems							
Septic Tank Pump-out	System	N/A	91	182	273	364	364
Septic System Repair	System	N/A	109	218	327	436	436
New Conventional Septic System	System	N/A	83	166	250	335	335
Alternative Sewage Disposal System	System	N/A	21	42	63	85	85
Pet Waste Management							
Pet waste education program	System	N/A	1	1	1	1	1
Pet waste digesters	System	N/A	17	35	35	35	35
Confined Canine Unit Waste Treatment System	System	N/A	1	3	3	3	3
Stormwater Runoff Best Management Practices							
Vegetated Buffers	Acres - Installed	N/A	0	4	17	29	42
Bioretention	Acres - Treated	N/A	0	0	0	56	140
Infiltration Trench	Acres - Treated	N/A	0	0	0	12	29

Impairment	Instantaneous Bacteria Standard Exceedance Rate (%)					
	Existing	Milestone 1	Milestone 2	Milestone 3	Milestone 4	Milestone 5
Little Dark Run	53	39	30	23	20	0
Upper Robinson River	22	11	7	5	3	1
Lower Robinson River	42	30	24	18	13	1

Monitoring

Implementation progress will be evaluated through water quality monitoring conducted by VADEQ through the agency's monitoring program and any additional monitoring support (*i.e.*, citizen monitoring) that may develop as implementation progresses. Five ambient VADEQ monitoring stations were utilized to assess water quality in the Little Dark Run and Robinson River watersheds (Table 7 and Figure 4). Stations 3-ROB001.90 and 3-ROB017.24 on the Robinson River are classified as "trend stations". Trend stations are historically located, long-term water quality monitoring stations used to assess changes in water quality over long periods of time and are sampled at least six times per year. The remaining stations are classified as "watershed stations". Watershed stations are typically located near mouth of a watershed, designed to provide comprehensive statewide coverage of smaller watersheds, and sampled 12 times over a consecutive two-year period (sampling occurs every other month) within a six-year rotational cycle.

The citizen monitoring program can be utilized to supplement samples collected through VADEQ's ambient monitoring program. The Coliscan Easygel method is a simple to use and relatively inexpensive method that measures total coliform and *E. coli*. The Coliscan Easygel method was compared to laboratory analysis and found to be an acceptable tool for screening purposes although the data cannot be used directly by VADEQ for water quality assessments. This method is important because it can assist in locating "hot spots" for fecal contamination, assess implementation progress, and target areas for more extensive monitoring. Citizen monitoring has been conducted at eight biological stations in the watershed (Table 8 and Figure 4). Biological stations are sampled on a yearly basis in the spring and fall for benthic macroinvertebrates and observational habitat data is collected. Incorporating bacteria monitoring into existing citizen monitoring should be explored.

The AWG, RWG, GWG, and Steering Committee request that monitoring continue at the TMDL impairment listing station for the following parameters: *E. coli* bacteria, temperature, dissolved oxygen, pH, specific conductance, total nitrogen, total phosphorus, total suspended solids, and stream flow.

Table 7. Monitoring station identification, station location, station type, last monitoring date, and monitoring schedule for VADEQ monitoring stations in the watershed.

Station ID	Station Location	Station Type	Date Last Sampled	Monitoring Schedule
3-LDR000.70	Little Dark Run at Route 680	Watershed	11/17/08	Program Dependent
3-ROE000.75	Rose River at Private Road (Trout Stocking Site)	Watershed	04/28/10	Program Dependent
3-ROB024.06	Robinson River at Route 649	Watershed	06/22/05	Program Dependent
3-ROB017.24	Robinson River at Route 638	Trend	06/07/10	Bimonthly, long-term
3-ROB001.90	Robinson River at Route 614	Trend	07/20/10	Bimonthly, long-term

Table 8. Monitoring station identification, stream name, station location, citizen monitoring group, and years sampled for citizen monitoring stations in the Robinson River watershed.

Station ID	Stream Name	Station Location	Citizen Monitoring Group	Years Sampled
3ROE-M11-SOS	Rose River	Route 670 at confluence with Robinson River	Save Our Streams	2001, 2002
3ROB-M12-SOS	Robinson River	Route 670 at confluence with Rose River	Save Our Streams	2001, 2002, 2006
3ROB-C13-SOS	Robinson River	Route 614 bridge, just downstream of bridge in middle of stream	Save Our Streams	2001, 2002
3ROB-M13-SOS	Robinson River	Route 636	Save Our Streams	2001
3WHO-M9-SOS	White Oak Run	1 mile north of Route 638 and Route 231; riffle downstream of big island	Save Our Streams	2001, 2002, 2005, 2006
3DRN-M6-SOS	Deep Run	10-20 yards downstream of Route 636 bridge, right next to concrete cylinder in bank	Save Our Streams	2001, 2002, 2005, 2006
3COO-C1-SOS	Crooked Run	100 feet upstream from Route 15 Bridge	Save Our Streams	2001, 2002, 2007
3GRA-M5-SOS	Great Run	100 feet downstream from Route 15 Bridge	Save Our Streams	2001, 2002, 2007

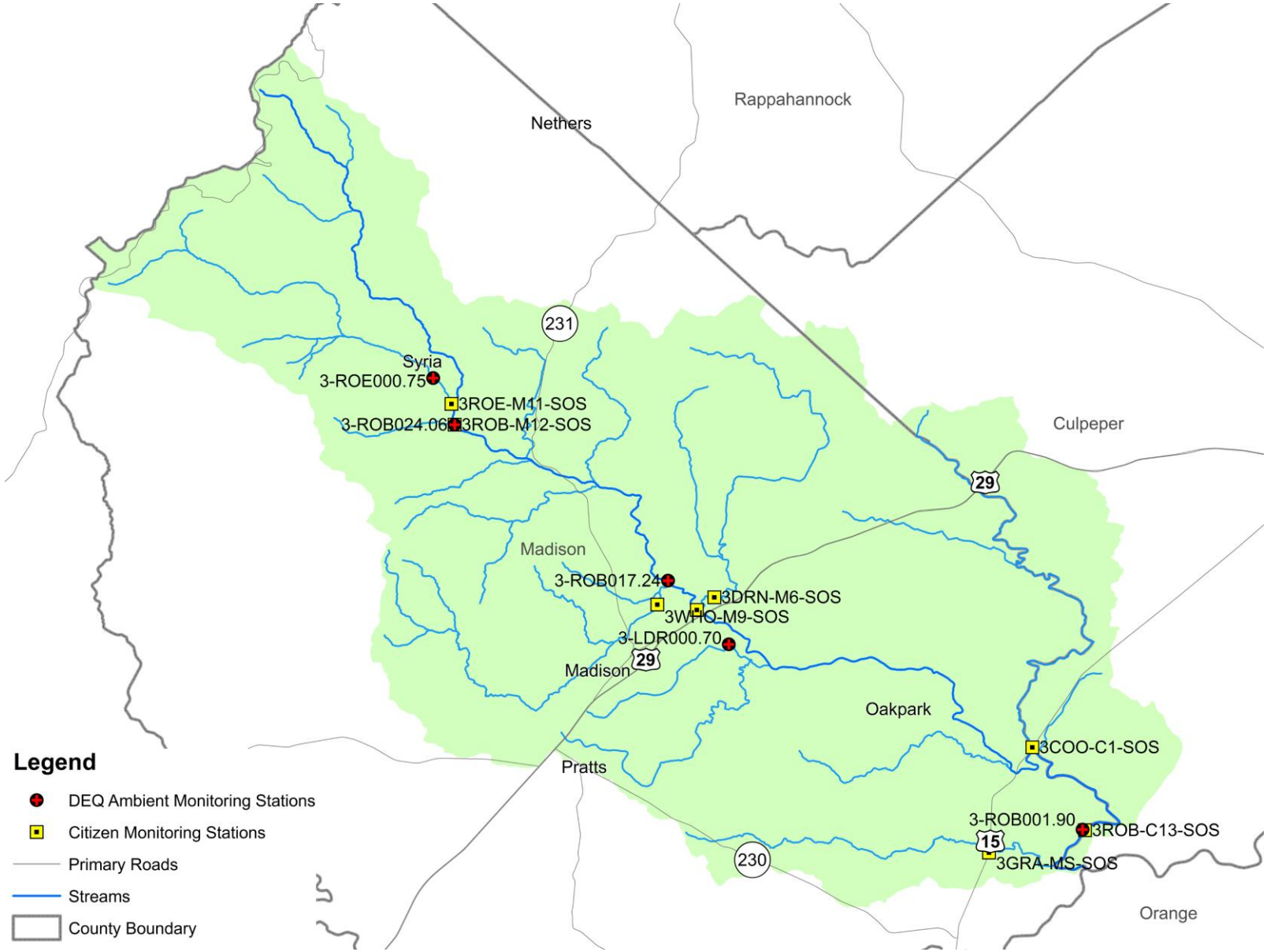

Figure 4. Location of VADEQ and citizen monitoring stations in the Little Dark Run and Robinson River watersheds.

STAKEHOLDER'S ROLES & RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals, and special interest groups. Successful implementation depends on stakeholders taking responsibility for their role in the process. The primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. 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.

Regional and local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. CSWCD and Madison and Culpeper Counties will have prominent roles during implementation. CSWCD will provide agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs. In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments in conjunction with the state can develop ordinances involving pollution prevention measures. State agencies conducting regulatory, education, or funding procedures related to water quality in Virginia include: VADEQ; VADCR; VDH; VADACS; VDGIF; VADOF; VCE, and VOF. Governmental, agricultural, residential action items during implementation are included in Tables 9 through 11, respectively.

Table 9. Governmental implementation action items.

Source Issues	Actions & Support	Potential Funding Source	Who will assist?
Continual baseline water quality monitoring	Water quality monitoring: ambient/benthic	VADEQ	VADEQ
Supplemental ambient/benthic monitoring	Water quality monitoring: ambient/benthic; coliscan (bacteria monitoring)	VADEQ, NFWF grant, VA Naturally	CSWCD, Citizen Volunteers
Local government incentives	Ordinance/code options to improve water quality (stream buffer overlay district)	Local Government, Grants	Local Government, RRRC, CSWCD, FOR
Inadequate tracking of on-site sewage disposal systems	Develop tracking system; ensure alternative OSDS maintenance agreement in place	VDH, Local Government	VDH, Local Government

Table 10. Agricultural implementation action items.

Source Issues	Corrective Actions	Potential Funding Source	Who will assist?
Livestock in stream	Livestock exclusion best management practices, Water development upslope	Ag BMP Cost-Share, WQIF, Section 319 Funds, NRCS, NFWF	CSWCD, NRCS
Cropland runoff	Cropland best management practices	Ag BMP Cost-Share, NRCS	CSWCD, NRCS
Pasture runoff	Pasture management best management practices	Ag BMP Cost-Share, NRCS, NFWF	CSWCD, NRCS
Streamside runoff	Improved buffers (grass, shrubs, trees)	CREP, EQIP, VDGIF, VADOF, Ag. BMP Cost-Share, NFWF	VDGIF, VADOF, CSWCD, NRCS
Lack of BMP knowledge	Ag BMP education, outreach events	WQIF, VCE, NRCS	CSWCD, VCE, NRCS
Livestock access to water	Alternate water source	Ag BMP, VADEQ (low interest loan), NRCS	CSWCD, VADEQ, NRCS
Targeting locations for fencing	Ground truthing, stream walks	WQIF, mini grants	CSWCD, community interest groups
BMPs and education for horse owners	Pasture management education, alternative watering sources, livestock exclusion	Ag BMPs, VCE, WQIF	CSWCD, VADEQ, interest groups

Table 11. Residential implementation action items.

Source Issues	Corrective Actions	Potential Funding Source	Who will assist?
Lack of septic system maintenance	Regular maintenance	WQIF, NFWF grant, Homeowners, Section 319 Funds	VDH, CSWCD
Septic system failure and/or straight pipes	Septic system repairs, replacement & maintenance	WQIF, NFWF grant, Homeowners, Block Grants, Rapidan Better Housiing	VDH, Local Government
No septic system pump out tracking	Computerized tracking system	VDH	VDH, Local Government
Need information on system location at time of home sale	Local ordinance	Homeowners	Local Government
Education needed on septic system function	Septic system education program	WQIF, NFWF grant	CSWCD, Realtors, Teachers, VDH, Community Interest Groups
No pet waste management	Education, bag stations, composters, structural practices in concentrated canine areas (kennels)	VCE, JMSWCD, WQIF, NFWF grant, Roundtables	Interest Groups, Local Governments, Hunt Clubs, Veterinarians, SPCA
Waterfowl impact to ponds	Buffer ponds to discourage waterfowl, especially geese	HOAs, NFWF grant, VDGIF	VADOF, Landowners
Runoff from streamside properties - non-agricultural	Low impact development techniques, install grass/shrub/tree buffers along streams	Homeowners, Developers, NFWF grant, PEC, VADOF, NFWF grant, Private Foundations	RRRC, PEC, Local Government, VCE, Interest Groups
Best management practices education for horse owners	Pasture management education; alternative watering sources, livestock exclusion	Ag BMPs, VCE, WQIF	CSWCD, VCE, Interest Groups

The roles and responsibilities of some of the major stakeholders on a local, state, and federal level are as follows:

CSWCD: The Culpeper Soil and Water Conservation District is a local unit of government responsible for the soil and water conservation work within Culpeper, Greene, Madison, Orange, and Rappahannock Counties. The district's overall role is to increase voluntary conservation practices among farmers, ranchers, and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices. Specific to the IP, the district will provide agricultural cost-share funds, lead education and technical assistance efforts, and track best management practice implementation for the agricultural and residential programs.

Madison and Culpeper Counties Government Departments: Government staff work closely with local and state agencies to develop and implement the TMDL. Staff will administer the erosion & sediment control and stormwater programs, provide mapping assistance, and may also help to promote education and outreach to citizens, businesses, and developers to introduce the importance of the TMDL process.

Rappahannock-Rapidan Regional Commission: Environmental planning is a long-standing area of emphasis of the RRRC, which is complementary to the TMDL process. RRRC continues to promote efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. TMDL development and implementation plan development have been contracted through the RRRC. RRRC will lead the pet waste management implementation with assistance from localities and CSWCD. Additionally, RRRC will continue to work with VADCR and the Steering Committee to periodically revisit implementation progress and suggest plan revisions as needed.

Citizens & Businesses: The primary role of citizens and businesses is simply to get involved in implementation. This may include participating in public outreach, implementing BMPs to help restore water quality, and partnering with other stakeholders to improve water quality.

FOR: Friends of the Rappahannock was formed in 1985 as a non-profit, grassroots conservation organization, whose common goal is to maintain the water quality and scenic beauty of the Rappahannock River and its tributaries.

PEC: Piedmont Environmental Council safeguards the landscapes, communities and heritage of the Piedmont by involving citizens in related public policy and land conservation.

Community Civic Groups: Community civic groups take on a wide range of community service including environmental projects. Such groups include the Ruritan, Farm Clubs, Homeowner Associations and youth organizations such as 4-H and Future Farmers of America. These groups offer a resource to assist in the public participation process, educational outreach, and assisting with implementation activities in local watersheds.

Animal Clubs/Associations: Clubs and associations for various animal groups (*e.g.*, beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other landowners, not only in rural areas, but in residential areas as well.

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

VADCR: The Virginia Department of Conservation and Recreation is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. Because of the magnitude of the NPS component in the TMDL process, VADCR is a major participant in the TMDL process. VADCR has a lead role in the development of IPs to address correction of NPS pollution contributing to water quality impairments. VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. Under the Virginia Stormwater Management Program, VADCR is responsible for the issuance, denial, revocation, termination, and enforcement of National Pollutant Discharge Elimination System (NPDES) permits for the control of stormwater discharges from municipal separate storm sewer systems (MS4) and land disturbing activities. VADCR staff will be working with other state agencies, local governments, soil and water conservation districts, watershed groups, and citizens to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

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

VADACS: The Virginia Department of Agriculture and Consumer Services 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 may include civil penalties. 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.

VDGIF: The Virginia Department of Game and Inland Fisheries manages Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; provides opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation; and promotes safety for persons and property in connection with boating, hunting, and fishing. The VDGIF has responsibility for administering certain U.S. Fish and Wildlife Service funding programs. Personnel participate, review, and comment on projects processed through state and federal project and permitting review processes to insure the consideration for fish and wildlife populations and associated habitats.

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

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

VOF: The Virginia Outdoors Foundation was established in 1966, "to promote the preservation of open-space lands and to encourage private gifts of money, securities, land or other property to preserve the natural, scenic, historic, scientific, open-space and recreational areas of the Commonwealth." The primary mechanism for accomplishing VOF's mission is through open-space easements. Open-space easements allow land to continue to be privately owned but restricted to serve and protect land for the public good.

USEPA: The United States Environmental Protection Agency 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. USEPA provides funding to implement TMDLs through Section 319 Incremental Funds.

NRCS: The Natural Resources Conservation Service is the federal agency that works hand-in-hand with the American people to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies along with policymakers also rely on the expertise of NRCS staff. NRCS is a major funding stakeholder for impaired water bodies through the CREP and EQIP programs.

INTEGRATION WITH OTHER WATERSHED PLANS

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include but are not limited to Chesapeake Bay Watershed Implementation Plan, TMDLs, Roundtables, Water Quality Management Plans, Erosion and Sediment Control Regulations, Stormwater Management Program, Source Water Assessment Program, and local comprehensive plans. The progress of these planning efforts needs continuous evaluation to determine possible effects on implementation goals. For example, financial and technical resources may be maximized for implementation by coordinating and expanding the planning and implementation activities of these on-going watershed activities. Current initiatives within Madison and Culpeper Counties to be integrated with the Little Dark Run and Robinson River TMDL IP include:

- Madison and Culpeper Counties Comprehensive Plans
- Town of Madison Comprehensive Plan
- Upper Hazel River Bacteria TMDL IP
- CSWCD Septic Program
- Blue Ridge Foothills Conservancy Strategic Plan
- Madison County Asset Management Project
- Chesapeake Bay Watershed Implementation Plan
- Piedmont Environmental Council Strategic Plan
- Friends of the Rappahannock Strategic Plan
- Rappahannock River Basin Commission

Blue Ridge Foothills Conservancy Easement Program

Chesapeake Bay Watershed Implementation Plan

POTENTIAL FUNDING SOURCES

Potential funding sources available during implementation were identified in the course of plan development. Detailed description of each source (*i.e.*, eligibility requirements, specifications, incentive payments) can be obtained from the CSWCD, VADCR, VADEQ, VADGIF, VCE, VDH, and NRCS. Table 12 illustrates various financial opportunities that exist from selected cost-share programs for agricultural and residential implementation needs. Sources include:

Federal Sources

- Federal Clean Water Act Section 319 Incremental Funds
- U.S. Department of Agriculture (USDA) Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Reserve Program (CRP)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Chesapeake Bay Watershed Initiative (CBWI)
- USDA Forest Incentive Program (FIP)
- USDA Wetland Reserve Program (WRP)
- USDA Wildlife Habitat Incentive Program (WHIP)
- U.S. Fish and Wildlife Service Conservation Grants
- U.S. Fish and Wildlife Service Private Stewardship Program

Virginia Sources

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Water Quality Improvement Fund
- Virginia Forest Stewardship Program
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Clean Water Revolving Loan Fund (VCWRLF)
- Virginia Outdoors Foundation

Regional and Private Sources

- Community Development Block Grant Program
- Southeast Rural Community Assistance Project (Southeast RCAP)
- National Fish and Wildlife Foundation
- Chesapeake Bay Foundation

Table 12. Control measures with estimated cost-share program and landowner costs.

Control Measure	Program Code	Unit	Cost-share	Average Cost/Unit to State or Federal Program ($)	Average Cost/Unit to Landowner ($)[1]
Livestock exclusion with 35 ft buffer	CREP	System	90% + varied incentive	23,850	2,650[A]
	EQIP/CBWI	System	75%	15,450	5,150
	LE-1T	System	85%	17,510	3,090
Small Acreage Grazing System with 35 ft setback	SL-6AT	System	50%	10,300	10,300
Livestock exclusion with 10 ft setback	LE-2T	System	50%	8,000	8,000
Stream Protection	WP-2T	System	75% + $0.50/ft incentive	10,625	2,875
Pasture and Hayland Re-planting	512	Acres	$165/ac	165	130
Prescribed grazing	528	Acres	$30/ac	30	40
Permanent vegetative cover on cropland	SL-1	Acres	75% + $35/ac incentive	313	57
Reforestation of erodible crop and pastureland	FR-1	Acres	up to $300/ac	175	0
Manure / biosolids soil incorporation	N/A	Acres	N/A	0	25
Septic Tank Pump-out	RB-1	System	50%	130	130
Connection to Public Sewer	RB-2	System	50% - 75%	2,000 – 3,000	1,000 - 2,000
Septic Tank System Repair	RB-3	System	50% - 75%	1,600 – 2,400	800 - 1,600
Septic Tank System Installation / Replacement	RB-4	System	50% - 75%	3,250 –4,875	1,625 - 3,250
Septic Tank System Installation / Replacement w/ Pump	RB-4P	System	50% - 75%	5,000 – 7,500	2,500 - 5,000
Alternative On-site Waste Treatment System	RB-5	System	50% - 75%	7,500 – 11,250	3,750 - 7,500

[1] Does not include tax credit or in-kind service; [A] Value does not reflect incentive payment

LIST OF ACRONYMS

AWG	Agricultural Working Group
BMP	Best Management Practice
CBWI	Chesapeake Bay Watershed Initiative
CCU	Confined Canine Unit
CREP	Conservation Reserve and Enhancement Program
CRP	Conservation Reserve Program
CSWCD	Culpeper Soil and Water Conservation District
CWA	Clean Water Act
EQIP	Environmental Quality Incentive Program
FR-1	Reforestation of Erodible Crop and Pastureland
FSA	Farm Service Agency
FTE	Full Time Equivalent
GWG	Government Working Group
IP	Implementation Plan
LE-1T	Livestock Exclusion with Riparian Buffers
LE-2T	Livestock Exclusion with Reduced Setback
LID	Low Impact Development
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
OSDS	On-Site Sewage Disposal System
RB-1	Septic System Pump-Out
RB-2	Connection of Malfunctioning OSSDS or Straight Pipe to Public Sewer
RB-3	Septic Tank System Repair
RB-4	Septic Tank Installation / Replacement
RB-5	Alternative On-Site Waste Treatment System
RCAP	Rural Community Assistance Program
RRRC	Rappahannock-Rapidan Regional Commission
RWG	Residential Working Group
SL-1	Permanent Vegetative Cover on Cropland
SL-6	Grazing Land Protection System
SWCB	State Water Control Board
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VADACS	Virginia Department of Agriculture and Consumer Services
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VADOF	Virginia Department of Forestry
VCE	Virginia Cooperative Extension
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
WP-2T	Stream Protection
WQIF	Water Quality Improvement Fund
WQMIRA	Water Quality Monitoring, Information and Restoration Act
WHIP	Wildlife Habitat Incentive Program
WRP	Wetland Reserve Program

GLOSSARY

Anthropogenic - involving the impact of humans on nature; specifically items or actions induced, caused, or altered by the presence and activities of humans.

Assimilative Capacity - a measure of the ability of a natural body of water to effectively degrade and/or disperse chemical substances. Assimilative capacity is used to define the ability of a waterbody to naturally assimilate a substance without impairing water quality or degrading the aquatic ecosystem. Numerically, it is the amount of pollutant that can be discharged to a specific waterbody without exceeding water quality standards. (see Loading Capacity)

Best Management Practices (BMPs) - reasonable and cost-effective means to reduce the likelihood of pollutants entering a water body. BMPs include riparian buffer strips, filter strips, nutrient management plans, conservation tillage, etc.

Cost-share Program - a program that allocates funds to pay a percentage of the cost of constructing or implementing a BMP. The remaining costs are paid by the producer(s).

Delisting - the process by which an impaired waterbody is removed from the Section 303(d) Impaired Waters List. To remove a waterbody from the Section 303(d) list, the state must demonstrate to USEPA, using monitoring or other data, that the waterbody is attaining the water quality standard.

E. coli- A type of bacteria found in the feces of various warm-blooded animals that is used as indicator of the possible presence of pathogenic (disease causing) organisms.

Failing septic system - Septic systems in which drain fields have failed such that effluent (wastewater) that is supposed to percolate into the soil, now rises to the surface and ponds on the surface where it can flow over the soil surface to streams or contribute pollutants to the surface where they can be lost during storm runoff events.

Full Time Equivalent (FTE) - Is a way to estimate staff needed for a project. A FTE of 1.0 means that the position is equivalent to a full-time worker, while a FTE of 0.5 indicates a part-time worker.

Geographic Information System (GIS) - a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. An example of a GIS is the use of spatial data for Emergency Services response (E-911). Dispatchers use GIS to locate the caller's house, identify the closest responder, and even determine the shortest route. All these activities are automated using the electronic spatial data in the GIS.

Impaired waters - those waters with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality standards.

Instantaneous criterion - The instantaneous criterion or instantaneous water quality standard is the value of the water quality standard that should not be exceeded at any time. For example, the Virginia instantaneous water quality standard for E.coli is 235 cfu/100 mL. If this value is exceeded at any time, the water body is in exceedance of the state water quality standard.

Modeling - a system of mathematical expressions that describe both hydrologic and water quality processes. When used for the development of TMDLs, models can estimate the load of a specific pollutant to a waterbody and make predictions about how the load would change as remediation steps are implemented.

Monitoring - periodic or continuous sampling and measurement to determine the physical, chemical, and biological status of a particular media like air, soil, or water.

Nonpoint source pollution - pollution originating from multiple sources on and above the land. Examples include runoff from fields, stormwater runoff from urban landscapes, roadbed erosion in forestry, and atmospheric deposition.

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

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

Riparian - pertaining to the banks of a river, stream, pond, lake, etc., as well as to the plant and animal communities along such bodies of water

Runoff - that part of precipitation, snowmelt, or irrigation water that does not infiltrate but flows over the land surface, eventually making its way to a stream, river, lake or an ocean. It can carry pollutants from the land and air into receiving waters.

Septic system - An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives liquid and solid wastes from a residence or business and a drainfield or subsurface absorption system consisting of a series of tile or percolation lines for disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Stakeholder - any person or organization with a vested interest in development and implementation of a local watershed water quality implementation plan (e.g., farmer, landowner, resident, business owner, or government official)

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

Total Maximum Daily Load (TMDL) - a pollution "budget" that is used to determine the maximum amount of pollution a waterbody can assimilate without violating water quality standards. The TMDL includes waste load allocations (WLAs) for permitted point sources, load allocations (LAs) for nonpoint and natural background sources, plus a Margin of Safety (MOS). A TMDL is developed for a specific pollutant and can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

Water quality standards - a group of statements that constitute a regulation describing specific water quality requirements. Virginia's water quality standards have the following three components: designated uses, water quality criteria to protect designated uses, and an anti-degradation policy.

Watershed - area that drains to, or contributes water to, a particular point, stream, river, lake or ocean. Larger watersheds are also referred to as basins. Watersheds range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states (see, drainage basin).

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