Maryland
319 Nonpoint Source Program
2011 Annual Report

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Maryland Department of the Environment
1800 Washington Boulevard, Suite 540
Baltimore MD 21230

Phone: 410-537-3906
Fax: 410-537-3873

Richard Eskin, Director
Science Services Administration

Jim George, Manager
Water Quality Protection and Restoration Program

Primary Author:
Ken Shanks, Chief
TMDL Implementation Division

MDE Contributors:
Jim George
Connie Louchs
Joe Mills
Robin Pellicano
Greg Sandi

Other Contributors
Agency and group contributors to the content of this report
are identified in Appendix B by an asterisk.

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TABLE OF CONTENTS

Preface

I. Executive Summary
II. Mission and Goals of the NPS Program
III. Overview
IV. Accomplishments, Successes and Progress
    A. Active 319(h) Grant-Funded Projects and Project Outcomes
    B. Implementation Tracking for Nonpoint Source Management
        1. Lower Monocacy River Watershed Plan Is Nationally Recognized
        2. Aaron Run
        3. Back River
        4. Casselman River
        5. Corsica River
        6. Lower Jones Falls
        7. Lower Monocacy River
        8. Sassafras River
        9. Upper Choptank River
V. Areas of Concern/Recommendations/Future Actions

LIST OF TABLES

1 Aggregate Pollutant Reductions Reported By 319 Projects Completed During 2011
2 Active Projects In Calendar Year 2011 Using Federal 319(h) Grant Funds
3 Projects Completed In Calendar Year 2011 Using Federal 319(h) Grant Funds
4 Watershed Plans In Maryland Accepted By EPA
4a Total Cumulative Watershed Plan Implementation Pollutant Load Reduction Reported
5 Aaron Run Pollutant Load Reduction
6 Aaron Run 319 Projects
7 Back River Small Area Watershed Plans
8 Upper Back River watershed implementation
9 Tidal Back River watershed implementation
10 Upper Back River 319 Projects
11 Corsica River watershed implementation
12 Corsica River 319 Projects
13 Lower Jones Falls watershed implementation
14 Lower Moncacy River watershed implementation
15 Lower Moncacy River 319 Projects
16 Sassafras River watershed implementation
17 Upper Choptank River watershed implementation
18 Upper Choptank River 319 Projects

LIST OF FIGURES

1 2010 Total Nitrogen Sources In Maryland
2 2010 Total Phosphorus Sources In Maryland
3 Aaron Run Acid Seep and Owens South Site Mitigation
4 Map of Implementation and Planning Project Areas in 2011
5 Certificate of Appreciation (Lower Monocacy Plan recognition)
6 Aaron Run watershed map and mitigation project photos
7 Back River watersheds map
8 Redhouse Run Stream Restoration photos
9 Casselman River watershed map and photos
10 Corsica River watershed map and photos
11 Corsica River area photos
12 Jones Falls watershed map
13 Lower Monocacy River watershed map and photos
14 Sassafras River watershed map
15 Upper Choptant River watershed map and cover crop photo

LIST OF APPENDICES

A – Financial Information – Federal 319(h) Grant Maryland Funding Summary
B – List of Agency Cooperators – Maryland Nonpoint Source Program
C – 2010 BMP Implementation Progress in Maryland
D – General Approach and Schedule to Implement Applicable Management Measures
E – Sligo Creek Success Story
F – EPA National Review of Watershed Plans, July 2011

COVER PHOTOGRAPHS

Top Center: Savage River downstream of Aaron Run (MDE photo)
Top Left Outside: Casselman River tributary fully accessible to cattle (MDE photo)
Top Right Outside: Stormwater flooding of impervious street area (Centreville photo)
Top Left Inside: Water sampling of Aaron Run segment with acid mine drainage (MDE photo)
Top Right Inside: Fish monitoring in Corsica River tributary (Corsica Implementers photo)
Far Left Top: Septic system nitrogen controls installation (Corsica Implementers photo)
Far Left Middle: Stream buffer planting in Pinecliff Park Nov. 2011 (Frederick County photo)
Far Left Bottom: Stormwater infiltration area installation (Montgomery County photo)
Far Right Top: Porous pavement installation (Corsica Implementers photo)
Far Right Middle: Redhouse Run stream restoration (MDE photo)
Far Right Bottom: Sligo Creek fish reintroduction event (Montgomery County photo)
Center: Trout (Maryland Dept. of Natural Resources photo)
Bottom Center: Corsica River (Corsica Implementers photo)

Preface

The report is produced by the Maryland Department of the Environment to meet a grant condition that appears in each annual 319(h) Grant award to Maryland from the US Environmental Protection Agency. This programmatic condition in the FFY11 award states:

> The report shall contain the following:
>
> a. A brief summary of progress in meeting the schedule of milestones in the approved Management Program, and,
>
> b. Reductions in nonpoint source pollutant loading and improvements in water quality that has resulted from implementation of the Management Program.
>
> c. Descriptions of priority Watershed Based Plan accomplishments. Accomplishments should be based the implementation milestone goals/objectives as identified in each priority plan. The goal information can be displayed in the form of a watershed goal/accomplishment chart showing percent achieved, supplemented by a short narrative that should give the reader a clear understanding of the actions being taken and the outputs and outcomes which are occurring from the actions. If monitoring was completed, a summary of that information should also be included. For example, if 1000 feet of streambank stabilization was completed, then how does that compare to the needs identified in the watershed based plan i.e. what percent of streambank stabilization was completed compared to the overall needs as identified by the plan. Similar comparisons should also be provided for each significant pollutant load reduction.

What is Nonpoint Source Pollution?

Nonpoint source (NPS) pollution is defined as polluted stormwater runoff caused associated with rainfall, snowmelt or irrigation water moving over and through the ground. As this water moves, it picks up and carries pollutants with it, such as sediments, nutrients, toxics, and pathogens. These pollutants eventually reach lakes, rivers, wetlands, coastal waters, ground waters and, most of the time in Maryland, the Chesapeake Bay.

NPS pollution is associated with a variety of activities on the land including farming, logging, mining, urban/construction runoff, onsite sewage systems, streambank degradation, shore erosion and others. For example, stormwater flowing off the land carries the nutrients nitrogen and phosphorus into local streams and eventually into the Chesapeake Bay. Under natural conditions, this is beneficial up to a point. However, if excessive nutrients enter a lake or the Chesapeake Bay, and cause nuisance algae blooms, then these nutrients are deemed pollutants.

The pollution contributed by nonpoint sources is the main reason why many of Maryland's waters are considered "impaired." Impaired waters are those waters that do not meet Water Quality Standards for designated uses (e.g., fishing, swimming, drinking water, shellfish harvesting, etc.). The most recent Chesapeake Bay model associates nonpoint source pollution into several land use categories as shown in Figures 1 and 2. The figures also show that the relative amount of nitrogen and phosphorus generated by the different land uses in Maryland varies significantly.

I. Executive Summary

This report documents the activities and accomplishments of the State of Maryland in general and in particular management of the State's 319 NPS Program, including administration of the Federal §319(h) Grant, by the Maryland Department of Environment (MDE). MDE plays a lead role in helping to achieve protection and improvement of Maryland's water quality by promoting and funding state and local water quality monitoring, stream and wetland restoration, education and outreach, and other measures to reduce and track nonpoint source pollution loads.

MDE is the lead agency responsible for coordination of policies, funds, and cooperative agreements with state agencies and local governments. Several other state agencies have key responsibilities, including the Maryland Department of Natural Resources (DNR), Maryland Department of Agriculture (MDA), and Maryland Department of Planning (MDP). The NPS Program is housed within MDE's Science Services Administration (SSA). During the past 22 years, Maryland has received over $46.5 million through the 319(h) Grant. (See Appendix A)

In calendar year 2011, there have been notable successes and accomplishments:

- Projects funded by 319(h) Grant that were completed during calendar year (Table 2) reported implementing best management practices resulting in pollutant load reductions: nitrogen 53,970 pounds/year; phosphorus 853 pounds/year; sediment 7.7 tons/year; acid 61.6 tons/year; iron 7.5 tons/year, and; aluminum 4/7 tons/year.
- Nine watershed plans in Maryland, including the Casselman River watershed plan completed in 2011, have been accepted by EPA. The Lower Monocacy River watershed plan by Frederick County was recognized by EPA as one of the best plans in the nation. Implementation to meet plan goals and objectives is completed for one plan and progress toward implementing the other eight plans is reported in this Annual Report.
- Implementation progress reported for the nine EPA-accepted watershed plans included significant overall total pollutant load reductions. For these watersheds, counting from the time of watershed plan acceptance through the end of 2011 including all reported projects regardless of funding source, the following overall cumulative pollutant load reductions were reported: 755,645 lbs/yr nitrogen; 74,222 lbs/yr phosphorus, and; 756 tons/yr sediment.

The Program continues to face several challenges and concerns. Because of increasing development, there has been in an increase in the urban/suburban component of nonpoint source pollution. Funding to the 319(h) Grant nationally was cut significantly for Federal Fiscal Year (FFY) 2011 compared the recent FFYs. Additionally, other federal and state budgets are continuing to decrease, which leads to an ever-tightening restraint on the amount of help, either technical or financial, that is available. There is also the need to show effectiveness or environmental results in an area that may take years or decades to do so.

II. Mission and Goals of the NPS Program

Maryland's mission is to implement effective nonpoint source pollution control programs. These programs are designed to achieve and maintain beneficial uses of water, improve and protect habitat for living resources, and protect public health through a mixture of water quality and/or technology based programs including: regulatory and/or non-regulatory programs; and financial, technical, and educational assistance programs.

Through leadership and financial support Maryland's Section §319(h) Nonpoint Source (NPS) Program plays a lead role in helping to achieve protection and improvement of Maryland's water quality. The Program promotes and funds state and local watershed planning efforts, implementation of NPS projects consistent with watershed plans, water quality monitoring, stream and wetland restoration, education and outreach, and other measures to reduce, prevent and track nonpoint source pollution loads. The NPS Program plays a key role in promoting partnerships and inter- and intra-governmental coordination to reduce nonpoint sources of pollution, and helps bring the necessary technical and financial resources to local watershed management planning, best management practices, and restoration of streams and wetland habitats. Program partners include State agencies, local government (counties, municipalities, Soil Conservation Districts), private landowners and watershed associations.

The NPS Program's three priority goals for funding of implementation projects through the 319(h) Grant are (FFY2012 RFP):

GOAL 1 To support meeting Total Maximum Daily Load (TMDL) nonpoint source reduction targets.

GOAL 2 To significantly contribute to reducing one or more nonpoint source water quality impairments in a water body identified in Maryland's 303(d) list of impaired water bodies leading toward full or partial restoration.

GOAL 3 To implement projects from EPA-accepted watershed-based plans that will produce measurable nonpoint source pollutant load reduction consistent with Goals 1 and 2.

III. Overview

Maryland surface waters flow into three major drainage areas:

- The Chesapeake Bay watershed receives runoff from of Maryland's mid section and encompasses about 90% of the State.
- Maryland's Coastal Bays receives runoff from Maryland's east side.
- The Youghiogeny River, which is part of the Ohio and Mississippi Rivers drainage, receives runoff from Maryland's west side.

Historically, the Program's policy has been to maintain an active presence in all three major drainage areas. The mix of 319(h) Grant-funded projects during 2011 reflects this policy. In Western Maryland where acidic mine drainage impairs local waterways, the 319 Program has invested in two watersheds: Aaron Run and Casselman River. On Maryland's Eastern Shore, there were no active projects in the Coastal Bays drainage. However, the 319 Program continued to provide assistance in several watersheds including the Corsica River watershed. In the central part of the State, the 319 Program helped to support projects in several watersheds including: Lower Monocacy River and Back River.

Overall, Maryland has over 9,940 miles of non-tidal streams and rivers. Maryland's water resources provide food and water for its residents, jobs for the economy and a place where people may relax and enjoy the natural environment. Maryland's water resources are under stress from a variety of causes, with nonpoint source pollution the greatest single factor.

Maryland's rich heritage and the bounty of its waters are threatened by the very prosperity that continues to draw newcomers. Recreation, tourism, commercial and recreational fishing, wildlife habitats, and our quality of life are ultimately dependant upon healthy watersheds. Yet, the state's waters are increasingly impacted by and remain impaired due largely to nonpoint sources of pollution and related habitat degradation due to altered land uses.

Addressing Nonpoint Source Pollution

Many agencies and programs in Maryland, including State agencies, Counties, Soil Conservation Districts and municipalities, have responsibilities in managing NPS pollutant. Contacts for key State agency programs with NPS management responsibility are listed in Appendix B.

The best methods for controlling NPS pollution are frequently called Best Management Practices (BMPs). These BMPs are designed to meet specific needs, like grassed buffers to control sediment and phosphorus that could leave farm fields, or wet stormwater ponds to capture sediment and nutrients in urban runoff. Every year, Maryland generates a cumulative total of BMPs implemented in the State. The most recent findings through 2010 are summarized in Appendix C.

A wide array of approaches and programs help to prevent, reduce or eliminate pollution from nonpoint sources. The general approach employed in Maryland to manage NPS pollution is summarized in Appendix D.

Demonstrating success in achieving nonpoint source management goals and objectives is an important focus for the program. Each year, at least one success story is submitted to EPA. Appendix E presents the most recent success story.

In 2011, EPA completed a national review of watershed plans and determined that Frederick County's Lower Monocacy River watershed plan was among the best in the country. Appendix F presents a copy of EPA's report.

Figure 1. 2010 Total Nitrogen Sources in Maryland

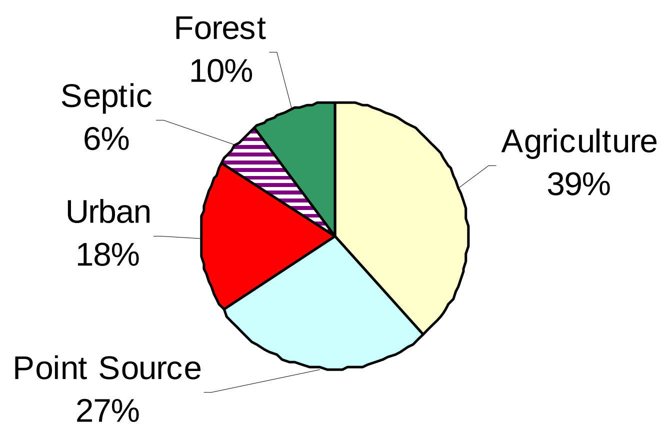
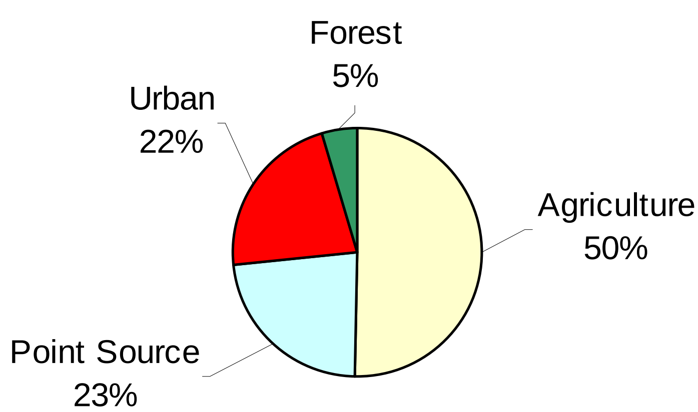


Figure 2. 2010 Total Phosphorus Sources in Maryland



* Data referenced from the Phase 5.3.2 Chesapeake Bay Model 2010 Progress Delivered loads using Constant Delivery Factors. The reported statistics include all of Maryland lands within the Chesapeake Bay Watershed except atmospheric deposition the main body of the Bay.

<u>IV. Accomplishments, Successes and Progress</u>

In the past year, there have been notable program accomplishments, successes and challenges. Progress was made in implementing best management practices in all nonpoint source areas through the provision of technical assistance, project funding or both.

A. Active 319(h) Grant-Funded Projects and Project Outcomes

During calendar year 2011, 26 projects in Maryland were reimbursed using the Federal 319(h) Grant. The geographic area encompassed by this implementation and planning activity is shown in Figure 3.

The status of all 26 projects that were active during 2011 is summarized in Table 2.
- 13 projects include on-the-ground implementation,
- 9 projects include either monitoring or tracking of implementation progress/results and
- 5 projects include planning in preparation for implementation.

Among these 26 projects, eight completed in 2011 produced the overall estimated outcomes in the adjacent table. More details on the completed project results are in Table 3.

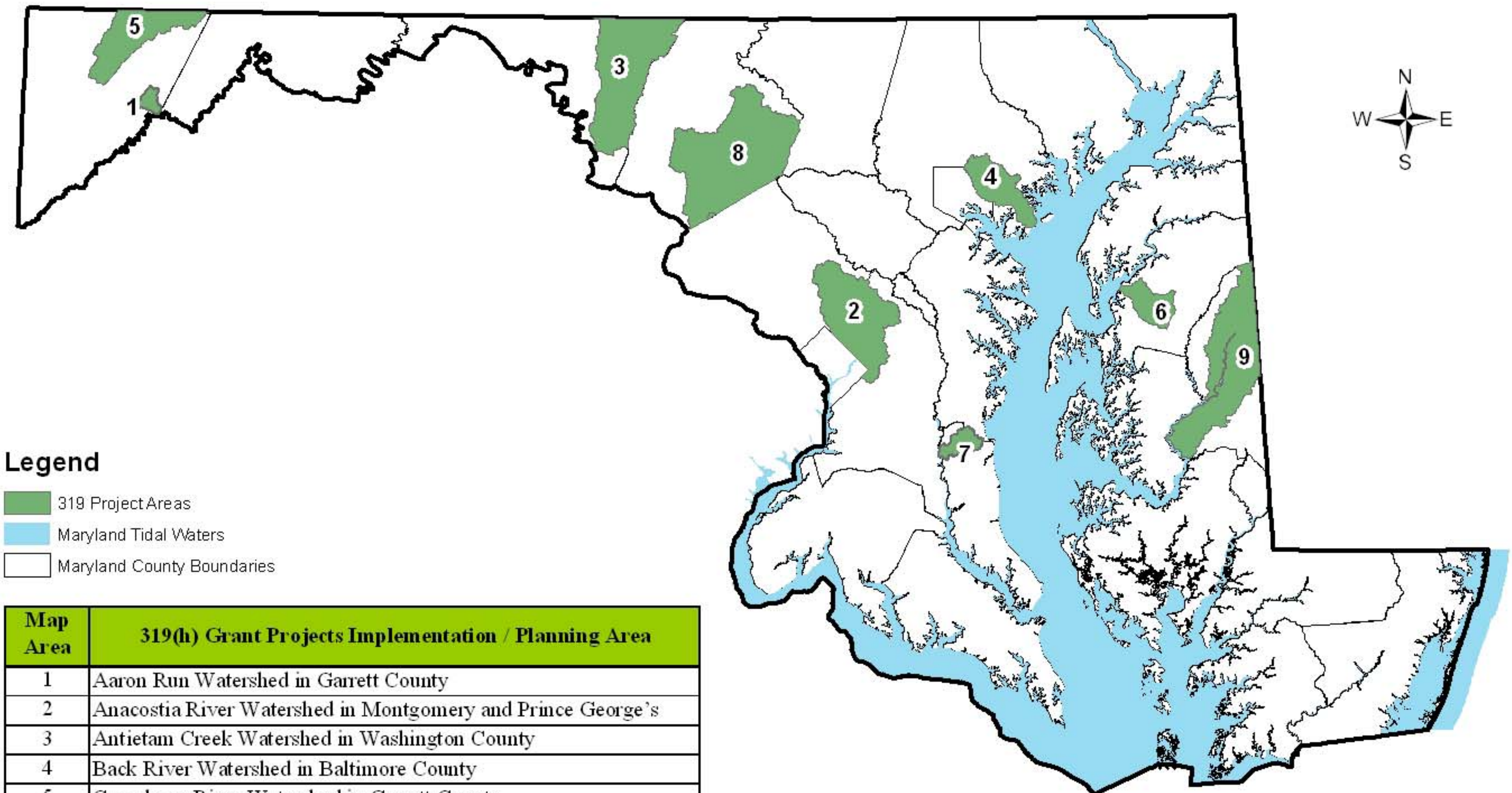
Table 1. Aggregate Pollutant Reductions Reported By 319(h) Grant Projects Completed During 2011

Acid Mine Drainage Mitigation			Nutrient/Sediment Controls		
Acid	61.6	Tons	Nitrogen	53,970	Pounds
Iron	7.5	Tons	Phosphorus	853	Pounds
Aluminum	4.7	Tons	Sediment	7.7	Tons



Figure 3. Aaron Run Acid Seep and Owens South Site Mitigation.
Top Left: Acid mine drainage seep near Aaron Run.
Middle: Limestone leach bed and wetland mitigation site under construction at the Owens South site adjacent to Aaron Run.
Bottom Right: In June 2011, EPA and MDE personnel inspect the Owens South site limestone leach bed and upstream end of the wetland mitigation shortly after their completion. Photos by MDE.

Figure 4
Map of Maryland Implementation and Planning Project Areas
Funded by the 319(h) Grant in 2011



Map Area	319(h) Grant Projects Implementation / Planning Area
1	Aaron Run Watershed in Garrett County
2	Anacostia River Watershed in Montgomery and Prince George's
3	Antietam Creek Watershed in Washington County
4	Back River Watershed in Baltimore County
5	Casselman River Watershed in Garrett County
6	Corsica River Watershed in Queen Anne's County
7	Hall Creek Watershed in Calvert County
8	Lower Monocacy River Watershed in Frederick County
9	Upper Choptank River in Caroline County

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TABLE 2. Active Projects In Calendar Year 2011 Using Federal 319(h) Grant Funds					
Map Area	**Watershed Name (Md 8-Digit #)**	**TMDL or WQA**	**Impairment ***	**Project Name (Lead Agency, Grant Year)**	**Status**
1	Aaron Run Watershed (Savage River tributary) 02141006	Low pH, Nutrients	Low pH, Methylmercury-fish tissue	Acid Mine Drainage Remediation (MDE: FFY05 #19, FFY06 #1, FFY07 #12)	Project start Oct. 2005 Completed 2011
2	Anacostia River 02140205	Bacteria, PCBs, Sediment, Nutrients, Trash	Bioassessment, Fecal Coliform, Heptachlor Epoxide, Nitrogen, PCBs, Phosphorus, Total Suspended Solids, Trash	Green Streets – Green Jobs Partnership (Chesapeake Bay Trust FFY10 #12)	Project start 2010 Anticipate completion 2012
3	Antietam Creek 02140502	Bacteria, BOD, Sediment	Bioassessment, Fecal Coliform, PCB in fish tissue, Phosphorus, Total Suspended Solids	Watershed Plan (Washington SCD FFY08 #20)	Project start July 2010 Anticipate completion 2012
4	Back River 02130901	Bacteria, Chlordane, Nutrients, PCBs, Zinc	Bioassessment, Fecal Coliform, Nitrogen, Phosphorus PCB in fish tissue, Total Suspended Solids	Redhouse Run at St. Patrick Stream Restoration (Baltimore Co. FFY07 #18)	Project start 2009 Completed 2011
				Stormwater Conversions (Baltimore Co. FFY08 #21)	Project start 2011 Anticipate completion 2012
				Bread and Cheese Creek Restoration (Baltimore Co. FFY10 #11)	Project start 2011 Anticipate completion 2013
5	Casselman River (Youghioghy River trib.) 05020204	pH, WQA Nutrients	Low pH, Methylmercury –fish tissue	Watershed Plan (MDE FFY08 #12)	Project start July 2008 Completed 2011
				Acid Mine Drainage Remediation Implementation (MDE FFY09 #6)	Project start July 2008 Anticipate completion 2013
6	Corsica River (Chester River tributary) 02130507	Bacteria, PCBs, Nutrients	Estuarine Bioassessment, Nitrogen, Phosphorus, Fecal Coliform, PCB in fish tissue, Total Suspended Solids	Bioretention Swale (Queen Anne's County FFY08 #19)	Project start July 2008 Completed 2011
				Capacity / Implementation (Centreville FFY09 #1)	Project start April 2006 Anticipate completion 2012
				Ag. Technical Assistance (MDA / Queen Anne's SCD FFY10 #10)	Multi Year/Grant Project
				Monitoring Urban Stormwater and On-Site Domestic Systems (MDE FFY10 #2, FFY11 #2)	Multi Year/Grant Project
7	Hall Creek Watershed (L. Patuxent River trib.) 02121101	None	None (for the Hall Creek watershed)	Watershed Plan (Calvert County FFY07 #19)	Project start 2009 Completed in 2011

TABLE 2. Active Projects In Calendar Year 2011 Using Federal 319(h) Grant Funds					
Map Area	**Watershed Name (Md 8-Digit #)**	**TMDL or WQA**	**Impairment ***	**Project Name (Lead Agency, Grant Year)**	**Status**
11	Lower Monocacy River 02140302	Bacteria, Sediments	Bioassessment, Fecal Coliform, Phosphorus, Sedimentation, Total Suspended Solids	Bennett Creek Pilot Urban Wetlands Prog. (Frederick County, FFY07 #4)	Project start Nov. 2006 Completed 2011
				Bennett Creek Implementation (Frederick County, FFY08 #4)	Project start July 2008 Anticipate completion 2012
				Green Infrastructure Project (Frederick County, FFY10 #9)	Project start 2010 Anticipate completion 2013
	Statewide	N/A	N/A	Grant Administration (MDE FFY10 #3, FFY11 #3)	Multi Year/Grant Project
				Md Bioassessment Stream Survey (DNR, monitoring FFY10 #8)	Multi Year/Grant Project
				Nonpoint Source Program (MDE FFY10 #4, FFY11 #4)	Multi Year/Grant Project
				Nutrient Trading Pilot (Md Dept. of Agriculture FFY07 #22)	Project start 2009 Completed 2011
				Targeted Watershed (MDE monitoring/analysis FFY10 #5, FFY11 #5)	Multi Year/Grant Project
				Analysis and Local Technical Assistance (MDE FFY10 #1, FFY11 #1)	Multi Year/Grant Project
				Urban Stormwater Mgmt Implementation Tracking (MDE FFY10 #6, FFY11 #6)	Multi Year/Grant Project
				Volunteer Monitoring Symposium (DNR FFY9 #12)	Completed 2011
				Water Quality Protection Pilot (MDE FFY10 #13)	Anticipate completion 2012
9	Upper Choptank River 02130404	None	Bioassessment, Nitrogen, Phosphorus, PCB in fish tissue, Total Suspended Solids	Dept. of Publics SWM Retrofit (Caroline County FFY10 #7)	Project start 2011 Anticipate completion 2012

* The 2010 Integrated Report of Surface Water Quality in Maryland, in accordance with Clean Water Act Sections 303(d), 305(b) and 314.

TABLE 3. Projects Completed
In Calendar Year 2011 Using Federal 319(h) Grant Funds

Map Area	Watershed Name (Md 8-Digit #)	Project Name * (Lead Agency)	Funding ** Federal $ Grant Year	Funding ** Match $	Accomplishments
1	Aaron Run (Savage River Tributary) 02141006	Acid Mine Drainage Remediation (MDE)	113,160 FFY07 #12	75,540	This completed project reported overall pollutant load reductions accomplished by implementation funded in-part by three 319(h) Grant grants. (See the section on Aaron Run implementation)
4	Back River 02130901	Redhouse Run at St. Patrick Stream Restoration Baltimore County	418,500 FFY07 #18	279,000 Including approx. $84,152 State funds	This project restored 3,000 linear feet of stream and created 0.1 acres of wetland. These improvements provided stream bank stabilization and uptake/filtration of nutrients and sediment by floodplain plants. Overall, the projected resulted in pollutant load reductions of 609 lb/yr nitrogen, 32.1 lb/yr phosphorus, and 5.37 tons/yr suspended solids.
5	Casselman River (Youghioghy River tributary) 05020204	Watershed Plan (MDE, 2 programs: Abandoned Mine Lands Division and the Water Quality Protection and Restoration Program)	46,933 FFY08 #12	31,289	This EPA-accepted watershed plan calls for mitigation of drainage from abandoned mine lands at selected sites based on integrated review of field assessment/analysis. Implementation consistent with this plan will lead to pollution reduction and meeting a pH TMDL. This will allow for recovery of habitat and fish including trout.
6	Corsica River (Chester River tributary) 02130507	Agricultural Technical Assistance (Md Dept of Agriculture with the Queen Anne's SCD)	61,590 FFY10 #10	41,060	Ongoing project outcome for July 2010 through June 2011: 1) facilitated implementation of 8 BMPs including: 1 stream fencing (7,245 feet, 43 acres), 1 wetland restoration (3.5 acres) 1 rooftop runoff management, and 5 heavy use area pads. 2) 5,525 acres of cover crops were implemented resulting in annual pollutant load reductions: 53,259 lbs/yr nitrogen and 802 lbs/yr phosphorus. 3) 116 tons of horse manure were transported from the watershed for composting and reuse elsewhere. 4) Four composters were purchased and put to use as demonstration for horse manure management/reuse.
		Bioretention Swale (Queen Anne's County)	TBD (Up to $50,000) FFY08 #19	TBD	The County reconstructed 425 linear feet of drainage swale to promote uptake of stormwater runoff and nutrients by plants while also capturing sediment before it can reach the Corsica River. The estimated pollutant reduction for this project is: 0.22 lbs/yr nitrogen; 0.35 lbs/yr phosphorus; 0.739 tons/yr sediment (total suspended solids)

TABLE 3. Projects Completed In Calendar Year 2011 Using Federal 319(h) Grant Funds

Map Area	Watershed Name (Md 8-Digit #)	Project Name * (Lead Agency)	Funding ** Federal $ Grant Year	Funding ** Match $	Accomplishments
7	Hall Creek (Patuxent River tributary) 02121101	Watershed Plan (Calvert County)	71,538 FFY07 #19	35,769	Calvert County created a Hall Creek watershed plan to meet EPA's guidance for components of a watershed based plan (A-I criteria). The project included extensive field assessment, some collection of water quality data, analysis by subwatershed, and identification of implementation project sites. In December 2011, EPA conditionally accepted the plan, i.e. several revisions are necessary before implementation in the watershed is eligible for 319(h) Grant funding.
11	Lower Monocacy River 02140302	Bennett Creek Pilot Urban Wetlands Program (Frederick County)	196,733 FFY07 #4	131,155	Projects results included: 1) Report on 4 years of habitat assessment/analysis. 2) Four wetland restorations and two tree plantings implemented through this project resulted in overall pollutant load reductions of 101.3 lbs/yr nitrogen, 18.5 lbs/yr phosphorus and 1.6 tons/yr sediment. 3) Several education/outreach events and publications were grant supported. 155 students received hands-on education by participating with these implementation projects. 26 grade school teachers received training on how to incorporate wetlands created by this project in their teaching. Produced signage for selected wetlands sites. 4) Water quality monitoring findings for one project reported.
	Statewide	MD Biological Stream Survey (DNR)	252,618 FFY09 #2	168,412	Ongoing project outcome for field work conducted during calendar year 2010 (final report dated June 2011): 1) Conducted sampling at 31 sites in 11 watersheds to address MDE needs regarding impaired waters regarding: fish, benthic macroinvertebrates, periphyton, water chemistry, physical habitat. 2) Conducted stream corridor assessments in two watersheds selected by MDE: South Branch Patapsco River in Carroll County, and Mattawoman Creek in Charles and Prince George's Counties. 3) Data for all the above was reported in database/GIS.

TABLE 3. Projects Completed In Calendar Year 2011 Using Federal 319(h) Grant Funds					
Map Area	**Watershed Name (Md 8-Digit #)**	**Project Name * (Lead Agency)**	**Funding ** Federal $ Grant Year**	**Funding ** Match $**	**Accomplishments**
	Statewide	Nutrient Trading Pilot (Md Dept. of Agriculture)	108,784 FFY07 #22	72,523	Project focused on implementing Maryland's agricultural nutrient trading (or offset) program: 1) Modified an existing Internet calculation tool and tested its function, performance and application. EPA Chesapeake Bay Program computations and features from USDA's Nutrient Tracking Tool were incorporated. The current version of the calculation tool and its accompanying modules are online at www.mdnutrienttrading.com. 2) Analyzed nutrient trading economics and incorporated the findings into the Internet tool. 3) Demonstrated some aspects of the tool: 100 accounts were opened; 130 farm property assessments were conducted and more than 50 were eligible to trade; 5 applications for trading were submitted. 4) Conducted education, outreach and training related to the tool and program including completion of an educational video. 1,200 people attended meetings and workshops. 186 people received hands-on training with the tools.
	Statewide	Volunteer Monitoring Symposium (Md. Dept. of Natural Resources)	15,000 FF09 #12	10,000	This project conducted a symposium on August 13, 2011 at Carroll Community College. The symposium was designed to provide information exchange and education to people involved in volunteer monitoring related to water quality and stream conditions. 397 people from 7 States and the Washington DC participated in 145 oral presentations, 24 workshops and 17 field trips.

* Statewide MDE projects that re-occur year after year are listed in Table 1 Active Projects but are not repeated in Table 2.

** Federal: Project expenditures reimbursed by Federal grant rounded to the nearest dollar. Match: Project expenditures covered by non-Federal fund sources. Some projects may also involve funding sources in addition to the Federal grant and the funding documented as match for the grant.

B. Implementation Tracking for Nonpoint Source Management

Nonpoint source implementation reporting included in this Annual Report three methods: Chesapeake Bay tracking, watershed-based plan tracking and water quality improvement.

To track Chesapeake Bay implementation, cumulative data on the best management practices constructed in Maryland's portion of the Chesapeake Bay is reported to EPA annually. The most recent cumulative information through 2010 is presented in Appendix C. This data is generated by MDE, several other State agencies and local governments. MDE collects the data from the other entities, provides quality control services, transforms the data into standardized reporting formats required by EPA and submits the data to the EPA Chesapeake Bay Program. During 2011, two MDE projects funded by the 319(h) Grant performed this work: 1) Analysis and Local Technical Assistance of NPS Pollution in Maryland, and 2) Urban Stormwater Management Tracking Implementation in Urban Areas.

To track watershed-based plan implementation, MDE enlists the government or private entity that is primarily responsible for each EPA-accepted watershed plan to report progress. These watershed plans are consistent with EPA guidance for components of a watershed-based plan (A-I Criteria). Implementation projects consistent with these watershed plans are eligible to use 319(h) Grant funds for implementation.

Table 4 lists watershed plans accepted by EPA in Maryland and Table 4a summarizes the total cumulative pollutant load reductions for the plans. By the end of 2011, EPA had accepted nine watershed plans. Consequently, implementation projects that are consistent with these plans are eligible to compete for 319(h) Grant funding. One watershed plan has conditional EPA acceptance, which means that several plan revisions are necessary in order for the plan to achieve full EPA acceptance and eligibility for implementation project funding by the 319(h) Grant.

MDE regularly assesses available information from at least three sources to find documented cases of water quality improvement / success stories:

- Impairments removed from the list of impaired water bodies (303(d) list) in Maryland's Integrated Report is reviewed biennially. 37 listings in the 2008 Report were delisted in the 2010 Report: 19 listings now meet water quality standards, 6 mercury or PCB listings now support designated use for fishing, 8 biological listings replaced by specific pollutant listings, 4 areas/impairment listings are no longer recognized as beaches. Review of these delistings could not document causality links to NPS implementation or potential candidates for success stories that meet EPA criteria.
- 319(h) Grant-funded projects' progress and accomplishments are assessed by MDE and reported in each Annual Report. Recent assessments identified potential future success story candidates.
- Candidates for water quality improvement / success stories are solicited from other sources by MDE. This approach has yielded at least one success story each year. In 2011, Montgomery County's success story in the Sligo Creek watershed was submitted to EPA for review and recognition. (See Appendix E.)

Table 4. Watershed Plans In Maryland Accepted by EPA		
Watershed	**Plan Description**	**2011 Progress**
Back River	*Upper Back River Small Watershed Action Plan.* Volume 1 and 2, Baltimore County Department of Environmental Protection and Resource Management, November 2008. (Drains to tidal Back River and then to Chesapeake Bay.) Accepted by EPA 2008. *Tidal Back River Small Watershed Action Plan.* Volume 1 and 2, Baltimore County Department of Environmental Protection and Resource Management, February 2010. (Tributary directly to the Chesapeake Bay.) http://www.baltimorecountymd.gov/Agencies/environment/watersheds/ep_brmain.html Accepted by EPA 2010.	Progress Reported (go to summary)
Casselman River	*Casselman River Watershed Plan for pH Remediation.* Maryland Department of the Environment, January 2010 revised 3/25/11. (Tributary to Ohio River Basin) http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/casselman.aspx EPA Accepted 2011.	Progress Reported (go to summary)
Corsica River	*Corsica River Watershed Restoration Action Strategy.* Town of Centreville, Final Report September 2004. (Tributary to the Chester River and the Chesapeake Bay.) http://www.dnr.state.md.us/watersheds/surf/proj/wras.html Accepted by EPA 2005. In 2011, EPA requested a report on plan implementation progress and, as appropriate, revisions to the 2005 plan in consideration of the report. Satisfactory response to this request is necessary to be eligible for future 319(h) Grant funding.	Progress Reported (go to summary)
Jones Falls	*Lower Jones Falls Watershed Small Watershed Action Plan.* Baltimore County, October 15, 2008. (Tributary to Patapsco River and Chesapeake Bay.) http://www.baltimorecountymd.gov/Agencies/environment/watersheds/ep_jonesmain.html Accepted by EPA 2008.	Progress Not Reported (no 319 projects)
Lower Monocacy River	*Lower Monocacy River Watershed Restoration Action Strategy (WRAS) Supplement: EPA A-I Requirements, Frederick County Maryland.* July 2008, Version 1.0. (Tributary to the Potomac River and the Chesapeake Bay.) http://www.watershed-alliance.com/mcwa_pubs.html Accepted by EPA 2008.	Progress Reported (go to summary)
Spring Branch	*Spring Branch Subwatershed – Small Watershed Action Plan (Addendum to the Water Quality Management Plan for Loch Raven Watershed).* Baltimore County, March 2008. (Tributary to the Loch Raven Reservoir, then to the Gunpowder River and then to the Chesapeake Bay.) http://www.baltimorecountymd.gov/Agencies/environment/watersheds/ep_lrmain.html Accepted by EPA 2008.	Completion reported in Maryland's 2009 319 NPS Annual Report
Sassafras River	*Sassafras Watershed Action Plan*. Sassafras River Association. (Tributary directly to the Chesapeake Bay.) www.sassafrasriver.org/swap/ Accepted by EPA 2009	Progress Reported (go to summary)
Upper Choptank River	*Upper Choptank River Watershed Based Plan Developed to be Consistent with EPA's 319(h) Nonpoint Source Program Grant "A through I Criteria".* Caroline County, November 2010. (Tributary to the lower Choptank River and the Chesapeake Bay.) http://www.carolineplancode.org/ Accepted by EPA 2010.	Progress Reported (go to summary)

Table 4a. Total Cumulative Watershed Plan Implementation Pollutant Load Reduction Reported From Plan Acceptance By EPA Thru 2011

Watershed	Subwatershed	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment tons/yr	Acid tons/yr	Iron tons/yr	Aluminum tons/yr
Aaron Run		NR	NR	NR	61.1	7.5	4.7
Back River	Tidal	NR	NR	NR	NR	NR	NR
	Upper	609	32.1	5.37	NR	NR	NR
Casselman River		NR	NR	NR	NR	NR	NR
Corsica River		48,929	39,486	718	NR	NR	NR
Lower Jones Falls		NR	NR	NR	NR	NR	NR
Lower Monocacy River	All Other	2,106.6	156.2	22.8	NR	NR	NR
	Lake Linganor	NR	47.9	9.6	NR	NR	NR
Sassfras River		NR	NR	NR	NR	NR	NR
Upper Choptank River		704,000	34,500	NR	NR	NR	NR
TOTAL		755,644.6	74,222.2	755.77	61.1	7.5	4.7

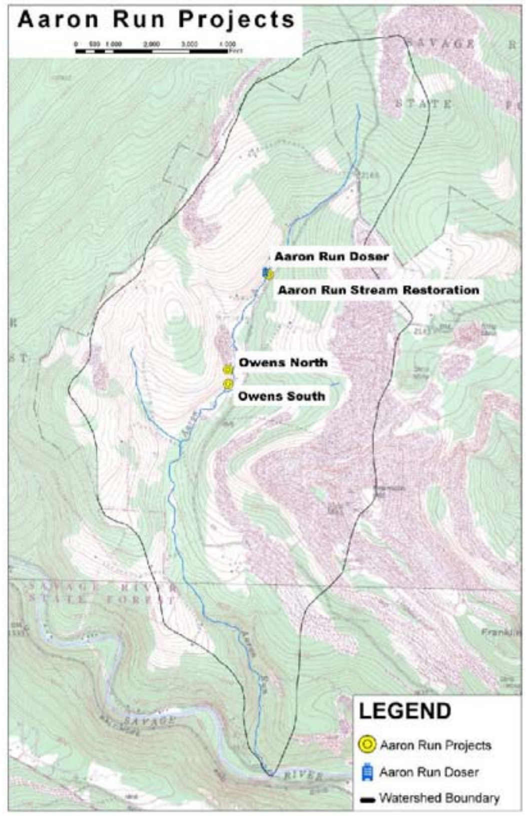
NR – not reported.

1. Lower Monocacy River Watershed Plan Is Nationally Recognized

In 2011, EPA recognized Frederick County's *Lower Monocacy River Watershed Restoration Action Strategy (WRAS) Supplement* as one of the best watershed plans in the nation. EPA's recognition was given to only four of the 49 plans reviewed.

The Lower Monocacy watershed plan demonstrates how EPA's guidance regarding their components of a watershed plan (A-I criteria) was applied to produce an effective nonpoint source implementation strategy. More information on EPA's review of the Lower Monocacy watershed plan is in Appendix F.

Figure 5. Following release of the national report in July 2011, EPA Region III presented MDE with this Certificate. This Certificate recognizes the work by the Frederick County, Community Development Division, Watershed Management Section who crafted the document and were open to MDE's input on technical issues and recommendations on integrating EPA's A-I criteria into the County's watershed plan.



2. Aaron Run Watershed AMD Mitigation Completed

Location

Aaron Run is a tributary to the Savage River, which drains to the Potomac River and then to the Chesapeake Bay. The watershed area is about 3.5 square miles entirely within Garrett County, Md.

Goal

One legacy of past coal mining in this watershed is continuing acid mine drainage (AMD). The intent of the 319(h) Grant-funded projects was to mitigate AMD in the Aaron Run mainstem to allow for re-establishment of native brook trout populations and recovery of fish populations.

Implementation

Beginning in October 2005, 319(h) Grant funds helped to pay for an assessment of acid mine drainage sources in the Aaron Run watershed, selection of mitigation sites and technologies, project designs and implementation of the projects. Implementation was completed August 2011. The tables on the next page summarize project results and 319(h) Grant contributions.

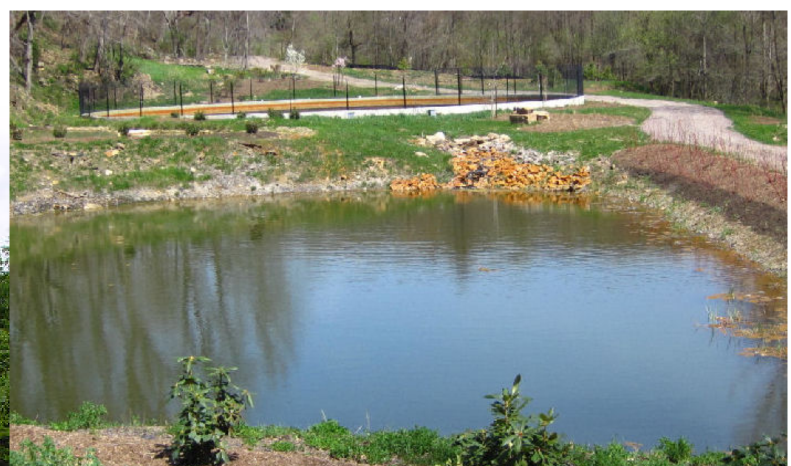


Figure 6. Left: EPA and MDE personnel inspect the Doser installed at Aaron Run to meter out lime adding alkalinity and counteracting in-stream acidity. Above: The oxidizing pond (foreground) and Successive Alkalinity Producing System (SAPS) cell (background) are treating AMD and discharging pH adjusted water into Aaron Run. (Map and photos provided by MDE)

Table 5. Aaron Run Watershed Pollutant Load Reduction Following Completion of Watershed Plan Implementation

Location	BMP	Acid			Iron			Aluminum		
		Lbs/Day	Lbs/Yr	Tons/ Yr	Lbs/Day	Lbs/Yr	Tons/Yr	Lbs/Day	Lbs/Yr	Tons/Yr
Owens North	Alkaline Leach Bed	42.4	15,478.4	7.7	8.4	3,052.7	1.5	3.0	1,113.6	0.6
Owens South	SAPS Cell	173.2	63,219.0	31.6	26.3	9,616.0	4.8	11.1	4,067.9	2.0
Stream Restoration	Doser	73.0	26,630.9	13.3	4.6	1,695.6	0.9	6.6	62,435.2	1.2
	SAPS Cell	49.5	18,080.7	9.0	1.6	566.1	0.3	5.1	1,852.7	0.9
TOTAL		338.1	123,409.0	61.6	40.9	14,930.4	7.5	25.8	9,469.4	4.7

The estimated pollutant load reductions resulting from the Aaron Run Acid Mine Drainage mitigation project shown above are based on monitoring conducted in the immediate area of each implementation site shortly after completion of project implementation in 2011. MDE is continuing to conduct periodic in-stream monitoring of project results and improvement of stream conditions for at least a year following completion of the Aaron Run implementation. The monitoring will help to document continuing project success and anticipated recovery of aquatic life. 2011-2012 in-stream monitoring is funded in part by 319(h) Grant project FFY2011 GRTS #5.

Table 6. Aaron Run Watershed - 319(h) Grant Projects Funding Implementation

MDE Project Name/Description	319(h) Grant Year Project # (1)	Grant Project Status	319(h) Grant Funds (2)	MATCH	Total Cost (4)
Aaron Run Watershed Remediation Project	FFY05 #19	Closed	$119,000.00	$79,333.33	$198,333.33
	FFY06 #1	Closed	$372,274.72	$248,183.15	$620,457.87
	FFY07 #12	Closed	$114,656.82	$76,437.88	$191,094.70
Total 319(h) Grant and Match for the grant			$605,931.54	$403,954.36	$1,009,885.90

1. All 319(h) Grant-funded implementation is reported.
2. Match includes funding from other sources including other Federal grants and/or State funds.
3. Funding/expenditures summarized in table is limited to implementation. Expenditures for monitoring and other activities are not shown.

3. Back River Watersheds

Location

The Back River watershed is located in Baltimore County and Baltimore City. This watershed is divided into two subwatersheds as shown in the map and summarized in the table below. A watershed plan for the Tidal and for Upper Back River subwatershed was accepted by EPA.

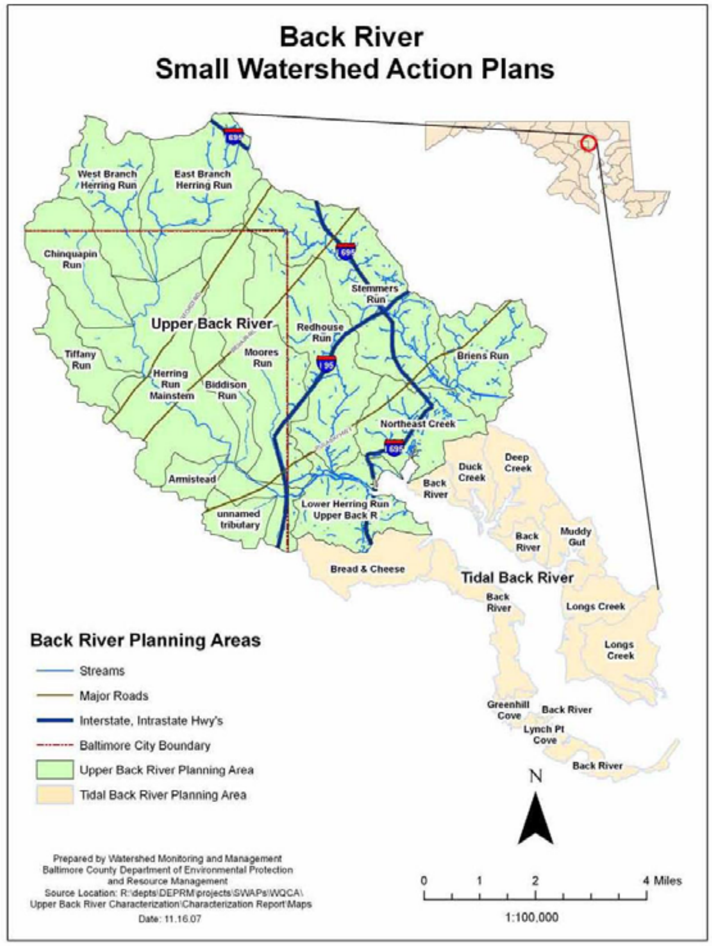


Figure 7. Back River Watersheds.

Implementation

Projects that are implementing watershed plan goals are summarized on the next pages. All projects using 319(h) Grant funds to date have been in Baltimore County's portion of the Upper Back River watershed. Other implementation progress contributing to watershed plan goals included in the tables was reported by Baltimore County, including projects conducted by nongovernmental organizations.

Table 7. Back River Small Area Watershed Plans

Upper Back River Watershed	**Tidal Back River Watershed**
Pollutant Load Reduction Goals - Total nitrogen: 48,190 pounds - Total phosphorus: 6,056 pounds Total drainage area: 27,716.7 acres (43.3 mi^2) Total open tidal water: NA Baltimore Co.: 55.5%; Baltimore City: 44.5%. Impervious cover: 30.7 % Land Use - Agriculture: --- - Commercial: 9.9% - Forest: 11.5% - Industrial: 6.5% - Institutional: 8.0% - Residential low density: 8.5% - Residential mid density: 26.5% - Residential high density: 20.4% - Urban open: 6.2% - Water/Wetlands: ---	Pollutant Load Reduction Goals - Total nitrogen: 6,498 pounds - Total phosphorus: 679 pounds Total Drainage area: 7,720 acres (12 mi^2) Total open tidal water: 3,947 acres (6.2 mi^2) Baltimore County: 100% Impervious cover: 18.4% Land Use - Agriculture: 4.4% - Commercial: 7.2% - Forest: 32.1% - Industrial: 3.5% - Institutional: 4.4% - Residential low density: 2.4% - Residential mid density: 23.0% - Residential high density: 8.6% - Urban other: 11.4% - Water/Wetlands: 3.0%

Table 8. Upper Back River Watershed Plan - 2011 Implementation Progress Summary								
Goals			**Progress (3)**					
			Implementation (4)			**Pollutant Reduction 2008-2011**		
Category (2)	**Unit**	**Goal**	**2011 (5)**	**2008 - 2010**	**Percent of Goal**	**Nitrogen (lbs/yr)**	**Phosphorus (lbs/yr)**	**Sediment (tons/yr)**
Reforestation - Forest Land Mgmt	acres	50	2	NA	4%	NR	NR	NR
Buffer Reforestation, Forest Stand Mgmt	acres	200	0.4	0	0%	NR	NR	NR
Nutrient Management	acres	3,000	0	0	0%	NR	NR	NR
Downspout Disconnect, Roof Runoff Mgmt	acres	180	0.2	0.69	0%	NR	NR	NR
Stream Channel Restoration (5)	feet	66,000	3,000	0	5%	609	32.1	5.37
Street Trees, Tree/Shrub Establishment	units	4,000	0	119	3%	NR	NR	NR
Stormwater Retrofits & Mgmt Wetlands	units	50	0	1	2%	NR	NR	NR
Stormwater Conversion, Urban Wet Pond	units	17	0	5	29%	NR	NR	NR
					Total Pollutant Reduction	609	32.1	5.37
					Watershed Plan Nutrient Reduction Goal	48,190	6,056	---
					Percent of Goal Achieved	1.3%	0.5%	---

1. 2011 = Calendar year. NA = not applicable. NR = not reported. BMP = best management practice.
2. Categories for watershed plan goals tracked by EPA for progress. All 319(h) Grant-funded implementation is reported.
3. Data is reported by Baltimore County, which includes results of nongovernmental organization activities.
4. All 319(h) Grant-funded implementation is reported.
5. 2011 and pollutant reduction shown includes reporting from Redhouse Run at St. Patricks stream restoration.

Table 9. Tidal Back River Watershed Plan - 2011 Implementation Progress Summary								
Goals			**Progress (3)**					
			Implementation (4)			**Pollutant Reduction 2008-2011**		
Category (2)	**Unit**	**Goal**	**2011**	**2008 - 2010**	**Percent of Goal**	**Nitrogen (lbs/yr)**	**Phosphorus (lbs/yr)**	**Sediment (tons/yr)**
Reforestation - Forest Land Mgmt	acres	35	1.5	NA	4.3%	NR	NR	NR
Buffer Reforestation, Forest Stand Mgmt	acres	156	0.3	0	0.2%	NR	NR	NR
Nutrient Management	acres	186	0	0	0%	NR	NR	NR
Downspout Disconnect, Roof Runoff Mgmt	acres	31	0	0	0%	NR	NR	NR
Stream Channel Restoration	feet	17,040	0	0	0%	NR	NR	NR
Street Trees, Tree/Shrub Establishment	acres	1.7	0	0	0%	NR	NR	NR
Stormwater Retrofits & Mgmt Wetlands	acres	6.4	0	0	0%	NR	NR	NR
Stormwater Conversion, Urban Wet Pond	units	2	0	0	0%	NR	NR	NR
Shoreline Protection/Enhancement	units	NA	0	0	NA	NR	NR	NR
					Total Pollutant Reduction	0	0.0	0.00
					Watershed Plan Nutrient Reduction Goal	6,498	679	---
					Percent of Goal Achieved	0.0%	0.0%	---

1. 2011 = Calendar year. NA = not applicable. NR = not reported. BMP = best management practice.
2. Categories for watershed plan goals tracked by EPA for progress. All 319(h) Grant-funded implementation is reported.
3. Data is reported by Baltimore County, which includes results of nongovernmental organization activities.
4. As of December 2011, all projects in the Tidal Back River watershed are funded by sources other than the 319(h) Grant.

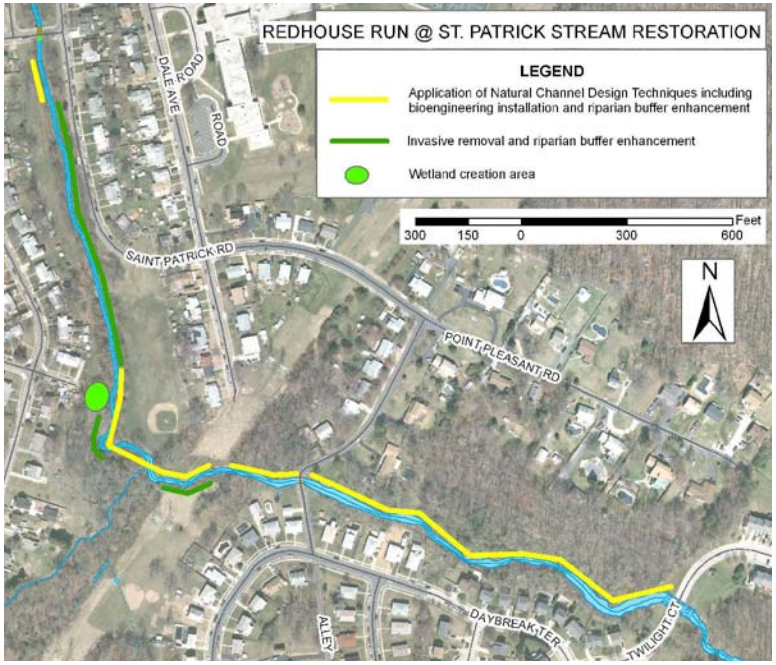


Figure 8. Redhouse Run Stream Restoration completed 2011.
Left: The map shows the area of Baltimore County's Redhouse Run stream restoration project near St. Patrick Road.
Center: Before the Redhouse Run project, severe bank erosion neared structures on residential lots.
Right: After the project, the same stream bank has been regraded and stabilized.
(Map and photos: Baltimore County Department of Environmental Protection and Sustainability.)

Table 10. Upper Back River Watershed - 319(h) Grant Projects Funding Implementation

Projects in Baltimore County (1)	**Grant Year Project # (2)**	**Grant Project Status**	**319(h) Funds (3)**	**Total Cost (4)**	**Estimated Load Reduction (5)**		
					Nitrogen (lb)	Phosphorus (lb)	Sediment (ton)
Redhouse Run/Overlea stormwater NPS control and stream restoration	FFY2000 #16	Closed 2001	$130,000	$530,000	--	9.46	2.67
Redhouse Run at St. Patricks stream restoration	FFY2007 #18	Closed 2011	$418,500.00	$883,016.00	609	32.1	5.37
Upper Back River stormwater NPS control	FFY2008 #21	Preconstruction	$422,373	$700,000	371.5	56.4	10.6
Bread and Cheese Creek stormwater NPS control and stream restoration	FFY2010 #11	Preconstruction	$556,443	$1,000,000	200.5	29.6	6.75

(1) Implementation directly or indirectly supported by the 319(h) Grant. Excludes projects/costs for management oversight, monitoring, etc.
(2) Additional information is available at http://iaspub.epa.gov/pls/grts/f?p=110:199:6181399484544479 Select "Find Projects" and select "Maryland", grant year, project #.
(3) Closed projects = total 319(h) Grant funds expended for project. Other projects = 319(h) Grant allocated. Excludes match.
(4) Closed projects = reported total expenditure. Other projects = projected total cost. Redhouse Run total cost includes all design/construction expenditures.
(5) Closed projects = reported annual pollutant reduction. Other projects = projected future pollutant reduction.

4. Casselman River Watershed 2011 Implementation Status

Location

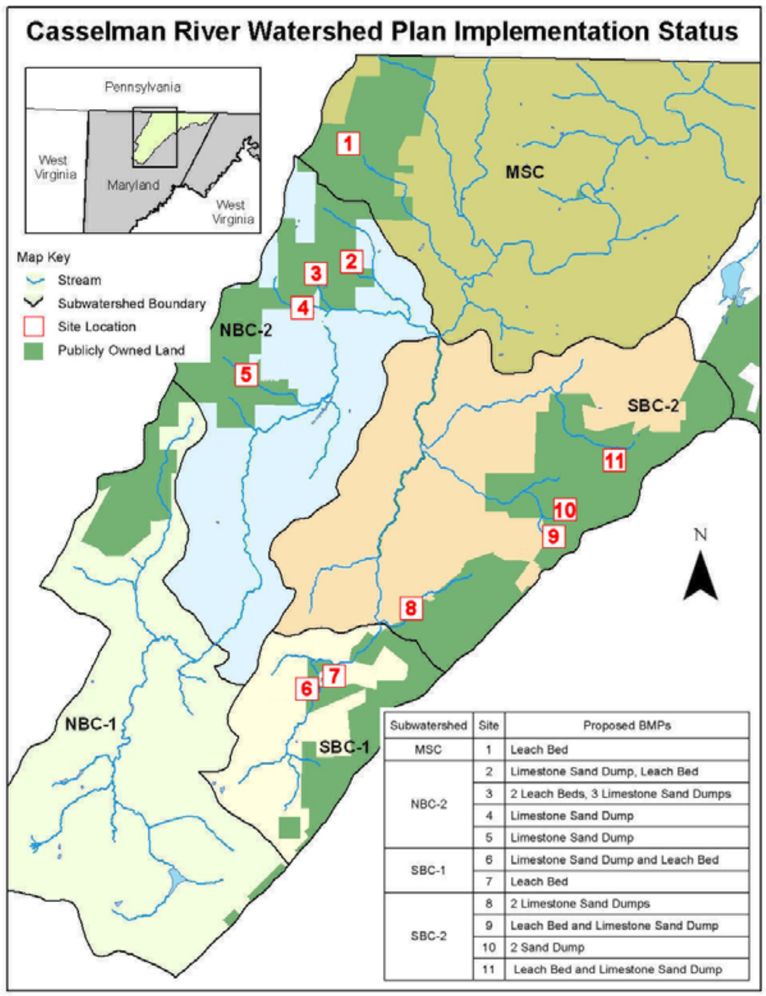
In Maryland, the Casselman River flows about 20 miles from Savage River State Forest into Pennsylvania. The watershed area is 66 square miles and is part of the Mississippi River drainage. Land use in the watershed can be aggregated into three broad categories:
- 89% woodland,
- 9% agriculture,
- 2% developed lands.

Goal

The watershed plan goal is to meet pH water quality standards in the Code of Maryland Regulations (no less than 6.5 pH and no greater than 8.5 pH) by increasing alkalinity (mg $CaCO_3$/l).

Implementation

In 2011, EPA accepted the Casselman River watershed plan and released FFY09 319(h) Grant funds earmarked for plan implementation. Preparations for implementation of Phase 1 projects at sites shown in the map began in 2011 and construction will begin in 2012.

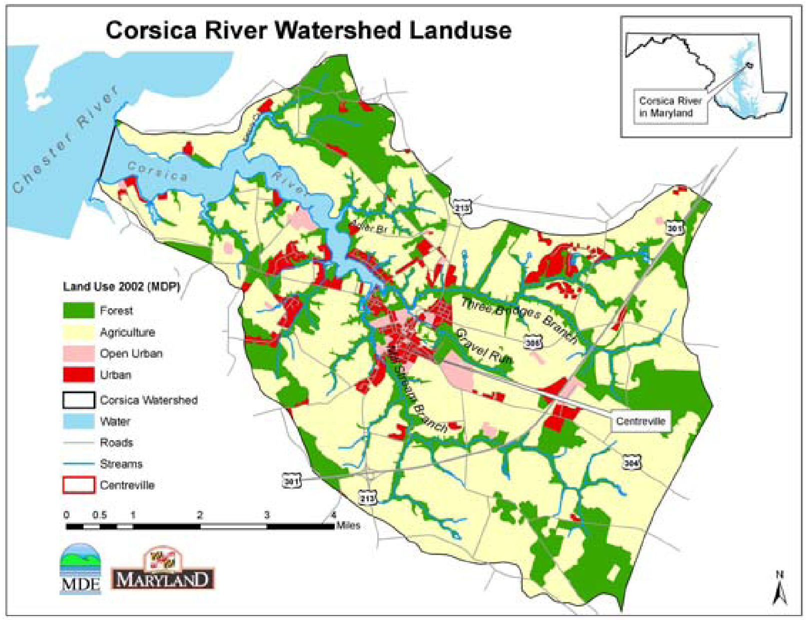


Subwatershed	Site	Proposed BMPs
MSC	1	Leach Bed
NBC-2	2	Limestone Sand Dump, Leach Bed
	3	2 Leach Beds, 3 Limestone Sand Dumps
	4	Limestone Sand Dump
	5	Limestone Sand Dump
SBC-1	6	Limestone Sand Dump and Leach Bed
	7	Leach Bed
SBC-2	8	2 Limestone Sand Dumps
	9	Leach Bed and Limestone Sand Dump
	10	2 Sand Dump
	11	Leach Bed and Limestone Sand Dump

Figure 9. Top: Monitoring conditions in the Casselman River.
Left: Surface preparations for an underground coal mine in the Casselman River watershed.
(Map and Figures by MDE, 2011)

5. Corsica River Watershed 2011 Implementation Status

Location



The Corsica River, which is 6.5 miles in length, is located in the upper eastern shore in Queen Anne's County. The watershed area is 40 square miles and is part of the larger Chester River Watershed (see map). Land use in the watershed can be aggregated into three broad categories:

- 66% agriculture,
- 26% woodland,
- 8% various types of developed lands.

Goal

The nonpoint source annual TMDL load allocation for nitrogen is 268,211lbs and for phosphorus is 19,380 lbs. Corsica River watershed ambient NPS nutrient loads already met the TMDL when it was approved by EPA, so the TMDL serves as a benchmark to prevent degradation (TMDL page 4 and 20). In addition, other goals were established as listed in the following implementation progress tables.

Implementation

Tables and photographs beginning here and continuing on the next pages summarize currently available watershed plan implementation progress.

Figure 10.

Top Right: The living shoreline is being constructed on the shoreline perpendicular to the roadway in Centreville's Wharf Area during May 2011.

Bottom Right: Wharf-living-shoreline-2011August: Newly completed living shoreline with breakwaters shortly after construction in August 2011.

Photos by Eva Kerchner, Watershed Coordinator, Town of Centreville

Table 11. Corsica River Watershed Plan - 2011 Implementation Progress Summary								
Goals			**Progress (3)**					
Category (2)	**Unit**	**Goal**	**Implementation Progress (4)**			**Total Pollutant Reduction Reported 2006-2011**		
			2011 (5)	**2006 thru 2010**	**Percent of Goal Achieved**	**Nitrogen (lbs/yr)**	**Phosphorus (lbs/yr)**	**Sediment (tons/yr)**
Agricultural BMPs	units	---	---	NR	NA	34,590	4,711	716
Cover Crop (6)	acres	6,000	4,808	NA	80%	11,643	34,558	NR
Conservation Cover (ag buffers)	acres	100	---	93.3	93%	2,173	141	NR
Forest Buffers (urban)	acres	200	---	12	6%	28	8	NR
Manure Transfer (6)	tons	27.4	0	NA	0%	0	0	NA
Oyster Bed Restoration	acres	10	---	10	100%	NA	NA	NA
Raingardens/Bioretention	units	50	---	308	616%	150	20	1.5
Septic Tank Upgrades	systems	30	---	14	47%	73.0	NA	NA
Stormwater Retrofits	acres	300	6.1	106.4	37.5%	61.7	5.9	NR
Waste Storage Facilities	units	1	---	1	100%	210.0	42.0	NA
Wetland Restoration	acres	50	---	88.3	177%	NR	NR	NR
					Total Pollutant Reduction	48,929	39,486	718
					Watershed Plan Nutrient Reduction Goal	100,132	6,306	---
					Percent of Goal Achieved	48.9%	626.2%	---

1. 2011 = Calendar year. NA = not applicable. NR = not reported. BMP = best management practice.

2. Categories for watershed plan goals tracked by EPA for progress.

3. Data is provided by the Town of Centreville in cooperation with the Corsica Implementers Group.

4. All 319(h) Grant-funded implementation is reported.

5. In most cases, data for calendar year 2011 is shown in aggregate with previous years and was not available separately.

6. Accomplishments for cover crops and manure transfer are considered annual practices. Therefore, reporting in this table is limited to the most recent calendar year. Significant accomplishments 2006 thru 2010 are reported, see footnote 3.

The Town of Centreville also reported the following 2011 accomplishments:

- 275 linear feet of living shoreline was completed on the Corsica River as part of a larger project called the Wharf Area. The living shoreline is protected by breakwaters to limit erosion. The 319(h) Grant funded project management. All other costs were funded by the Maryland Waterway Improvement Program, the Maryland Chesapeake Bay Trust and Federal NOAA funding. (photos on previous page)
- A stream buffer was improved at a local cemetery in Spring 2011 by planting 255 shrubs/trees and 900 young trees called “whips”. Maryland’s Natural Filters program funded the project.
- 160 rain barrels were sold at a reduced cost of $10 to residents during 2011. Purchase of the rain barrels was funded by Maryland’s Chesapeake and Atlantic Coastal Bays Trust Fund. The 319(h) Grant funded project management and outreach.

Table 12. Corsica River Watershed - 319(h) Grant Projects Funding Implementation

Project Description (1)	Grant Year Project # (2)	Grant Project Status	319(h) Funds (3)	Total Cost (4)	Estimated Load Reduction (5)		
					Nitrogen (lb)	Phosphorus (lb)	Sediment (ton)
Centreville Corsica Watershed Restoration Project	FFY2005 #2	Completed	232,666.15	387,776.92	0	0	NR
	FFY2006 #3	Completed	241,974.82	403,291.37	62	6	NR
	FFY2009 #1	In Progress	300,504	500,840	NR	NR	NR
MDA / Queen Anne's Soil Conservation District Agricultural Technical Assistance Project	FFY2005 #12	Completed	145,554.24	242,590.40	767	79	463
	FFY2006 #9	Completed	14,272.71	23,787.85	NR	NR	NR
	FFY2007 #6	Completed	22,187.16	36,978.60	286	10	755
	FFY2008 #7	Completed	50,780.00	84,633.00	46	3	62
	FFY2009 #4	Completed	58,539.00	97,565.00	19,740	6,664	33
	FFY2010 #10	Completed	61,590.00	102,650.00	53,259	802	NR
	FFY2011 #10	In Progress	69,546	115,910	NR	NR	NR
Queen Anne's County Corsica and Beyond Project	FFY2006 #13	Completed	124,281.44	207,135.73	NR	NR	NR
Queen Anne's County Bio-Retention Swale Project	FFY2008 #19	In Progress	50,000	pending	0.22	0.35	0.74

(1) Implementation directly or indirectly supported by the 319(h) Grant. Excludes 319(h) Grant projects that do not include implementation.
(2) Additional information is available at http://iaspub.epa.gov/pls/grts/f?p=110:199:618139948454479 Select "Find Projects" and select "Maryland", grant year, project #.
(3) Closed projects = total 319(h) Grant funds expended for project. Other projects = 319(h) Grant allocated. Excludes match.
(4) Closed projects = total expenditure Federal Grant + nonfederal match unless noted otherwise. Other projects = projected total cost.
(5) NR = not reported. Closed projects = reported annual pollutant reduction rounded to nearest pound/ton. Other projects = projected future pollutant reduction.

Figure 11.
Right: Monitoring Gravel Run.
Middle Right: 30 students in Centreville's Kennard Elementary School volunteered in the 2011 hands-on education program to create these rain barrels.
Far Right: Volunteers planting shoreline grasses.
Photos by Corsica Implementers and Eva Kerchner, Watershed Coordinator, Town of Centreville.

6. Lower Jones Falls 2011 Implementation Status

Location

The Lower Jones Falls watershed encompasses 16,550 acres (25.9 mi^2) that drains portions of Baltimore County (30.09%) and Baltimore City (69.91%). About 54 miles of streams in the watershed flow into the tidal Patapsco River and then the Chesapeake Bay. Land use in the watershed is 55.9% residential (11.1% low density, 23.7% mid density and 21.1% high density). Various developed land uses cover 21.7% of the watershed (6.9% commercial, 2.4% industrial, 10.5% institutional and 1.9% highway). Open land uses account for the remaining 22.2% of the watershed area (6.1% open urban, 13.6% forest, 1.3% agriculture, 0.6% bare ground, 0.6% extractive and 0.3% water). Overall impervious cover is 31.8%.

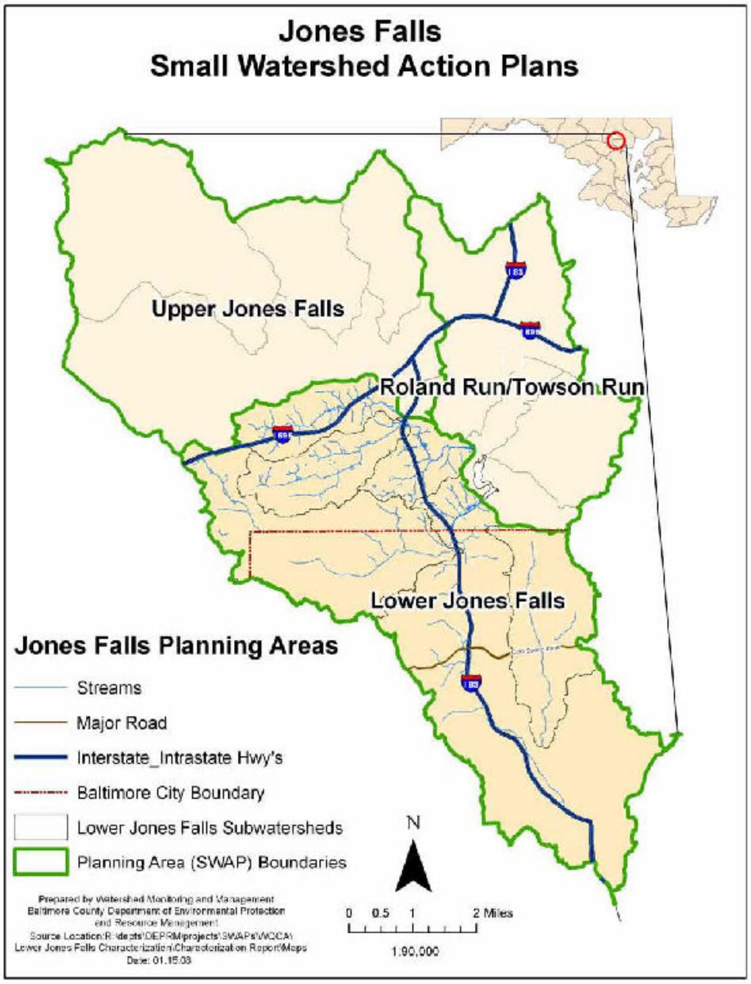


Figure 12. Map of Jones Falls

Goals

The Lower Jones Falls Watershed Small Watershed Action Plan (Plan) was developed by Baltimore County in 2008 (CWA 104(b) funding) in conjunction with Baltimore City and the Jones Falls Watershed Association. (Go to http://www.baltimorecountymd.gov/Agencies/environment/watersheds/ep_jonesmain.html) The Plan was accepted by EPA in 2009. The 2008 Plan calls for the nutrient load reductions shown in the following table (including sanitary sewer overflow abatement).

Baltimore County anticipates that the watershed goals will be updated due to recent changes in the Chesapeake Bay Watershed Model and issuance of the Chesapeake Bay TMDL.

Implementation in the Lower Jones Falls Watershed

Currently, all active implementation projects in the Jones Falls watershed do not involve the 319(h) Grant. Implementation progress reported by Baltimore County for the 2009-2011 time period is shown in the following table.

In Baltimore City, several implementation projects are in progress or planned. Lower Stoney Run stream restoration project will stabilize several thousand feet of stream using natural channel design techniques (design: $0.2 million, construction: $1 million, construction completion anticipated 2011). The Western Run Stream restoration (ER4014 Project 1) will stabilize 2,100 feet of stream (design: $235,776, construction $600,000, potential 2010-2011 start). The East Stoney Run Phases I and II will stabilize stream using natural channel design techniques (design: $0.4 million, construction: $4 million, potential construction start 2010-2011).

Table 13. Lower Jones Falls Watershed Plan - 2011 Implementation Progress Summary

Goals			Progress (3)					
			Implementation (4)			Total Pollutant Reduction Reported		
Category (2)	Unit	Goal	2011	2008 - 2010	Percent of Goal	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Sediment (tons/yr)
Reforestation - Forest Land Mgmt	acres	2	0.9	NA	45.0%	NR	NR	NR
Buffer Reforestation, Forest Stand Mgmt	acres	NA	0.7	0	NA	NR	NR	NR
Nutrient Management	acres	2,210	NR	NR	NA	NR	NR	NR
Downspout Disconnect, Roof Runoff Mgmt	acres	250	0.2	0.03	0.1%	NR	NR	NR
Stream Channel Restoration (5)	feet	20,000	NR	NR	NA	NR	NR	NR
Street Trees, Tree/Shrub Establishment	units	1,000	NR	NR	NA	NR	NR	NR
Stormwater Retrofits, Urban SWM Wetlands	acres	100.0	NR	NR	NA	NR	NR	NR
Stormwater Conversion, Urban Wet Pond	units	NA	NR	NR	NA	NR	NR	NR
					Total Pollutant Reduction	0	0	0
					Watershed Plan Nutrient Reduction Goal	111,160	14,357	---
					Percent of Goal Achieved	0%	0%	---

1. 2011 = Calendar year. NA = not applicable. NR = not reported. BMP = best management practice.
2. Categories for watershed plan goals tracked by EPA for progress. All 319(h) Grant-funded implementation is reported.
3. Data is reported by Baltimore County, which includes results of nongovernmental organization activities.
4. All 319(h) Grant-funded implementation is reported.

7. Lower Monocacy River

Location

The Lower Monocacy River watershed encompasses 194,700 acres (304 mi^2) that drains portions of Frederick County (87%), Montgomery County (10%) and Carroll County (3%). The mainstem of the Monocacy River is 58 miles long. About 304 square miles of watershed drain into the tidal Potomac River and then the Chesapeake Bay. Overall impervious cover is 4% but it is concentrated in two subwatersheds: Carroll Creek (18.6%) and Ballenger Creek (13.4%). Land use in the watershed is:

- 47% Agricultural
- 30% Forest
- 22% Developed land uses

Goals and Implementation

The Lower Monocacy River Watershed Restoration Action Plan was developed by Frederick County in 2004 to address the 168,960 acres (264 mi^2) that drain Frederick County. In 2008, the County used local funds to revise the Plan and EPA accepted the revision. The Plan's 25-year goals and implementation progress are presented in the following tables.

Figure 13. The photographs show two projects that were executed and completed during 2011 using the 319(h) Grant.
Left: Excavation of a wetland project installed at the Worthington Manor Golf Course in July 2011.
Below: Students and community volunteers work together to plant native trees, shrubs and grasses as part of the Urbana Elementary School's bioswale project.

(The map and photos were provided by Frederick County Community Development Division Watershed Management Section.)

Table 14. Lower Monocacy River Watershed Plan Implementation Progress Summary								
Lower Monocacy Goals				Lower Monocacy Implementation Progress				
Parameter		Unit	Units Needed	2011	Previous Years		Total Thru 2011	Goal % Achieved
					2008-2010	Pre- 2008		
Nitrogen	Agriculture	Pounds	582,949	NR	NR	NR	NR	NR
	Urban	Pounds	67,049	532.6	1,003.0	571.0	2,106.6	3.14%
Phosphorus	Agriculture	Pounds	57,337	NR	NR	NR	NR	NR
	Urban	Pounds	11,615	46.6	76.2	33.4	156.2	1.34%
Sediment	Agriculture	Pounds	18,342,280	NR	NR	NR	NR	NR
	Urban	Pounds	2,348,084	9,225.6	23,225.0	13,149.7	45,600.4	1.94%
Lake Linganore Goals				Lake Linganore Implementation Progress				
Phosphorus	Agricultural	Pounds	601,489.60	NR	NR	NR	NR	NR
	Urban	Pounds	92,106.30	2.1	20.2	25.6	47.9	0.05%
	Forest	Pounds	4,186.70	NR	NR	NR	NR	NR
Sediment	Agricultural	Tons	38,401	NR	NR	NR	NR	NR
	Urban	Tons	3,615	0.4	4.5	4.6	9.6	0.26%
	Forest	Tons	1,033	NR	NR	NR	NR	NR

1. 2011 = Calendar year. NA = not applicable. NR = not reported. 2. All 319(h) Grant-funded implementation is reported.
3. Implementation accomplished with "other" funding sources may not be fully tracked or reported.
4. Lake Linganore drainage is a subwatershed with a TMDL that is within the larger Lower Monocacy River watershed.

Table 15. Lower Monocacy River Watershed - 319(h) Grant Projects Funding Implementation							
Frederick County Project Description (1)	Grant Year Project # (2)	Grant Project Status	319(h) Funds (3)	Total Cost (4)	Estimated Load Reduction (5)		
					Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
Lower Monocacy Watershed Restoration	FFY05 #17	Closed	$216,237.00	$360,395.00	615.9	43.9	8.2
Urban Wetlands Program, Bennett Creek Pilot	FFY07 #4	Closed	$196,732.92	$327,888.00	101.3	18.5	1.6
Bennett Creek Urban BMP Demonstration	FFY08 #4	In Progress	$234,545	$390,900	194.5	45.1	4.4
Lower Monocacy Green Infrastructure	FFY10 #9	In Progress	$318,396	$530,660	247	25.9	4.9

(1) Implementation directly or indirectly supported by the 319(h) Grant. Excludes projects/costs for management oversight, monitoring, etc.
(2) Additional information at http://iaspub.epa.gov/pls/grts/f?p=110:199:6181399484544479 Select “Find Projects”.
(3) Closed projects = total 319(h) Grant funds expended for project. Other projects = total 319(h) Grant to project excluding match.
(4) Closed projects = reported total expenditure. Other projects = projected total cost, including project activities in addition to implementation.
(5) Closed projects = reported annual pollutant reduction. Other projects = projected future pollutant reduction in the project scope of work.

8. Sassafras River Watershed

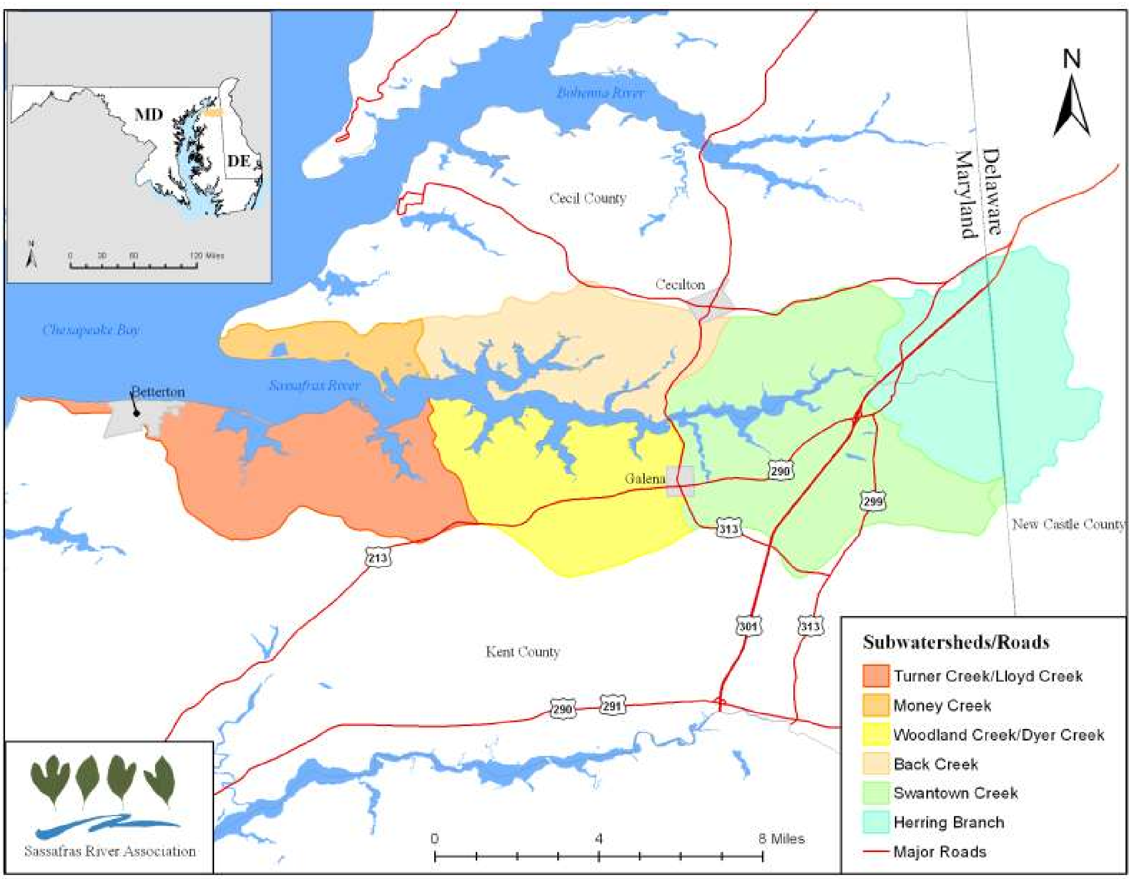
Location

The Sassafras River watershed encompasses 62,000 acres (96.9 mi^2) that drains portions of three counties in two States Kent County, MD (57%), Cecil County, MD (28%) and New Castle County, DE (8%) with 13% of the watershed being surface water. The 20.6 mile-long Sassafras River mainstem flows into the Chesapeake Bay. Impervious area covers 2.2% of the watershed. Land use in the watershed is: 57% agricultural; 24% forest; 4% developed; 14% water, and; 1% wetland.

Goal

The Sassafras River Watershed Action Plan (SWAP) was developed by the Sassafras River Association (SRA), a private nonprofit organization, in 2009. The Plan lists numerous goals to be achieved within 10 years.

Figure 14. The Sassafras River Watershed's Six Subwatershed Areas. (source: Sassafras Water Action Plan. Sassafras River Association in partnership with the Center for Watershed Projection. 2009. Page 3.)



Implementation in the Sassafras River Watershed

Most of the goals outlined in the Sassafras SWAP require significant preparatory work before implementation. In the past two years since EPA accepted the watershed plan, SRA has laid much of this ground work, which cannot be captured in load reduction totals. The Sassafras Summary table below lists Plan goals that have a measureable environmental outcome relating to nonpoint source management. Additionally, the SRA reports for 2011:

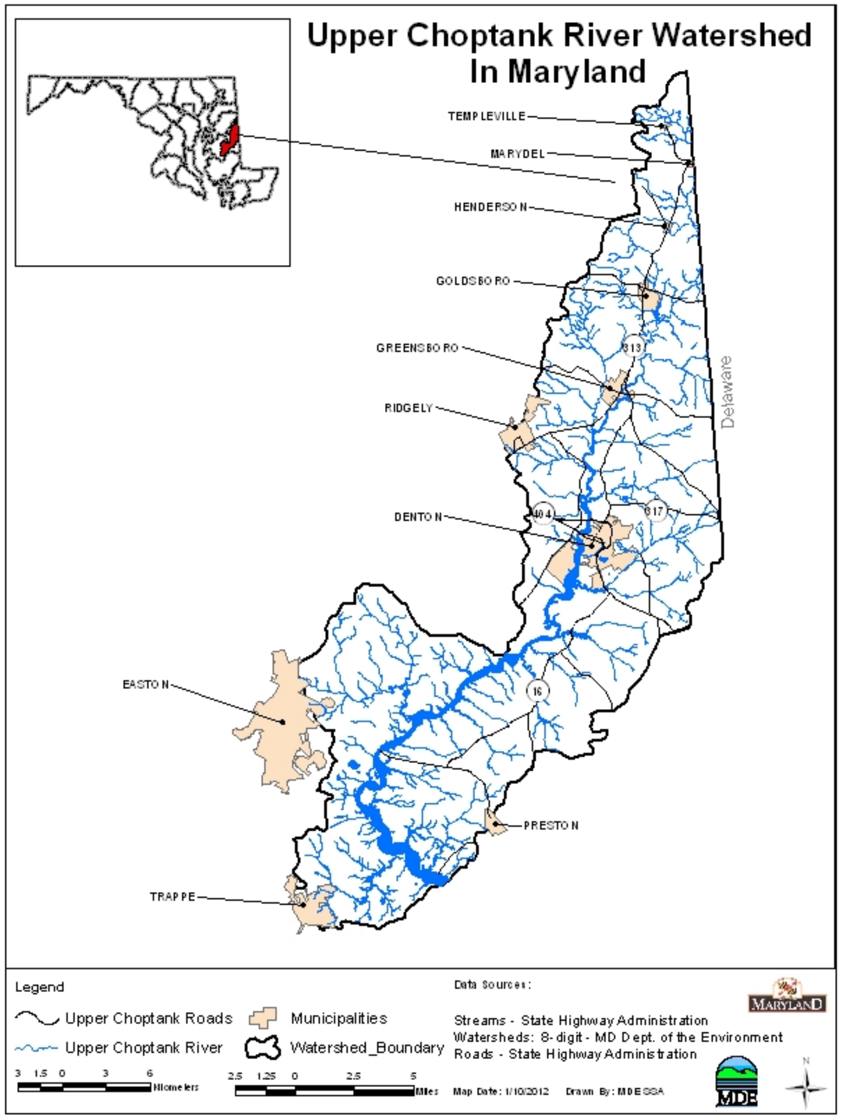
- Signed up 2,046 new acres of cover crops in the SRA cover crop bonus program in the Sassafras watershed, based on a rolling two year average of total acres enrolled.
- Held 6 community workshops focusing on building rain barrels, green landscaping and soil testing, and septic testing and BNR.
- Built approximately 45 rain barrels and conducted 46 soil tests in priority neighborhoods
- Conducted water testing, geotechnical analysis, survey work, and design for two major treatment wetlands downstream from CAFOs that will be fully constructed in 2012.
- Conducted survey and design for a 1600 linear ft regenerative stormwater project to repair severely eroding woodland gully
- Ordered prototype poultry manure injection unit for use in the Sassafras watershed in 2012, and laid ground work for conducting test plots with assistance from University of MD to determine effectiveness of the practice.
- Conducted about 25 tests on private septic systems in the critical area to determine condition and eligibility for upgrade.

Table 16. Sassafras River Watershed - 2011 Implementation Progress Summary

Goals			Progress					
			Implementation Progress (2)			Total Pollutant Reduction 2009-2011		
Goal Number and Name	Unit	Units Needed	2011	Previous Years (2009-10)	Percent of Goal Achieved	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Sediment (tons/yr)
#1 Road retrofit, stream restored	project	3	0	0	0%	NR	NR	NR
#2 Stormwater retrofits	project	4	NR	1	25%	NR	NR	NR
#5 Septic system upgrades	project	150	NR	NR	0%	NR	NR	NR
#12 Stabilize eroding ravines	miles	1	0	0	0%	NR	NR	NR
#13 Stabilize eroding shoreline	miles	0.5	0	0	0%	NR	NR	NR
#14 Increase buffers (stream/shore)	miles	3	0	0	0%	NR	NR	NR
#17 Agricultural cover crops	acres/yr	5,000	NR	NR	0%	NR	NR	NR
#21 Wetland creation	projects	5	NR	1	20%	NR	NR	NR
#22 Agricultural BMPs	acres	500	NR	NR	0%	NR	NR	NR

1. 2011 = Calendar year. NA = not applicable. NR = not reported.
2. No 319(h) Grant funds have been directed to this watershed. Implementation using other funding sources may not be fully tracked or reported.
3. Implementation progress reported was tracked and reported by the Sassafras River Association.

9. Upper Choptank River



Location

The Upper Choptank River watershed encompasses 163,458 acres (255 mi^2) and drains portions of three Maryland counties (Caroline, Talbot and Queen Anne's Counties) as well as a portion of Delaware. The 20.6 mile-long Sassafras River mainstem flows into the Chesapeake Bay. Impervious area covers 2.2% of the watershed. Land use in the watershed is: 58% agricultural; 31% forest; 8% developed and; 3% water.

Goal

In the Upper Choptank River watershed plan, which was developed by Caroline County in 2010, the goal with a measureable water quality result is to reduce nonpoint source nutrient loads:

- Total nonpoint source nitrogen reduction: 704,000 pounds/year
- Total nonpoint source phosphorus reduction: 34,500 pounds/year

Implementation

Reporting of implementation to meet watershed plan goals since plan completion in 2010 includes two 319(h) Grant-funded projects as summarized on the next page.

Figure 15.
Left: Cover crops like that shown in this agricultural field are an important annual best management practice to implement as part of meeting nutrient reduction objectives in the Upper Choptank River watershed plan.

Table 17. Upper Choptank River Watershed Plan Implementation Progress Summary									
Categories (3)	**2011 Implementation**					**Previous Implementation 2010 (4)**			
	Units	**Count**	**Nitrogen (lb)**	**Phosphorus (lb)**	**Sediment (ton)**	**Projects**	**Nitrogen (lb)**	**Phosphorus (lb)**	**Sediment (ton)**
Agricultural Cover Crops	acres	NR	NR	NR	NR	NA	NA	NA	NA
Agricultural BMPs (all others)	# of BMPs	NR	NR	NR	NR	NR	23,456	2,498	NR
Urban BMPs (all)	# of BMPs	NR	NR	NR	NR	30	675	185	19
TOTAL Pollutant Reduction			0	0	0		24130.6	2683.2	19
				Watershed Plan Goal			704,000	34,500	
				Overall Total Pollutant Reduction			24,131	2,683	19
				Percent of Goal Achieved			3.4	7.8	

1. 2011 = Calendar year. NA = not applicable. NR = not reported. BMP = best management practice. 2. All 319(h) Grant-funded implementation is reported.

3. The Upper Choptank watershed plan has numberous BMP goals that are aggregated into the broad categories listed in this table. Implementation that does not involve 319(h) Grant funds may not be fully tracked or reported.

4. Previous implementation data was provided by Caroline County. The agricultural BMP data supersedes that reported in the 2010 Annual Report. The urban BMP data reported for previous implementation was not available at the time of the 2010 Annual Report.

Table 18. Upper Choptank River Watershed - 319(h) Grant Projects Funding Implementation							
Baltimore County Project Description (1)	**Grant Year Project # (2)**	**Grant Project Status**	**319(h) Funds (3)**	**Total Cost (4)**	**Estimated Load Reduction (5)**		
					Nitrogen (lb)	Phosphorus (lb)	Sediment (ton)
Caroline County DPW Stormwater Retrofit	FFY2010 #7	Construction	46,440	77,400	NR	NR	NR

(1) Implementation directly or indirectly supported by the 319(h) Grant. Excludes projects/costs for management oversight, monitoring, etc. Project prior to July 2009 are not presented.
(2) Additional information is available at http://iaspub.epa.gov/pls/grts/f?p=110:199:6181399484544479 Select “Find Projects” and select “Maryland”, grant year, project #.
(3) Closed projects = total 319(h) Grant funds expended for project. Other projects = 319(h) Grant allocated. Excludes match.
(4) Closed projects = reported total expenditure. Other projects = projected total cost.
(5) Closed projects = reported annual pollutant reduction. Other projects = projected future pollutant reduction.

V. Areas of Concern/Recommendations/Future Actions

Key challenges addressed by the NPS Program in collaboration with other state efforts include:

Urban/Suburban Nonpoint Source Pollution is increasing: Maryland has seen tremendous population growth over the last several decades and the trend is projected to continue. An accompanying trend is a decrease in the number of people per household. These trends contribute to increasing development acreage, increasing impervious area as a percentage of the landscape and a tendency for increasing urban stormwater runoff and the nonpoint source pollutant loads associated with it. The State has had two long-standing programs in place to control pollution generated from the development of land. The Maryland Department of the Environment (MDE) is responsible for administering these two programs that are erosion and sediment control and stormwater management. For over 40 years, Maryland's erosion and sediment control program has required that specific vegetated techniques and structural practices be implemented and plans be designed, reviewed, and approved to control runoff from construction sites. This statewide program has undergone numerous changes and improvements over the last four decades, the last of which occurred recently.

In January 2012, MDE completed a comprehensive two year process of modifying the regulations governing erosion and sediment control. This effort culminated in the adoption of the "2011 Standards and Specifications for Soil Erosion and Sediment Control" (Standards). These Standards improved the design of practices found in previous versions of the document (last edition dated 1994) and was based on current technology and experience and exhaustive public input from various development related communities. Accompanying the Standards were changes to the Code of Maryland Regulations (COMAR 26.17.01) that further improved construction site runoff management. Major improvements included limiting the amount of earth allowed to be disturbed for any project to 20 acres, and decreasing the time that soil is allowed to remain bare. Stabilization is now required to be applied within 3 days to site perimeters and controls and 7 days to inactive areas (previously 7 and 14 days, respectively).

The State's stormwater management program has also undergone numerous changes since it was first implemented in 1982. Recently however, MDE overhauled the way new development runoff is controlled by requiring the use of environmental site design (ESD). This represented a significant sea change in how stormwater management is to be designed. Prior to the passage of the Stormwater Act of 2007 (Act), Maryland allowed large, structural practices to be used to manage runoff from new and redevelopment projects. The Act mandated that MDE alter this approach in order to use ESD to better mimic natural hydrology.

Code Of Maryland Regulations (COMAR 26.17.02) modifications adopted in May 2009 now require better site planning, nonstructural techniques, and small-scale structures to be used to replicate the runoff characteristics of "woods in good condition" and reach a standard of maximum extent practicable (MEP). MEP is to be reached using alternative surfaces, green roofs, rainwater harvesting, rain gardens, micro-bioretention, and landscape infiltration. MDE revised Chapter 5 of the 2000 Maryland Stormwater Design Manual, provided guidance and ESD examples, and reviewed and approved all county and municipal stormwater management ordinances all in an effort to improve Maryland's program. Local implementation for private development and MDE implementation for State and federal construction projects has been ongoing since May 2010.

Additional information related to urban/suburban nonpoint source pollutant control:
http://mde.maryland.gov/programs/Water/StormwaterManagementProgram/SedimentandStormwaterHome/Pages/Programs/WaterPrograms/SedimentandStormwater/home/index.aspx

Another ongoing effort to improve NPS management in Maryland is State Agency input and assistance to local governments regarding their Comprehensive Plans, which are used by Counties to establish long term direction for their decisions regarding use of land, resources, etc. During 2009-2010 when local governments were working to integrate Water Resource Elements (WRE) into their Comprehensive Plans, MDE assisted by: 1) developing NPS analysis tools for use by local governments, 2) providing direct staff assistance in using these tools and in meeting NPS program objectives, and 3) reviewing and commenting on the local government's drafts. Now in continuing these efforts, MDE receives proposed changes to local Comprehensive Plans through the State's Clearing House Review process and offers recommendations and assistance designed to promote effective NPS management by local government.

Resource Constraints/Measurable Environmental Results: As federal and state budgets grow tighter, there is a push for all programs to demonstrate their effectiveness at producing results. The national Nonpoint Source Program is under pressure to demonstrate program effectiveness through measurable environmental results. Over the past two decades, the Maryland NPS Program has focused on a *targeted watershed* approach to help target resources in a way that would generate measurable results. Although the logic is compelling, findings of a retrospective assessment of results for the past two decades are not as compelling. Maryland's NPS Program, in coordination with EPA Region III, will evaluate the findings in a manner that has the greatest potential to generate measurable results. In coordination with EPA Region III, the NPS Program will selectively target program resources consistent with the following priorities:

Protection of high quality (Tier II) waters: The 319 Program is supporting implementation of Maryland's anti-degradation regulations by funding biological monitoring. This is being targeted to Tier II waters in which there are proposed development activities. This monitoring supports MDE decision-making and provides data to evaluate the effectiveness of the anti-degradation policies and support future policy refinements.

Biological Restoration Initiative: Maryland uses biological data from streams as one gauge of potential degraded conditions. If the percentage of degraded streams in a watershed exceeds a certain threshold, Maryland formally identifies that watershed on the State's list of impaired waters. Because watersheds that are just below the threshold of impairment may have a higher potential for restoration than those that are significantly more degraded, resources from the 319(h) NPS Program are being directed to these marginally impaired watersheds in an effort to remove them from the State's impaired waters list. The 319(h) Grant funding for this Biological Restoration Initiative (BRI) was coordinated in 2010 with the State's Chesapeake and Coastal Bays Trust Fund (Trust Fund) grant program trough the Trust Fund's targeting scheme. Coordination between Federal 319(h) Grant and the State Trust Fund will continue in 2012. It is anticipated that this coordination will assist in providing leveraging opportunities for funding in the future.

Reducing nutrient and sediment pollution to the Chesapeake Bay: Nutrient and sediment pollution are the main causes of impairment of our tidal waters. These pollutants have been the focus of EPA's development of TMDLs for the Chesapeake Bay. The 319 Program provided resources to support the development of Maryland's Phase I and Phase II Watershed Implementation Plans (WIP). In addition to this Chesapeake Bay restoration planning, the 319 Program is coordinating implementation grant proposals through Maryland's Trust Fund, which targets resources to areas with the greatest nutrient loading to the Bay and to the BRI target areas discussed above. As attention turns from WIP planning to tracking, reporting and validation of implementation the 319 Program will continue to play a vital role in refining and implementing these systems in coordination with the Chesapeake Bay Regulatory and Accountability Program (CBRAP) grant.

Improvement of Impaired Waters: Maryland has a two-track system for targeting resources to improving impaired waters. Both priority tracks are designed to address EPA's Strategic goals of improving living resources and showing observable water quality improvement. They also increase the likelihood of generating success stories discussed below.

One track is to identify waters with high recovery potential for removal from Maryland's 303(d) list. These waters tend to be impaired just slightly beyond the threshold of water quality standards or are conducive to restoration in other ways, e.g., the State has significant control over the sources of impairment. During 2009, MDE assessed the list of waters with biological impairment and ranked them to identify watersheds that have the highest potential for removal from Maryland's 303(d) list. Beginning in 2010, MDE integrated these priorities into the 319(h) grant selection criteria and into the State's criteria for dispersing Trust Fund grant. 319 grant funds were subsequently directed to field assessments of the causes of stream degradation and opportunities for remediation for several highly ranked waters.

Another example of this first track of priority attention is the continued 319 Program funding of acid mine drainage (AMD) restoration projects in Western Maryland. Because theses projects can be engineered to control sources of acidity, they have a high potential for meeting pH water quality criteria thereby resulting in their removal from Maryland's 303(d) list.

One challenge with this track is that soliciting implementation partners and directing funding to these types of projects must compete with the high-profile Chesapeake Bay restoration initiative. The 319 Program will make a concerted effort to balance resources in view of the dominant interest in Bay restoration.

The second track is to show incremental improvement in water quality short of removal from the 303(d) list. The waters prioritized for this objective tend to be intensely degraded with apparent low-cost opportunities for remediation. Due to the intense level of degradation, improvements tend to be more readily observable than cases of less degradation. A classic example of this is the situation of over grazing in or near streams, which cause multiple impacts including elevated bacteria, nutrients and sediments as well as physical stream degradation. Targeting these cases presents the opportunity to address multiple kinds of impairment with the same restoration actions. The 319 Program's pioneering use of the synoptic survey monitoring technique, which collects numerous samples within a watershed, provides information at a fairly high resolution for use in both targeting and evaluation of progress in the future.

Documenting Success Stories: Maryland is committed to documenting NPS management & implementation success stories. A challenge in doing this is that site-specific environmental monitoring of NPS best management practice implementation documenting before/after change in terms of in water quality or in-stream biology improvement requires significant effort and investment. This investment is frequently not part of the BMP project itself. Commonly, generating sufficient monitoring documentation requires years of data collection in a local watershed where the environmental improvements produced by the BMPs are not obscured by weather variability and other sources of impairment. Additionally, long term monitoring before and after installation of BMPs has sometimes shown that environmental improvements in receiving streams may take years to appear due to environmental conditions like travel time through groundwater and effects of historic pollutant storage that can linger long after BMPs are installed. Consequently, it is difficult: 1) to identify partners who had initiated their success story monitoring years prior to BMP implementation, 2) to find adequate monitoring data/analysis to verify results, and 3) to assemble documentation that can survive critical technical review. The *Sligo Creek Success Story*, *Stream Restoration Reduces Peak Flow and Brings Back the Fish* presented in Appendix E met these challenges and was submitted to EPA in 2011.

To help meet these challenges in the future, MDE continues to seek out partners who volunteer to help generate success story documentation. Additionally, MDE is focusing a percentage of 319(h) Grant funded monitoring on generating monitoring data in watersheds with targeted NPS BMP implementation so that documentation for potential success stories can be developed.

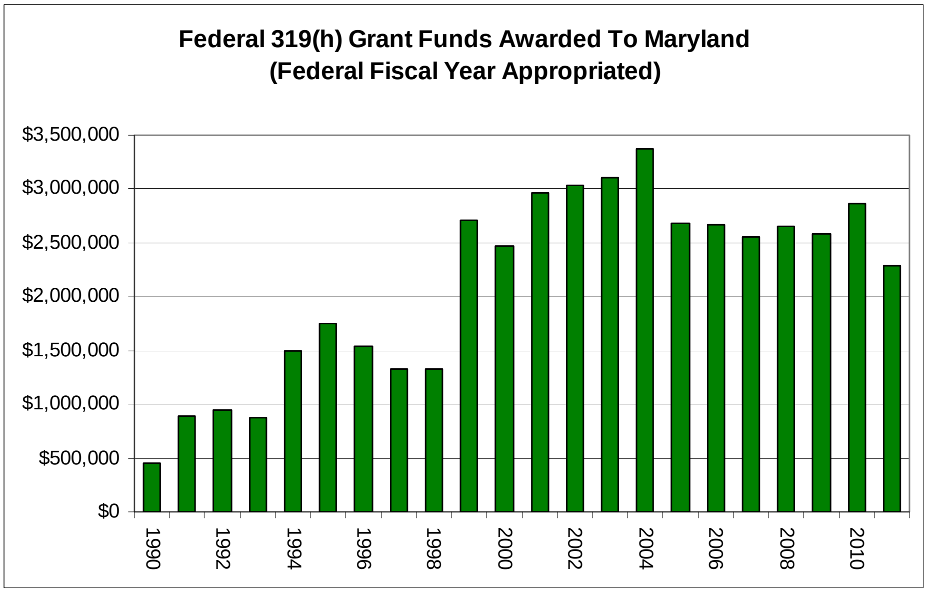
Appendix A – Financial Information

Contents

- Federal 319(h) Grant Funds Awarded To Maryland
  - Overview
  - Award Amounts
- Nonpoint Source Expenditures Reported (Maintenance of Effort Reporting)
  - Overview

Overview of Federal 319(h) Grant Funds Awarded to Maryland

Grant funding from the Federal Clean Water Act Section 319(h) was first awarded to the State of Maryland in 1990. The adjacent chart shows the relative grant award for each award beginning in 1990. The table on the next page lists the award amount and the amount of nonfederal match for each award.



The year shown for each grant award is the Federal Fiscal Year (FFY) that the federal funds were appropriated. Upon award, each grant has a maximum life of five years.

As the chart shows, grant award received by Maryland from the FFY 2011 appropriation was the smallest since FFY1998 (not adjusted for inflation). This smaller award is a result of a reduction in the national 319(h) Grant appropriation, which similarly affected all States. The allocation to Maryland is based on a national formula for distribution of 319 (h) Grant funds among the States, which has remained unchanged since the early 1990s.

Appendix A – Financial Information

Award Amounts for Federal 319(h) Grant Funds Awarded To Maryland

Since 1990, about $46.5 million in Federal 319(h) Grant funds have been awarded to Maryland as shown in the table below.

Federal 319(h) Grant Funds Awarded To Maryland
By Federal Fiscal Year Appropriated

FFY (1)	319(h) Grant Funds (2)	Non-Federal Match (3)	Total Grant + Match
1990	$447,771	$298,514	$746,285
1991	$890,039	$593,359	$1,483,398
1992	$939,298	$626,199	$1,565,497
1993	$877,070	$584,713	$1,461,783
1994	$1,494,413	$996,275	$2,490,688
1995	$1,755,964	$1,170,643	$2,926,607
1996	$1,541,980	$1,027,987	$2,569,967
1997	$1,327,699	$885,133	$2,212,832
1998	$1,327,699	$885,133	$2,212,832
1999	$2,708,298	$1,805,532	$4,513,830
2000	$2,467,576	$1,645,051	$4,112,627
2001	$2,958,486	$1,972,324	$4,930,810
2002	$3,035,576	$2,023,717	$5,059,293
2003	$3,104,500	$2,069,667	$5,174,167
2004	$3,369,190	$2,246,127	$5,615,317
2005	$2,675,598	$1,783,732	$4,459,330
2006	$2,666,655	$1,777,770	$4,444,425
2007	$2,551,736	$1,701,157	$4,252,893
2008	$2,653,500	$1,769,000	$4,422,500
2009	$2,575,782	$1,717,188	$4,292,970
2010	$2,860,785	$1,907,190	$4,767,975
2011	$2,283,639	$1,522,426	$3,806,065
Total	$46,513,254	$31,008,836	$77,522,090

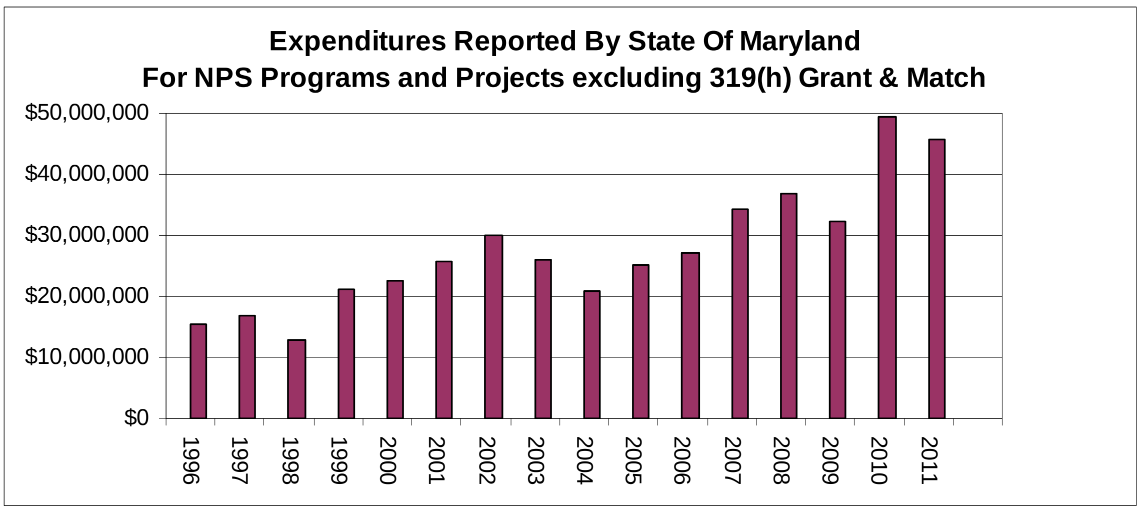
1) Federal Fiscal Year is the year of appropriation. Shaded years are closed grants. Other years shown are active grants.
2) Federal grant amount awarded to Maryland by Federal Fiscal Year.
3) Matching funds required for each grant award (40%) from nonfederal sources.

Appendix A – Financial Information

Overview Of Nonpoint Source Expenditures Reported

When Federal Clean Water Act Section 319(h) was enacted in the 1987 Amendments to the Act, Congress included provisions that the 319(h) Grants to the States would not be used to replace State expenditures that already were occurring. The requirement that the States continue their previously existing level of investment in nonpoint source programs and projects is referred to as Maintenance Of Effort (MOE). As a prerequisite for receiving the next 319(h) Grant award, each State is required to document that their nonfederal expenditures for nonpoint programs and projects in the prior year, excluding the match required for the previous 319(h) Grant, were at least as much as the dollar amount for their MOE.

Maryland's MOE is $8,447,270. The chart below shows that Maryland has reported nonfederal expenditures for nonpoint programs and projects, excluding federal funds and match for the 319(h) Grant, has always been more than $10 million for each year reported.



The expenditures reported by Maryland to EPA to meet MOE requirements as summarized in the chart is the cumulative dollar amount of expenditures reported by three State agencies for a single State fiscal year (July 1 through June 30):

- Maryland Department of Agriculture;
- Maryland Department of the Environment, and;
- Maryland Department of Natural Resources.

Expenditures for nonpoint programs and projects by other State agencies, local governments, private organizations or other entities has not been included in Maryland's MOE reporting to EPA. Therefore, it is likely that the total annual expenditure for nonpoint source programs and projects in Maryland is significantly greater than the dollar amount reported to meet MOE requirements.

Appendix B
List of Agency Cooperators - Maryland Nonpoint Source Program (1)

State Lead Agency	Maryland Department of Environment Science Services 1800 Washington Blvd., Baltimore MD 21230 410-537-3902	Jim George - Director, Water Quality Protection and Restoration Program Ken Shanks - TMDL Implementation Division Eric Ruby - § 319(h) Grant Manager §319(h) Staff – Susan Douglas Projects – James Forrest, Jen Jaber, Robin Pellicano, Sekhoane Rathhebe, Adam Rettig, Gregorio Sandi, Ian Spotts
State Other Agencies	(Maryland) Chesapeake Bay Trust 60 West Street, Suite 45, Annapolis MD 21401	Jana Davis, Associate Executive Director
	***** Maryland Department of Environment Acid Mine Drainage Section, Abandoned Mine Lands Div. 160 South Water Street, Frostburg MD 21532	Constance Lyons Loucks - Chief
	Maryland Dept. of Natural Resources, Watershed Services 580 Taylor Ave. E-2, Annapolis MD 21401 410-260-8710	Matt Fleming – Director, Watershed Services Kevin Smith – Ecosystem Restoration Services
	Maryland Dept. of Natural Resources, Resource Assessment Service, Monitoring and Nontidal Assessment Division 580 Taylor Ave. C-2, Annapolis MD 21401 410-260-8605	Daniel Boward, Chief, Data Management and Administration Program
	Maryland Department of Agriculture 50 Harry S. Truman Parkway Annapolis MD 21401	John Rhoderick- Office of Resource Conservation Projects – Janet Crutchley
	Maryland Department Of Planning 301 W. Preston Street Suite 1101 Baltimore MD 21201-2305	Joe Tassone- Landuse Planning and Analysis
Federal	EPA Region III Nonpoint Source Program Water Protection Division Mail Code 3WP10 1650 Arch Street, Philadelphia PA 19103-2029	Fred Suffian, Team Leader David Greaves, Maryland Project Officer

Appendix B
List of Agency Cooperators - Maryland Nonpoint Source Program (1)

Local Other Agencies & Contributors (2)	Baltimore City, Dept. of Public Works, Surface Water Div.	Kimberly Burgess, Director. Duncan Stuart, Watershed Liaison
	* Baltimore County, Department of Environmental Protection and Resource Management	Implementation: Robert Ryan, Manager Capital Programs and Operations Planning: Steve Stewart, Watershed Management and Monitoring
	Calvert County Dept. of Planning and Zoning	Dr. David Brownlee, Manager. Steven Kullen, Watershed Planner
	* Caroline County, Planning and Codes Administration	Kathleen Freeman, Director
	* Centerville, Town of	Bob McGrory, Town Manager. Eva Kerchner, Watershed Manager
	* Frederick Co. Div. of Public Works Watershed Mgmt Sect.	Shannon Moore, Manager Project Managers: Jessica Hunicke, Heather Montgomery
	Harford County, Dept. of Public Works	Christine Buckley, Betsy Weisengoff
	Prince George's Co. Dept. of Environmental Resources	Dr. Mow-Soung Cheng, Assistant Associate Director
	Queen Anne's Co. Dept. of Public Works	Todd Mohn, Director. Lee Edgar, Civil Engineer
	Queen Anne's Soil Conservation District	via MDA
	* Sassafras River Association	Pamela Duke, Executive Director
	University of Maryland Center for Environmental Science	Dr. Margaret Palmer, Professor and Director
	Washington Soil Conservation District	Elmer Weibley, District Manager

(1) Cooperators list is limited to contact persons for 319(h) Grant Projects that were active any time between January 1, 2011 and December 31, 2011.
(2) Local includes all forms of local government.

* Agency or group that make a significant contribution to the Annual Report.

Appendix C
2010 BMP Implementation Progress In Maryland

From MDE's Analyzing and Tracking Nonpoint Source Data Project, FFY11 319(h) Grant
Robin Pellicano, Febraury 2012

Type of Practice	Statewide Total	Nitrogen Reduction Approx. (lb/yr)	Phosphorus Reduction Approx. (lb/yr)
Animal Composters on Ag Lands	26	237	6
Animal Waste Management Systems-Livestock	1,202	1,446,967	163,841
Animal Waste Management Systems-Poultry	1,276	286,729	32,466
Cover Crops	197,905	357,073	16,318
Dry Detention Ponds and Hydro Structures	48,239	17,614	2,180
Dry Extended Detention Ponds	25,860	56,655	5,844
Filtering Practices	3,552	10,376	963
Forest Conservation	93,354	0	0
Forest Harvesting Practices	23,087	15,804	206
Grassed Buffers	46,557	455,767	53,932
Heavy Use Poultry Pads	288	0	0
Infiltration Practices	14,439	52,722	4,568
Nutrient Management Plan Implementation	749,638	853,311	150,296
Retirement Of Highly Erodible Lands	19,149	90,527	950
Riparian Forest Buffers on Ag Lands	20,930	243,008	29,840
Riparian Forest Buffers on Urban Lands	346	408	1,183
Runoff Control	1,049	766	47
Septic Connections to Sewers	538	3,929	0
Septic Denirification	2,843	13,077	0
Soil Conservation Water Quality Plans	775,209	882,418	155,423
Stream Protection w/Fencing	8,886	121,381	11,877
Stream Protection w/o Fencing	37,578	256,647	25,113
Stream Restoration	152,514	6,944	12
Tree Planting on Agricultural Lands	17,537	203,612	25,002
Water Control Structures	413	3,102	0
Wet Ponds	54,030	118,370	12,209
Wetland Restoration on Ag Lands	8,248	95,769	11,760

1. For each type of practice in the table, data represents cumulative totals through June 2010 using CBP Model Phase 5.3.2.
2. Nutrient load reduction estimates for each type of practice represent the affect of each BMP acting independently. The nutrient reduction estimates do not account for the potential aggregate affect of multiple BMPs interacting together. For example, an agricultural field may have both cover crops and grassed buffers.
3. These values do not constitute all BMPs implemented. Some BMP reductions are not able to be easily calculated.

Appendix D
General Approach and Schedule to Implement Applicable Management Measures
Page 1 0f 2

Category / Priority		Implementation Timeline (Years)		
		1998-2002	2003-2007	2009-2012
Agriculture	Statewide	Farmers using commercial fertilizers must have n & P based plans by 2002	Soil Conservation Water Quality Plans (SCWQP) on 50% of all farms by 2003	
		Farmers using animal manure or sludge must have n & P based plans by 2002	SCWQP implemented on 25% of all farms by 2003	
			Farmers using animal manure or sludge must have N&P based plans by July 1, 2004	
	Watershed Focus	Tributary Strategies	Agricultural Priority Watersheds**	
		Agricultural Priority Watersheds**		
Forestry	Statewide	Riparian Forest Buffer (RFB) goal of 43 mi/yr	RFB goal of 43 mi/yr	600 miles of RFB created by 2010
	Watershed Focus	Coastal Bays		
		Special Streams Project		
		Monocacy		
		Anacostia		
		Susquehanna		
		Town Creek		
		Rock & Carroll Creek		
Urban runoff: developing and developed areas	Statewide			
	Watershed Focus	Washington - Baltimore Metro Area, Roland Run, Redhouse Run, Severn River SWM plan		
		Anacostia Watershed		

Appendix D
General Approach and Schedule to Implement Applicable Management Measures
Page 2 0f 2

Category / Priority		Implementation Timeline (Years)		
		1998-2002	2003-2007	2009-2012
Marinas and Recreational Boating	Statewide	96 Certified Clean Marinas by 2002	125 Certified Clean Marinas by 2004	270 Certified Clean Marinas by 2010
				Marine Sewage Pumpout Program goal of 460 facilities by 2010
	Watershed Focus	Chesapeake Bay		
		Coastal Bays		
		Deep Creek Lake		
Channelization and Channel Modification, dams, and shoreline erosion	Statewide			
	Watershed Focus	Chesapeake Bay Shoreline		
		CWAP Priority Watersheds		
		Anacostia Northwest Branch		
		Anacostia Town Park Stream		
Wetlands	Statewide	3000 acres by 2002	10,500 acres by 2007	15,000 acres by 2010
	Watershed Focus	CWAP Priority Watersheds		
		Coastal Bays		

From "Maryland Nonpoint Source Management Plan December 1999"

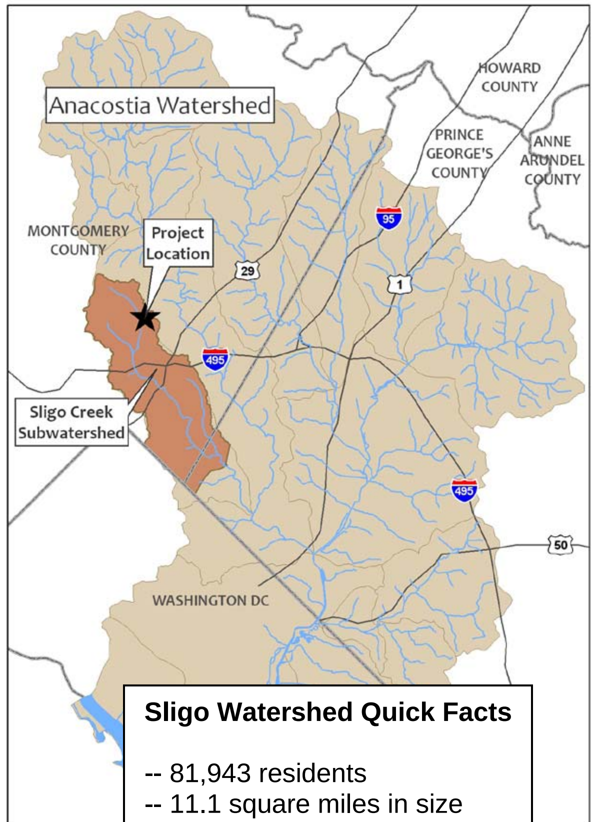
Appendix E

Sligo Creek Success Story

Stream Restoration Reduces Peak Flow and Brings Back the Fish

Sligo Creek Success Story

Stream Restoration Reduces Peak Flow and Brings Back the Fish



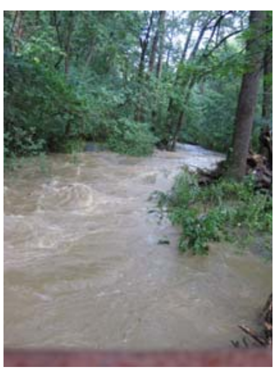
Sligo Watershed Quick Facts

-- 81,943 residents
-- 11.1 square miles in size
-- 34% impervious surfaces
-- 415 feet in elevation drop
-- 8.3 miles of stream

High volumes of rapidly moving stormwater and extensive habitat destruction contributed to elimination of all but four of the most pollution-tolerant fish species in Maryland's Sligo Creek. The Maryland Department of the Environment added the Anacostia River/Sligo Creek to the State's Clean Water Act section 303(d) in 2002 for impairment as measured by combined fish/benthic bio-assessment. By implementing stormwater management for water quality on 48% of Sligo Creek's watershed, restoring 2.7 miles of stream habitat and adding forested buffer, in-stream conditions improved as measured by a change in fish Index of Biotic Integrity (IBI) from poor to fair. Conditions continue to show progress that contributes to meeting total maximum daily load (TMDL) limits for phosphorus, nitrogen and sediment in the Anacostia River.

PROBLEM

Sligo Creek is one of 14 tributaries to the Anacostia River. Its waters enter the nation's capital from the north on their way to Potomac River and eventually to the Chesapeake Bay. The Creek's watershed encompasses 11.1 square miles of highly developed Washington DC suburbs in Montgomery County, Maryland. This area was almost entirely built-out during the 1950s and 1960s before environmental standards were adopted for stormwater management and stream valley protection. Today, 82,000 people call the Sligo Creek watershed home. About one third surface is impervious, nearly all of the small streams are paved over and piped in storm drains and the only visible remnant of the natural stream network are stream mainstems including Sligo Creek itself. Within the floodplain, utilities and a park road closely parallel the Creek. This development history has left few areas large enough to retrofit for stormwater management controls.



Figures: High peaks in storm flows (above) are the primary cause of gully and stream bank erosion (right) in the Sligo Creek watershed. (photos by Montgomery County)

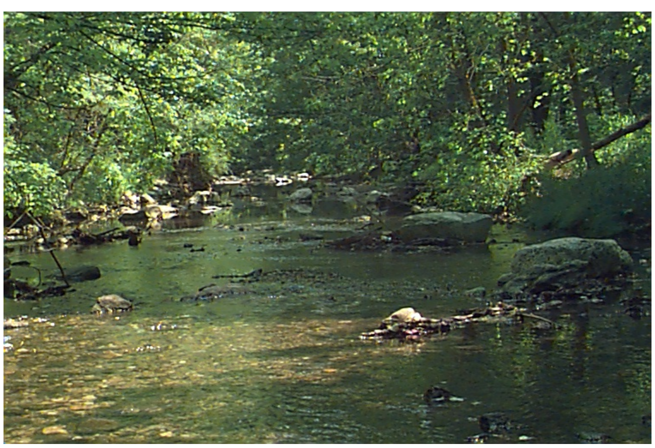
Sligo Creek's problems are counted toward impairments listings for the overall Anacostia River watershed. For example, in 2000 only four species of fish could be found in Sligo Creek: blacknose dace, creek chub, white sucker, and goldfish. These fish are extremely pollution tolerant habitat generalists that have a generalized feeding strategy. Sligo was rated "poor" using EPA's Index of Biotic Integrity (IBI) for fish and this finding contributed to Maryland's 2002 listing of the Anacostia overall as impaired for fish and benthic bio-assessments. Other Anacostia impairments (each with a TMDL) include phosphorus, nitrogen, sediments, fecal coliform bacteria and trash.

PROJECT HIGHLIGHTS

Work to redress water quality and habitat problems begin over 20 years ago. Beginning in 1987 with the signing of the Anacostia Watershed Restoration Agreement, there has been an evolving interjurisdicational blueprint for cooperation and goals that have guided efforts across the Anacostia watershed including those in Sligo Creek. Shortly thereafter in 1989, Montgomery County embarked on an ambitious effort in upper Sligo Creek to restore water quality and habitat.

In Phase 1 (1989), a dry stormwater pond that collects runoff from 805 acres (37% impervious in Wheaton Branch) was transformed into a three-celled, extended detention wet pond with wetland plantings improving appearance, providing fish and wildlife habitat, and capturing sediment and trash. Below the pond 1,000 linear feet of downstream aquatic habitat was restored by creating two vernal pools for amphibian breeding habitat along with a 1,200-foot riparian stream corridor restoration.

Phase II (1992-94), another stormwater pond serving 434 acres (23% impervious near University Boulevard) was rebuilt as a two-celled wet extended detention pond/marsh. Other projects included 2.5 miles of aquatic habitat restoration, a quarter acre marsh creation, five acres of reforestation, and; 19 small physical aquatic habitat improvement projects. Additionally, systematic reintroduction of native species was initiated because downstream fish barriers made natural recruitment impossible and surrounding watersheds also exhibited with very poor benthic macroinvertebrate communities and amphibian communities, which made natural recolonization unlikely.



Figures: Phase IV projects include the Godwin Marsh stormwater wetland completed in 1999 (top) and the Sligo Creek stream restoration above.

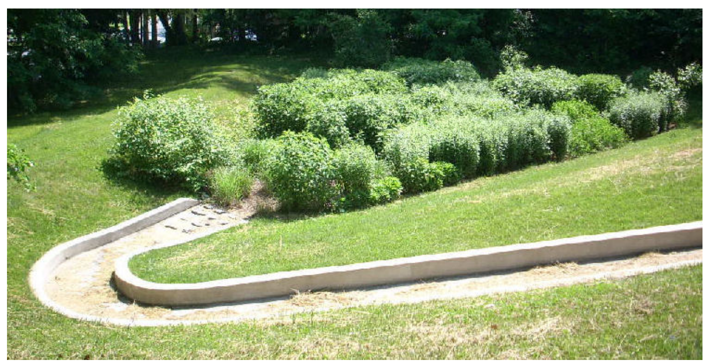
This Phase V stormwater infiltration project was funded through a partnership between Prince George's County, Montgomery County and EPA.

Phase III (1996), a new one-acre detention wet pond at a Sligo Creek golf course was constructed to capture stormwater runoff from 70 acres including a one mile portion of the six-lane Capital Beltway (I-495).

Phase IV (1999) included creation of two stormwater wetlands near Godwin Drive and the Capital Beltway, and stream restoration work in middle segments of Sligo Creek.

Phase V (2005-2007) focused on bioretention systems serving the Dennis Avenue Recreation and Health Centers and the Capital Beltway using low impact development (LID) design for stormwater management. The County established a new goal to improve the fish IBI from 'poor' to 'fair' through targeted fish reintroductions of native fish that occurred in 2004 and 2007.

Phase V1 (2010 – present) involves numerous small restoration projects that together will contribute to Sligo Creek restoration through cumulative results. The County is currently working with residents in the 45-acre Breewood tributary catchment where one third of the surface is % impervious and approximately 90% of the area lacks stormwater management for water quantity and quality. Here, an innovative comprehensive management approach to address major sources of water quality impacts is linking upland watershed source control measures like low impact design (LID) with stream and wetland restoration and vegetated control practices.



The continuing affects of this Phase V stormwater project are being monitored by the University of Maryland.

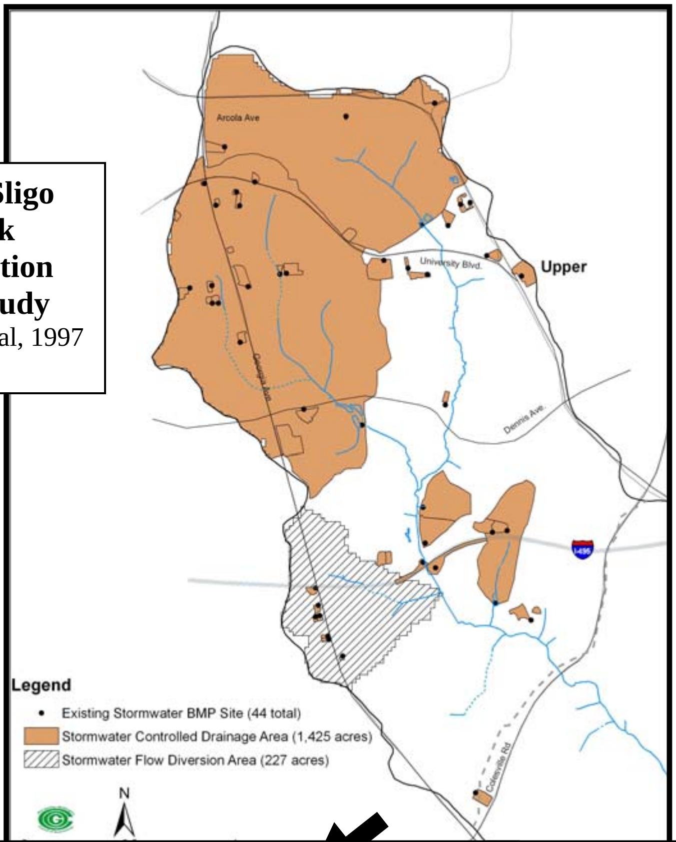
RESULTS

Table 1. Peak Flow Discharge Rate Reductions - Upper Sligo Creek Watershed

Phase / Yr	Area Name	1990 CFS	2007 CFS	Improvement
I - 1990	Wheaton Branch SWM Pond	864	386	55%
II - 1993	SWM Pond	448	125	72%
III - 1996	SWM Pond at Sligo golf course	51.5	9.94	81%
IV - 1999	Capital Beltway East	8.1	0.78	90%

Phases I-V improvements in stormwater management for 1,425 acres (48%) of upper Sligo Creek watershed resulted in 41% reduction in peak flow discharge (Table 1). This change contributes to improving water quality, stream bed and bank stability and in-stream habitat capabilities. The maps on the next page provide additional information.

Upper Sligo Creek Restoration Case Study
Cummins et al, 1997

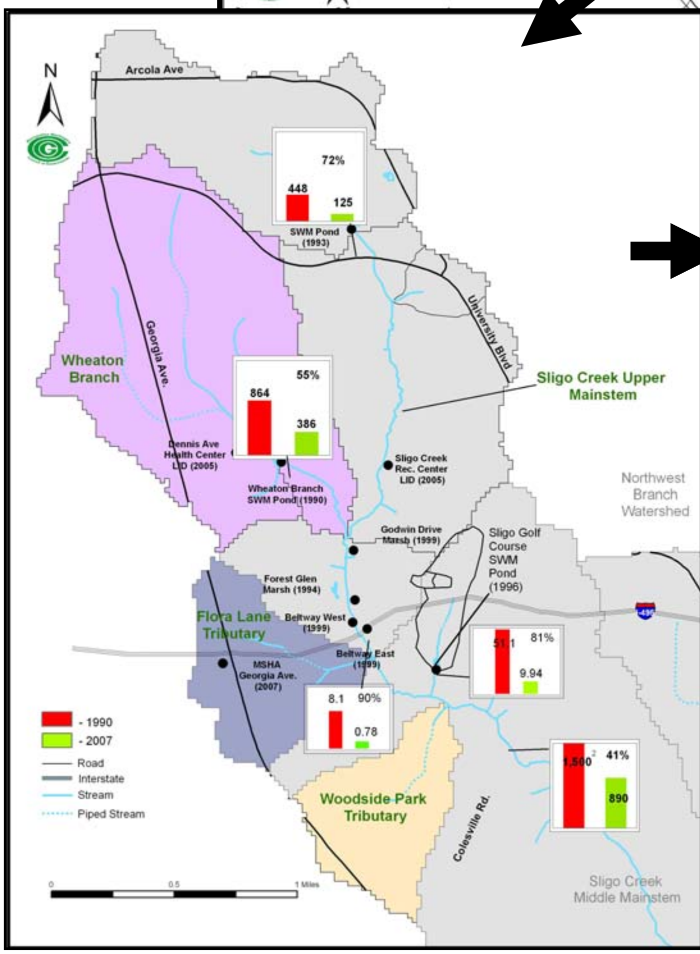


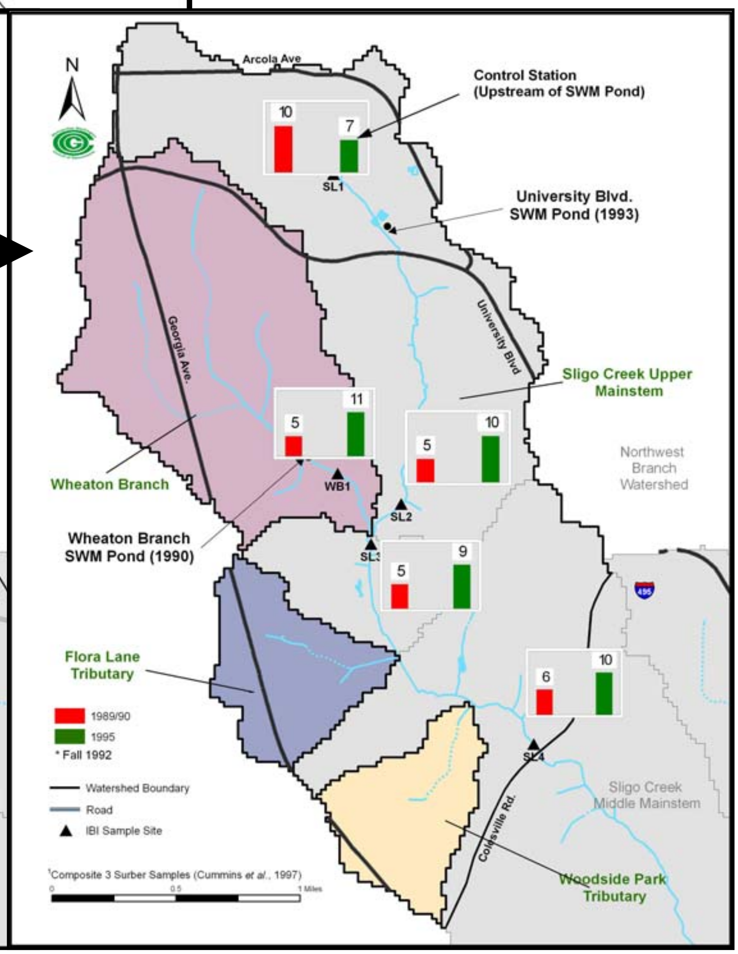
Top: Upper Sligo Creek stormwater management control effort 1989-2007 encompassed 48% of headwater areas.

Lower Left: Peak stormwater runoff for 2-year frequency storms declined significantly following project implementation.

Lower Right: The stormwater management also resulted in improved habitat for benthic macroinvertebrates.

(Maps were provided by the Washington Metropolitan Council of Governments)





In the 1990s, benthic macroinvertebrates become more abundant and diverse (Table 2) although their community IBI score remains in the ‘poor range. This improvement helps to support fish population improvements.

Table 2. Macroinvertebrate Community Species Diversity Sligo Creek Watershed			
Station	**Location**	**Species 1989/90**	**Species 1995**
WB1	Wheaton Branch (SWM Pond)	5	11
SL2	Sligo Creek upper mainstem	5	10
SL3	Flora Lane Tributary	5	9
SL4	Woodside park Tributary	6	10
SL1	Control (upstream of SWM pond)	10	7

Source MOCO Map of (Cummins et al., 1997)

From 2000 to 2009, most of upper Sligo Creek improved from a “poor” fish community IBI rating to “fair” (graph). Monitoring data documents the presence of 14 naturally sustaining fish species throughout the Sligo watershed, including habitat specialists and some species with more specialized feeding strategies (Table 3). Tessellated darters (Etheostoma olmstedi) of different size classes are now abundant throughout the watershed. Reintroduction of this native benthic fish, which does not have a swim bladder, would not have been successful if that movement of peak flows and fine sediments had not been reduced by improved stormwater management.

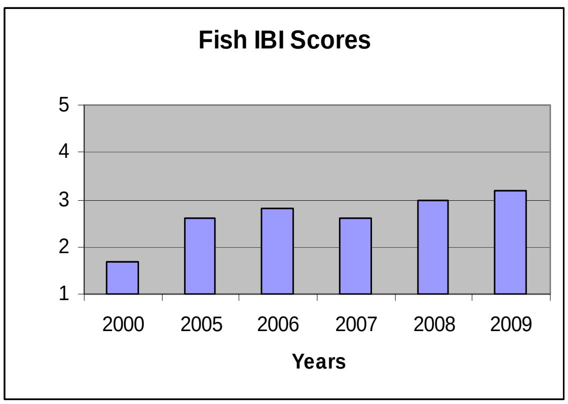


Table 3. Species Found 2009 - Sligo Creek Watershed		
Species	**Tolerance**	**Trophic Level**
American eel	Intermediate	Generalist
Blacknose dace	Tolerant	Omnivore
Bluegill	Tolerant	Invertivore
Brown bullhead	Tolerant	Omnivore
Creek chub	Tolerant	Generalist
Green sunfish	Tolerant	Generalist
Longnose dace	Intermediate	Omnivore
Redbreast sunfish	Tolerant	Generalist
Satinfin shiner	Intermediate	Invertivore
Silverjaw minnow	Intermediate	Omnivore
Spotfin shiner	Intermediate	Invertivore
Swallowtail shiner	Tolerant	Omnivore
Tessellated darter	Tolerant	Invertivore
White sucker	Tolerant	Omnivore

Top figure: These are five of the fish species now found in Sligo Creek. Bottom figure: Two year classes of the same fish species found in the Sligo Creek demonstrate that natural reproduction is occurring.

PARTNERS and FUNDING

The total capital cost of the Sligo Creek restoration projects is $3,056,000 including:

- $1.8 million from the Montgomery County capital budget,
- $1 million State cost share from the small creeks and estuaries program,
- $256,000 from the US Army Corps of Engineers.

CONTACT INFORMATION

Craig Carson
Watershed Restoration Program, Watershed Management Division
Montgomery County Department of Environmental Protection
255 Rockville Pike, Suite 120
Rockville MD 20850
240-777-7713
Craig.Carson@montgomerycountymd.gov

John Galli
Metropolitan Washington Council of Governments
Department of Environmental Programs
777 North Capitol Street, N.E.
Washington DC 20002-4239
202-962-0238
jgalli@mwcog.org

James George, PhD
Manager, Water Quality Protection & Restoration Program
Maryland Department of Environment
1800 Washington Blvd, Suite 540
Baltimore MD 21230-1718
410-537-3579
jgeorge@mde.state.md.us

Appendix F – EPA National Review of Watershed Plans, July 2011

Contents

- Complete copy of EPA report
  - Cover page
  - Body of report (21 pages)
    - Review of Lower Monocacy River watershed plan supplement (pages 16-18)
  - Appendix A (2 pages, i thru ii)
    - EPA Region 3 contact and link to watershed plans (page i)
  - Appendix B (3 pages, iii thru v)
    - Best examples of watershed plan components based on EPA criteria

Introduction

In response to EPA's request for watershed plans for their national review, MDE assessed the all the watershed plans in Maryland that had received EPA acceptance. Based on this assessment, MDE believes that several watershed plans in Maryland would have received national recognition if EPA's review process had allowed for multiple submissions from each State. Unfortunately, each State was allowed to submit only one plan for EPA review. EPA's recognition of Frederick County's Lower Monocacy River watershed plan is indicative of important efforts by local governments to meet nonpoint source management and water quality restoration needs in Maryland.

Watershed Based Plan Review

Final Report

July 2011

U.S. Environmental Protection Agency
Office of Wetlands, Oceans, & Watersheds
Assessment & Watershed Protection Division
Nonpoint Source Control Branch

Introduction & Purpose

In 2006, the Non Point Source Control Branch (NPSCB) of the EPA Office of Wetlands, Oceans, and Watersheds completed a review of the "best" watershed plans from each state. The purpose of the review was to evaluate how well stakeholders were meeting the challenge of developing high-quality watershed-based plans in accordance with the 9 essential components outlined in the October 2003 "Nonpoint Source Program & Grants Guidelines for States and Territories". The 2006 review found that while some states were able to develop high quality watershed-based plans, many plans were still not sufficiently well designed or did not contain sufficient information to support a fully successful implementation effort that would lead to the attainment of water quality standards in the waterbodies identified.

Recommendations from the 2006 review included:

- Greater oversight by EPA Regions to assure watershed-based plans are adequate
- Developing a guidance document providing "best" examples for each of the 9 components
- Providing better training and guidance that demonstrates the level of detail needed to assure water quality standards are achieved in a watershed
- Distributing the "best" plans to the Regions as examples of the level of detail required for a good watershed-based plan.

Since the 2006 review, EPA Headquarters has taken action to provide guidance for developing effective watershed based plans, including publishing the Watershed Planning Handbook; releasing the best plans from the last review; posting additional exemplary plans on the EPA nonpoint source website; and convening workshops addressing watershed-based plan issues such as modeling.

In 2008, EPA Headquarters decided to conduct a second review of state watershed-based plans to determine the level of progress that states and their stakeholders have made in addressing the nine essential components of watershed-based plans. In September of 2008, the NPSCB again asked each of the regional offices to coordinate with their states and territories to identify and submit the "best" watershed-based plan from each state. A total of 49 plans were reviewed during the period 2008 – 2010.

Purposes of this review included:

- Improving our understanding of States' ongoing efforts to develop watershed based plans and identifying needs for improvement.
- Identifying effective and innovative approaches to watershed planning and management that can be shared with states, tribes, and local partners.
- Help guide future activities to promote improved watershed planning and management.

Evaluation Method

EPA developed scoring criteria based on the nine components of a watershed based plan, as identified in the October 2003 Federal Register notice. There are several critical elements identified for each criterion. In order for a plan to meet a criterion, it should contain each of its corresponding elements. Upon the review of each plan, each criterion was given a score of 0-3, 3 being the highest score. Scoring is further explained in **Table 1**

Table 1: Criterion Scoring

3	Excellent – Criterion was met at a level that goes above and beyond the minimum and/or included especially effective approaches to addressing the criterion.
2	Good - Criterion met an adequate level of detail; i.e. information provided was adequate to support successful implementation.
1	Fair – Information provided addressed some aspects of the criterion, but failed to fully address it.
0	Poor - Criterion was not adequately addressed

The overall score for each plan was based on a maximum score of 100. Each criterion was assigned a percent weight, and the weight of each criterion was based upon its relative level of importance in assuring that implementation of the plan would attain water quality standards. In particular, 54% of the final score is focused on the first three criteria.

A criterion's score of 0-3 was converted to a percentage, which was multiplied by the weight to determine how many of the possible percentage points were earned for each criterion. For example, a plan that achieves a 2 for all criteria would have a total score of 67% and would be considered by the scoring system to be adequate to support successful implementation. The overall score was not used to assign a particular "rating" to each watershed plan, or declare that a plan "passed" or "failed". Rather, it was used to rank all of the watershed plans; i.e. the higher the score, the higher the rank. This information has been used to identify the merits of those plans that appear to be of high quality – providing excellent models that states, local governments, watershed groups can review and learn from and to assess the overall quality of all of the plans.

The criteria that were used to evaluate the plans are listed in **Table 2**.

Table 2. Numerical Criteria

A. CAUSES/SOURCES OF POLLUTION ARE IDENTIFIED		
Goals for restoration & protection are clearly defined, quantified & thoroughly explained		8.0%
	Impaired, partially impaired, and/or threatened water bodies on the 303(d) list are identified	
	Goals are clearly defined, and quantified (if applicable)	
Causes/sources of pollution that need to be controlled to meet goals are identified as it applies to areas for restoration and protection		14.0%
	Sources of pollution, both point and non point, are mapped/causes identified	
	Loads from identified sources are quantified	
	Watershed sufficiently subdivided by landuse type, cover or other characteristics to enhance the assessment of sources and strategic placement of BMP's	
	Data sources, estimates and assumptions are cited & documented	
	Data Gaps Identified if they exist, but data gaps not significant enough to delay implementation	
B. EXPECTED LOAD REDUCTIONS FOR SOLUTIONS IDENTIFIED		18.0%
	Expected load reductions are linked to a pollution cause/source identified in (A)	
	Expected load reductions are analyzed to ensure water quality criteria, and/or other goals will be achieved	
	Basis of load reduction effectiveness estimates is thoroughly explained	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	
C. NONPOINT SOURCE MANAGEMENT MEASURES IDENTIFIED		14.0%
	Management measures needed to address causes/sources of pollution identified in (A) are listed, described, and mapped (if known)	
	Explanation for the selection of measures is included to ensure they are applicable to the pollutant causes/sources and are feasible and acceptable	
	Management measures are prioritized based on critical pollutant causes/sources, type, and location as well as compatibility with landowner operations	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	
D. ESTIMATE OF TECHNICAL & FINANCIAL ASSISTANCE		
Estimate of Technical Assistance needed		4.0%
	Significant existing sources of technical assistance that may be needed to implement the plan are accounted for.	
	Additional technical assistance needs are identified, and referenced back to the solutions	

Estimate of Financial Assistance Needed		4.0%
	General cost estimate is included by task (project work plans should have more detailed cost information)	
	Multiple funding sources are listed, as well as an estimated contribution from each source	
E. EDUCATION/OUTREACH		8.0%
	Reaches out to the appropriate sectors of the population in the watershed	
	Both educates public and encourages participation	
	Encourages the implementation of BMP's necessary to fulfill the plan requirements	
F. IMPLEMENTATION SCHEDULE		6.0%
	Timeline presents projected dates for the development and implementation of the actions needed to meet the goals of the plan and includes information on how implementation will be tracked	
	Implementation of point source and regulatory activities are coordinated with nonpoint source actions and other watershed implementation activities	
G. MILESTONES IDENTIFIED		6.0%
	Milestones are measureable and attainable	
	Includes expected completion dates to ensure the continuous implementation of plan	
H. SHORT TERM CRITERIA TO ENSURE PROGRESS IS BEING MADE TOWARDS ATTAINING WATER QUALITY STANDARDS		9.0%
	Interim numerical criteria present	
	Expected dates of achievement identified.	
	Includes a review process to determine if the reductions are being met	
	Includes criteria to determine whether the watershed based plan needs to be revised based upon failure to make adequate progress in accordance with the implementation schedule	
I. MONITORING COMPONENT		9.0%
	Includes description of how monitoring will be used to evaluate the effectiveness of the implementation efforts	
	There is a routine recording element in which progress and methodology are evaluated.	
	Monitoring is tied to a quality assurance plan	
	Parties responsible for monitoring are identified	

Additional details were recorded for each plan to assess any trends across plans. These included:

- Organization(s) authoring the document
- Predominant pollutants addressed in plans
- Watershed size, to determine if there was any correlation between the quality of the plan and the size of the watershed.

- Model used, if applicable, to get a better idea of the models that are being most commonly used and where.

General Results

Based on the above described scoring system, the average score for all of the plans was 56%. Figure 1 presents the average score for each of the 9 watershed based plan components required in 319 plans.

The majority of reviewed plans have done very well with respect to the following components:

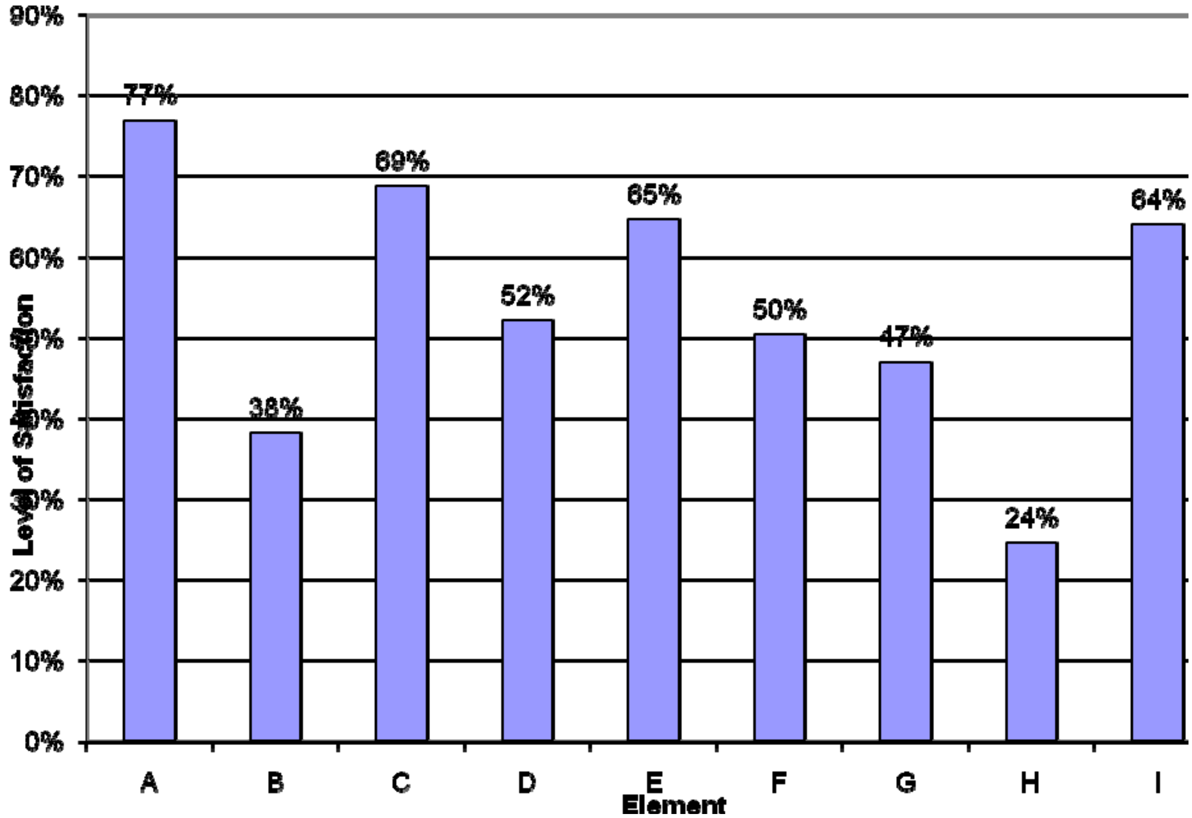
- Identifying causes and sources of pollution that need to be controlled to achieve watershed goals (Component A);
- Describing the NPS management measures that need to be implemented to achieve watershed goals (Component C);
- Developing an information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing NPS management measures (Component E); and
- Including a monitoring component to evaluate the effectiveness of the implementation efforts over time (Element I)

However, many states continue to struggle with estimating load reductions expected for the management measures selected, and setting criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards (components B and H). Components B and H were found to be problematic in the 2006 review and again were often addressed inadequately in the plans reviewed for this study. These two components go hand in hand; without adequate load reduction estimates, a state cannot develop criteria that can be used to determine whether load reductions are being achieved at an adequate rate over time.

While plans in small watersheds were usually easiest to review, there appeared to be no correlation between size of watershed and overall quality of the plans (Figure 2). However, 40 of the 49 plans submitted were less than 1000 square miles and most of these were significantly smaller than that. Table 3 lists which models were used for components A-C. 13 of the plans reviewed relied solely on monitoring data, and used no formal model for estimating pollutant sources or reductions expected from management practices. Where a model was used, the model used was as varied as the plans themselves.

It is notable that the average score of the plans that used some kind of model (61%) was substantially higher than the average score of those plans that did not use a model (44%).

FIGURE 1



90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Level of Satisfaction
77%
38%
69%
52%
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FIGURE 2

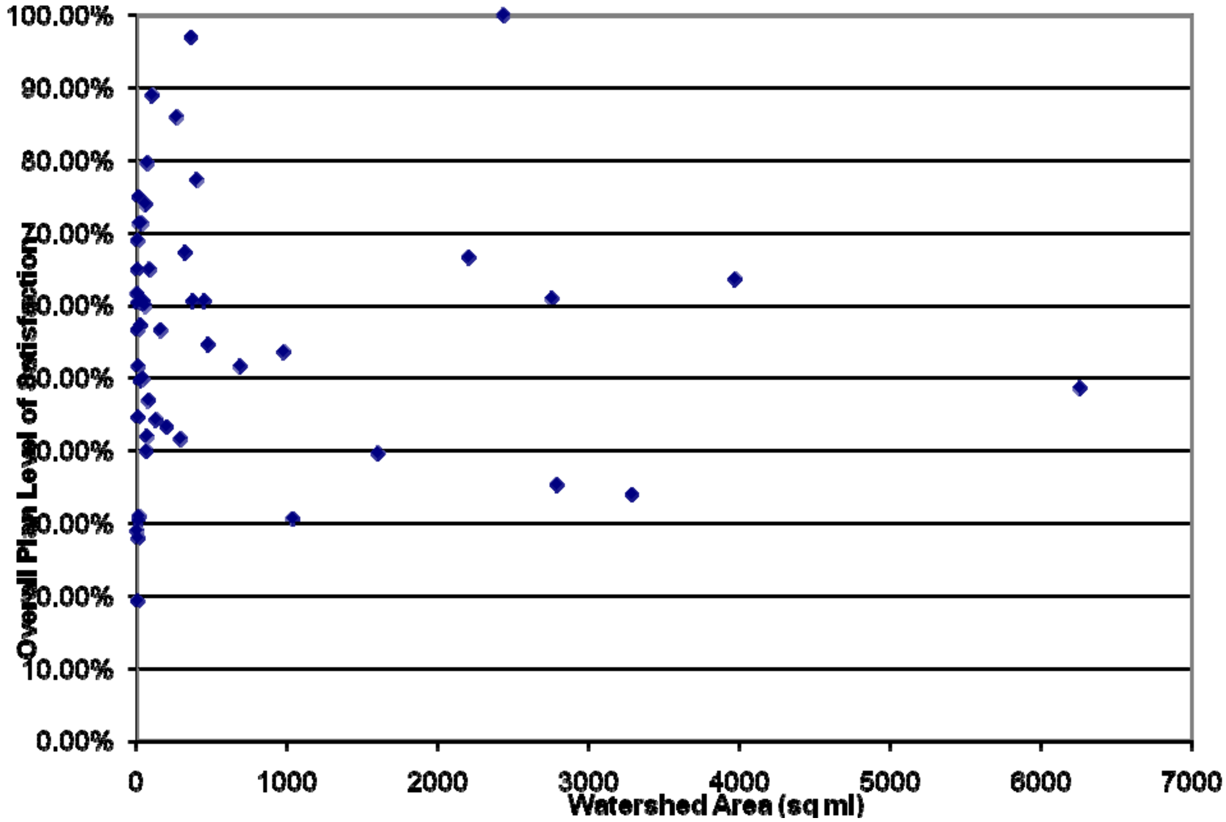


Table 3: Models used in Watershed Based Plans

Model Name	Use
[No Model]	13
Soil & Water Assessment Tool (SWAT)	4
[Revised] Universal Soil Loss Equation ([R]USLE)	3
ArcView Generalized Loading Function (AVGWLF)	3
Loading Simulation Program in C++ (LSPC)	3
Speadsheet Tool for Estimating Pollutant Loads (STEPL)	3
Stormwater Management Model (SWMM)	3
Automated Geospatial Watershed Tool (AGWA, uses Kinematic Runoff and Erosion Model (KINEROS2) and SWAT)	2
Hydrologic Simulation Program Fortran (HSPF)	2
Long Term Hydrologic Impact Assessment (L-THIA)	2
Pollution Reduction Impact Comparison Tool (PreDICT)	2
Annualized Agricultural Non-Point Source Pollution Model (Ann AGNPS)	1
AVNPS	1

Bacteria Indicator Tool	1
Bacteria Source Load Calculator	1
BATHTUB	1
Environmental Fluid Dynamics Code (EFDC)	1
FLUX	1
Impervious Cover Model	1
Integrated Pollutant Source Identification Pollutant Loading Model (IPSI/PLM, from TVA)	1
Method for Assessment, Nutrient-loading and Geographic Evaluation of watersheds (MANAGE)	1
BASINS Nonpoint Source Model (NPSM)	1
Nonpoint-Source Pollution and Erosion Comparison Tool (NSPECT)	1
PLAT/NLEW	1
Pollutant Load Screening Model (PLSM)	1
QUAL2E	1
R5 Pollutant Control Model	1
SELECT	1
Site Evaluation Tool (SET)	1
Stream Network Temperature model (SNTEMP)	1
Watershed Management Model	1
Watershed Treatment Model	1
Delaware Inland Bays Model (Based on CB Model)	1
Sediment Delivery Calculator	1
CE-QUAL-ICM	1

Sediment, bacteria, and nutrients were the most common pollutants addressed in the plans (Table 4).

Table 4: Pollutants Addressed in Watershed Based Plans

Pollutant	# Addressed
Sediment	24
Bacteria (Fecal Coliform & E.Coli)	19
Nutrients (Both Nitrogen & Phosphorus)	16
Phosphorus	8
Metals (Cadmium, Zinc, Lead, Mercury, Copper)	8
Temperature	7
DO	6
Impaired Aquatic Communities	5
Herbicides/Pesticides (including Atrazine, DDT)	4
BOD	3
pH	3
Nitrogen	2
Water Quantity	2
Aromatic Hydrocarbons	1
Oil & Grease	1

Trash	1
Salinity	1
Selenium	1
Noxious Aquatics/Exotic Species	1

While many plans were developed under the supervision of a technical committee, the "author" is the person or group that is named as the actual writer of the plan. As seen in Table 5, private consultants, hired by local watershed groups, states, and other stakeholders authored a greater number of plans than other groups, followed closely by state environmental agencies and miscellaneous entities, such as local planning commissions, large nonprofits, and other state agencies.

Table 5: Watershed Based Plan Authors

Author	# Addressed
Consultant	11
State Environmental Agencies	10
Etc (Incl. State NRCS, Area Planning Commissions and Environmental Councils)	7
Multiple Authors	6
Local Watershed Group	6
SWCD	4
Extension	3
Local Government (city or county)	2

Summary of Findings for Each Component

Component A

An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed based plan (and to achieve any other watershed goals identified in the watershed-based plan). Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed.

It is difficult to remediate an impaired waterbody without first identifying the causes and sources of impairment. Identification of pollutant sources and reductions needed to meet water quality standards (component A) are the essence of TMDL's; in a number of cases, TMDL's had already addressed this component to a significant extent, thereby setting a foundation for the plan. In the few plans that did not satisfy this component, load estimates from significant source categories were absent, or the sources of pollution that need to be controlled were not quantified at a level that is useful for waterbody remediation.

Component B

An estimate of the load reductions expected for the management measures selected

Without load reduction estimates, it is not possible to determine whether or not the proposed management measures are sufficient to meet the water quality goals set in component A. As mentioned previously, many states had difficulty addressing component B. Many plans simply did not provide any load reduction estimates. Others provided estimates, but made no attempt to show that the management measures chosen would lead to meeting the overall goals described in component A.

Quantifying expected load reductions is difficult, requiring both sufficient data and an analysis leading to a judgment as to what assumptions are appropriate to make for the situation. The processes that planners need to take into account are complex, and therefore difficult to translate to a simple numerical endpoint. While there are a myriad of tools available, from complex to simple spreadsheets, as EPA discusses in considerable detail in the "Handbook for Developing Watershed Plans to Restore and Protect Our Water" (2008), it requires considerable analysis supported by experience and training to determine which one will suit the needs of a specific watershed.

However, the watershed planning process isn't necessarily about getting exactly the right answer the first time. Rather, it is about successfully employing an adaptive management approach in which available information and analytical tools are used to support the best planning decisions that can be made. The best plans were not necessarily relying on the most sophisticated watershed models or making any claims that their load estimates are 100% correct. In fact, some plans contained explicit discussions stating factors that may lead to errors in the estimates. However, it is critical that the best effort be made to develop good estimates; set a bar to measure whether or not the proposed measures are adequate; and establish a feedback loop to determine if there are additional issues in the watershed that may have been missed when the plan was first written.

Component C

A description of the NPS management measures that will need to be implemented to achieve the load reduction estimated in component B, and an identification of the critical areas in which those measures will need to be implemented

After the causes and sources of pollution are identified, the next step is to identify management measures that will reduce the pollutant loads from these sources to the extent necessary to meet water quality goals. Most states were able to do this without significant difficulties. However, some states failed to adequately explain why certain management measures were chosen over similar alternatives.

The discrepancy between the level of satisfaction in components B and C suggests plan writers can successfully identify best management practices to address pollutants, but many are having a difficult time quantifying the expected load reduction from these practices.

Component D

An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the plan.

Component D was met with a moderate degree of success. The best plans were able to list the partners that would be called upon to complete each action in the plan, and included a full cost estimate, including possible sources of funding. Other plans were commonly missing one or more of these pieces of information or included all of this information at a level of detail that was much lower than the best plans.

Component E

An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.

Actions to reduce nonpoint sources of pollution are usually voluntary; therefore, effective education campaigns are extremely important to watershed based plans. A good educational campaign helps to ensure that needed management measures will actually be implemented. Most of the time, some kind of education campaign was included (passing out flyers, PSA's etc) but an explanation of how these campaigns would enhance public understanding or encourage involvement was absent. In these cases, there is a serious question whether adequate community understanding of and support for the watershed plan and its implementation have been established.

Component F

A schedule for implementing the NPS management measures identified in the plan that is reasonable expeditious.

A schedule helps ensure that the plan's developers have thought about the feasibility of their plan in relation to its objectives and available resources. It also helps to ensure the continuous implementation of the plan. In many cases, plans failed to include a schedule beyond a year of implementation, or had a much less detailed schedule compared to the best plans reviewed.

Component G

A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

Component F and G are closely related. Most states received the same scores for both components, and had the same issues with component G as they did with component F, namely, one, or in some cases, no interim milestones, and a lesser level of detail than the best plans reviewed.

Component H

A set of criteria that can be used to determine whether load reductions are being achieved over time and substantial progress is being made towards attaining water quality standards, and, if not, the criteria for determining whether the watershed based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.

Components B and H go hand in hand; without adequate load reduction estimates, a state cannot develop criteria that can be used to determine whether load reductions are being achieved at an adequate rate over time. Therefore, it is unsurprising that states which are struggling with Component B are also struggling with Component H. Most of the time, Component B was not mentioned in the context of Component H, or there seemed to be confusion between what was required with respect to components G and H. Many times, the criteria that would be used to determine whether loading reductions were being achieved were actually milestones; this indicates that there was confusion surrounding the difference between the two. The criteria should be expected levels of pollutants of concern in the waterbody at different points in time, whereas milestones indicate achievement of implementation steps like the number of BMP's that will be installed in a certain year. Many plans also failed to identify how often progress would be reviewed, and who would actually be responsible for reviewing the plan to determine this information. This would likely result in a lack of implementation of this important step and perhaps lead to continued implementation along a path that needs to be modified.

Component I

A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under component H.

Most plans were relying on the implementation of existing state monitoring programs, which have well established procedures, so component I is relatively straightforward. In a very small number of plans, responsibility for monitoring was unclear, as well as how often monitoring would take place.

Best Watershed Plans

These are the plans the received the highest scores of all rated plans. EPA recommends that state and EPA nonpoint source staff review these plans to gather some ideas regarding effective ways to address watershed based plan development. None of these plans is perfect, yet each represents a concerted effort to understand and address information and factors that affect the watershed's problems.

Kansas: Lower Big Blue/Lower Little Blue River

Contact: Donald Snethen
KS Dept. of Health & Environment
Division of Environment
Bureau of Water - Watershed Management Section
1000 SW Jackson St. Suite 420
Topeka, KS 66612-1367
Phone: (913) 296-5567
Fax: (913) 296-5509,
dsnethen@kdhe.state.ks.us

http://www.kcare.ksu.edu/DesktopModules/ViewDocument.aspx?DocumentID=4055

The Lower Big Blue/Lower Little Blue River watershed is a transboundary watershed (Only ~ 25% of watershed is in Kansas, the rest is in Nebraska) and drains into Tuttle Creek Lake, a flood control reservoir in Kansas. The lake is impaired by phosphorus, total suspended solids, and atrazine. While the plan only addresses Kansas portion of the watershed, it is overall an excellent watershed-based plan. Every required component was fully addressed, and the information for components B-I were presented in an especially effective manner. The tables and maps made the information easy to read and digest and all of the information was tied back to meeting the goals of the plan; there was little extraneous information. It was also one of the few plans that included a brief explanation of the model used in the analysis, including why the model was selected, major assumptions, and data sources used. Specific highlights include:

- The Soil and Water Assessment Tool (SWAT) was used to determine loading rates and locations of pollutant causes and sources. Pollutant source analysis is further explored pollutant by pollutant in the critical areas identified in the modeling process.

- The plan explicitly compares load reductions expected from management measures with load reductions prescribed in the TMDL, to ensure that management measures chosen will meet the goals of the plan. Also, there is a section that clearly explains the load reduction estimate methodology.

- Using the model with some ground-truthing, the plan identifies "areas or subwatersheds with the top 20-30% of the highest loads among all areas within the watershed" as critical (targeted) areas for BMP implementation.

- The plan broke cost estimates down to BMP's per year; provided the source of information for these costs; and also included the estimated cost of technical assistance.

- Target audiences are identified for different education/outreach activities, and the plan includes an outline for evaluating these activities.

- The implementation schedule covered the entire life of the plan, and included milestones (# of acres of BMP, miles of streambank stabilization, etc) and interim water quality milestones.

- The plan includes a strategy for reviewing the plan over time, complete with a schedule, delegation of responsible parties, and a list of indicator and parameter criteria and data sources that will be used to assess progress.

Overall, the Lower Big Blue/Lower Little Blue River plan was one of the best reviewed, and it provides an excellent example of how to develop and write a watershed based plan.

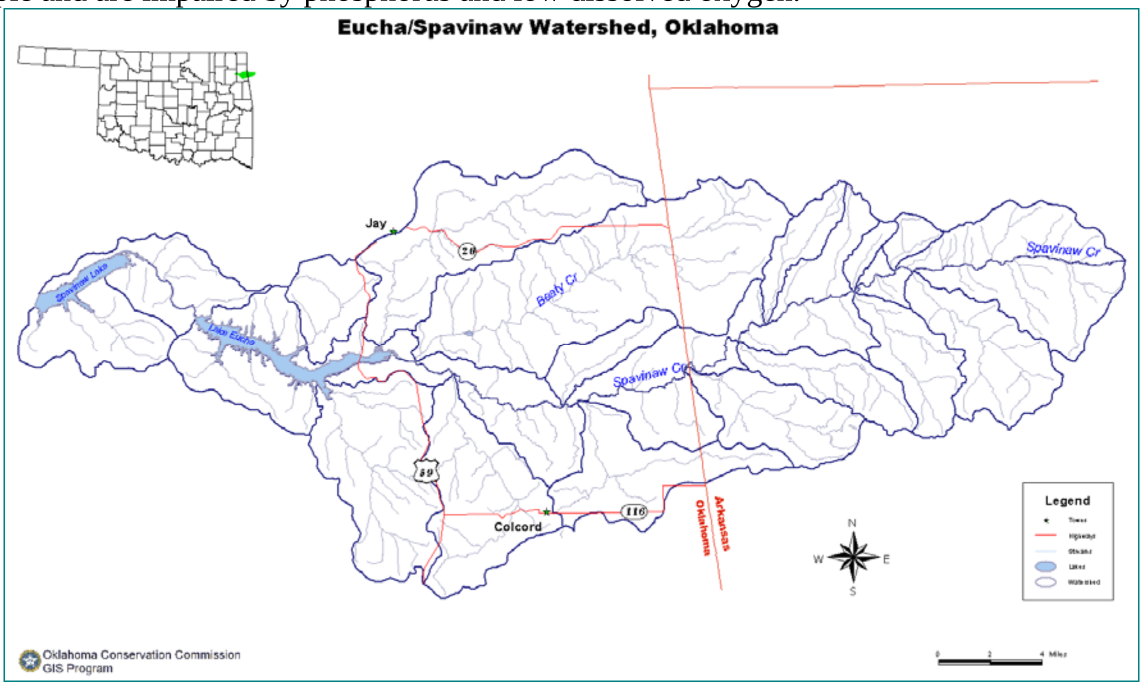
Oklahoma: Lake Eucha/Spavinaw

Contact: Dan Butler, Director
Oklahoma Conservation Commission
Water Quality Program
2800 N. Lincoln Blvd., Room 160

Oklahoma City, OK 73105-4110
Phone: (405) 522-4730
Fax: (405) 522-4770
dan.butler@conservation.ok.gov

http://www.environment.ok.gov/documents/CWA/GrantWorkplans/Eucha-Spavinaw%20Watershed%20Riparian%20Protection%20Initiative/EuchaSpavWBPRev2-07.pdf

The Lake Eucha/Spavinaw watershed is a transboundary watershed (60% in OK, the rest in AR, see figure) and has been the subject of conflict, including litigation, regarding its many point and nonpoint sources of pollution. The lakes supply drinking water to approximately 1 million people and are impaired by phosphorus and low dissolved oxygen.



The watershed based plan addresses each of the 9 components and includes adequate specifics for each. In particular:

- The plan contains clear quantitative goals complete with an explanation for choosing those goals and how the goals correspond to the load reduction goals and interim water quality criteria.
- All of the information in the plan was tied back to the goals of the plan, so there was very little extraneous information which made the plan very easy to read and comprehend.
- SWAT was used to determine sources of phosphorus, including point sources of phosphorus, and was calibrated with soil test phosphorus results. The model was also used to identify critical areas in the watershed to target implementation.

- Information used for the SWAT analysis was clearly documented, and information not crucial to the WBP was included in a separate report of the modeling efforts. Results were summarized in an easy to understand table in the report, with references to a separate report if more detail is needed.

- Assumptions of the analysis are clearly stated and explained.

- Barriers to attainment of goals are discussed (for example, soils supersaturated with phosphorus may take decades to deplete) but these barriers are not presented as an excuse for inability to attain standards, rather as something to be aware of throughout the implementation of the plan.

- Reasoning for the selection of BMP's is included with the corresponding estimated load reduction. In addition, several simulations were performed to see which practices might have the greatest impact on water quality.

- The cost estimate included BMP's, education, and monitoring, and included the responsible parties for each task. The delegation of work is particularly well explained in the educational activities, which lists each group involved and clearly states what the group will be doing.

- The implementation schedule includes load reduction goals associated with planned activities and a schedule for evaluating the actions to determine if any adjustments need to be made.

- One possible improvement for the plan would be to include more interim water quality criteria.

- The monitoring plan lists what parameters will be measured and who will be responsible for which monitoring activities, as well as a map where monitoring will take place.

Overall, the Lake Spavinaw/Eucha plan was one of the best reviewed, and should be shared as another example of an excellent watershed based plan.

Virginia: Hawksbill & Mill Creek

Contact: Richard Hill
Nonpoint Source Program Manager
Division of Soil and Water Conservation
Department of Conservation and Recreation
203 Governor Street, Suite 206
Richmond, VA 23129-2094
Phone: (804) 786-7119
Fax: (804) 786-1798
rick.hill@dcr.virginia.gov

http://www.deq.state.va.us/export/sites/default/tmdl/implans/hksmillip.pdf (Does not include the technical report)

Hawksbill & Mill Creek are tributaries of the South Fork of the Shenandoah River, located in the northern part of Virginia. Both waterbodies are impaired due to violations of the State's water quality criteria for fecal coliform and E. Coli. In Virginia, TMDL Implementation plans are required to be written for each TMDL and this plan was written under that requirement, taking into account watershed plan requirements from other programs, such as 319. The watershed plan for remediating Hawksbill & Mill Creek satisfies all 9 components of a watershed based plan. Highlights of the plan include:

- Several stakeholders in the watershed were involved in developing this plan. In addition to general public meetings, 3 specialized working groups (agricultural, residential, and government) were assembled to seek public input from specific stakeholders and a steering committee collected information from the different groups and guided the overall development of the plan. Throughout the rest of the plan it was clear that these groups were all very involved in the process.

- The assumptions of pollutant source analysis are clearly stated and discussed.

- Selection of management measures needed to control sources of pollution was well explained, and the public was included in selection of management measures to ensure implementation.

- The quantity of management measures needed to meet water quality goals was estimated using modeling, spatial analysis, and input from the public, and possible locations for these measures were identified in the plan.

- Education strategies that proved successful in other watersheds, which were identified by the working groups involved in plan development, were used in the implementation plan.

- This is one of the few plans that included a cost efficiency analysis of the BMP's selected; which consisted of a breakdown of pollutant removed per $1000 spent, as well as an explanation of the non-monetary benefits of the selected BMP's. This information, along with information gathered from a land use analysis, was used to prioritize implementation.

- All information, from pollutant reduction of BMP's to costs of implementation, was clearly referenced.

- A suggestion for improvement to this plan is to explain how this plan will be reviewed over time, specifically, who will be responsible for reviewing the plan to determine whether or not changes need to be made?

Hawksbill & Mill Creek plan is another excellent example of a watershed based plan.

Maryland: Lower Monocacy River

Contact: Kenneth Shanks
Acting NPS Program Manager
Maryland Department of the Environment

1800 Washington Boulevard, Suite 540
Baltimore, MD 21230-1718
Phone: (410) 537-4216
Fax: (410) 537-3873
kshanks@mde.state.md.us

http://www.watershed-alliance.com/mcwa_pubsWRASsupplement.html

The Lower Monocacy River plan is a supplement to the original Watershed Plan completed in May 2004. The Lower Monocacy River and its subwatersheds are listed as impaired for: fecal coliform (2002), nutrients (1996), sediment (1996), and impacts to biological communities (2002, 2004, and 2006). However, there is only 1 TMDL that has been approved and adopted in the watershed (Phosphorus & Sediments in Lake Liganore, an impoundment within the watershed). One TMDL has been submitted but has not been approved, and the rest were scheduled for development in 2008 and 2009. In the absence of completed TMDL's, the plan developers used stream corridor assessments and the Impervious Cover Model to identify causes and sources of pollution and estimate loads. This illustrates that an excellent plan can still be written with simpler models. Additional highlights of the plan include:

- The plan was successfully able to integrate information from several sources (such as TMDL's and Tributary strategies from the 2000 Chesapeake Bay agreement). The plan contained a lot of information, but it was easy to read because everything was summarized well and contained clear references to other documents.

- The chosen management measures were adequately described, and included assumptions about their operation and effectiveness.

- This was another one of the few plans that included a benefit cost ratio of pollutant removal to aid in prioritizing implementation actions.

- A responsible party is identified for each implementation action, and all actions are clearly tied back to the goals of the plan.

- Education and outreach efforts are linked to implementation actions and goals, and each activity has measureable outcomes.

- The watershed has an extensive and well organized network of watershed groups. Plan includes a list of all groups with contact information and a summary of the type of assistance each group can provide.

- Implementation schedule reports the status of implementation, as well as the schedule for future implementation.

- The County has an electronic implementation database to track the progress of the plan. The database also calculates expected pollutant removal for each BMP entered.

- The monitoring plan includes project level and watershed level monitoring. All monitoring efforts list who is responsible, and the monitoring parameters that will be measured at each monitoring location.

- The plan includes a section dedicated to discussing issues requiring further study, and strategies for resolving these issues in the future.

This plan would benefit from additional details on the implementation of agricultural BMP's, but it is mentioned that new goals are being adopted by the Tributary Strategy program and this information will be included in the next revision of the plan. Also, there is no explicit plan for reviewing and revising the watershed based plan, but considering this is a supplement of the original plan, it is clear that this work is being done.

Overall, the Lower Monocacy River plan provides an excellent example of a watershed based plan.

Best Examples for Individual Plan Components

Several plans reviewed, while not overall "the best", did excellent jobs addressing some of the required components of a watershed based plan. Appendix B lists these examples by plan component, and hopefully can be used by plan writers in the future.

Plans In Need of Some Improvement

The purpose of this report is to provide information that can be used to help move State watershed planning and implementation programs in the right direction. Identifying and describing some of the chief deficiencies found in some plans helps to achieve this purpose. In contrast, identifying specific States' plans as having specific deficiencies would not help achieve this purpose. Therefore, the discussion in this section and the following section does not provide names of specific States but does provide descriptions of shortcomings that should be avoided by all States.

Overall, one plan suffers from a lack of detail in certain components, but contains an excellent example of how to identify the causes and sources of pollution (component A of the 319 requirements.) The plan contains an excellent summery of existing data, and a great summary of management measures and why they are chosen. However, more information is needed to determine if the management measures chosen will achieve the pollutant reduction goals. There are no interim water quality goals, or any details on how the implementation of this plan will be assured, although the plan refers to several data sets that would be useful for further efforts.

A second plan was very easy to read because it was well laid out. For example, the 9 components of the plan are summarized in the appendix, and the plan includes a "using this document" section with summaries of each part of the plan right up front. However, there are several major flaws. While the whole plan is focused on future growth and how it will impact the stream, there doesn't seem to be any mention of revisiting the plan once it is implemented to make sure the plan is adequately meeting the water quality goals. There is no detail on reducing the impact of agriculture on water quality, even though it is a significant portion of the watershed.

A third plan suffers most from a lack of quantitative data. The plan does not include load estimates for identified sources of pollution, or load reduction estimates for the nonpoint source management measures selected to address pollutant sources. This might be because there is no TMDL in place. The state provides the option of a locally led watershed management planning effort in place of a full TMDL. However, while specific interim numerical water quality criteria were absent, there is a clear procedure for periodically reviewing plan progress. The implementation plan was very strong, and the management measures were listed with the specific overall goals, funding mechanisms, responsible parties, and information/education activities that would be used to promote the adoption of the measure. This made it very clear how every action proposed in the plan fit together. The monitoring plan was also very clear.

Plans in Need of Significant Improvement

One plan suffers from a lack of quantitative detail, especially regarding the expected pollutant-reduction benefits from management measures. There is also very little detail in terms of implementation. The evaluation of the plan that was conducted by the state DEQ, which was included with the plan, summarizes the issues best: "The TMDL provides specific numbers and pollutant reductions targets for the general basin. The (plan) provides information on general BMP's that will address pollutants in the TMDL, but they don't link specifically to load reductions or water quality numbers"

A second plan is missing several critical pieces of information required of a watershed-based plan, most notably the extent of management measures implementation needed to meet the goals of the plan, and load reduction estimates for the management measures that are identified. Without this information, there is no way to tell whether or not the proposed management measures are sufficient to meet the goals of the plan. There is also very limited implementation detail.

A third plan provided very little information, and the state supplemented this through a web- link to the statewide watershed based plan website to find any information missing from plan submitted. Few of the data gaps in the submitted plan were addressed in the documents on the website, since those documents focused on a much larger spatial scale (HUC 12 level) and none of them discussed the watershed in the submitted plan. Thus no information is provided in the plan regarding the watershed's water quality impairments, the types and quantities of sources, and all other similar relevant information. After reviewing the grant application and the other documents provided, an overall plan for addressing the water quality impairments in the watershed could not be determined. Actions are proposed in a grant application to address the water quality issues in the pond, but the expected impact is not. The amount or percentage of water quality impairment of this pond to be addressed by these projects is unstated. In addition, there is no discussion of a feedback loop and relevant monitoring related to this watershed.

Conclusions & Recommendations

This review of watershed plans from around the country indicated that while it is possible to meet the challenge of developing high quality watershed based plans, many plans fail to rise to that level. There is not a single clear reason for this; some plan developers may lack the expertise needed to develop a high quality plan, while others may be suffering from the lack of availability to sufficient information and resources. In some cases it may simply be the lack of sufficient effort or resources devoted to the development of the plan. It is clear that more needs to be done so all plans are of a quality that will support a successful implementation effort to restore impaired waterbodies. Specific recommendations are listed below:

- EPA Regional offices should use the results of this review to discuss with States the specific components that the states are struggling with, and to also share information from States that have successfully addressed those components.

- EPA Regions should work more closely with the States to assure that the States and their watershed partners have sufficient technical capacity and are investing sufficient funds to develop robust watershed-based plans that will lay a good foundation for a successful implementation effort that will restore the waterbodies being addressed to meet water quality standards.

- States' should take greater care in their development of watershed-based plans to assure that the plans truly address all nine components of EPA's guidelines and provide as good and specific a guidepost to future actions in the watershed as reasonably possible. The Section 319 program and grants guidelines allow each State to use up to 20% of its "incremental" watershed-based plan implementation funds to develop watershed-based plans. States should dedicate sufficient funds to the development of each watershed-based plan to assure that they will successfully address all nine components of these plans in a thoughtful and useful manner that will support successful implementation.

- EPA should follow up with the developers of the best watershed plans. Interviewing writers of successful plans would provide insight from those "on the ground" as to what resources contribute most to a successful plan. This information can in turn be used by EPA to prioritize training and tool development.

- EPA should make the best watershed plans, as well as the best examples of different components of watershed based plans, available online and in tools such as EPA Plan Builder. Overall, there seems to be confusion on "how much is enough". Several plans included extraneous information that made the plan hard to review and, most likely, less useful to those using the plan. Providing more examples of what is considered adequate will clarify what an excellent WBP should look like. EPA should also take actions to promote the resources available for WBP's.

- States should focus on developing plans at a scale that allows for the development of the right level of detail. This means, for example, that even if a State develops an integrated watershed plan at an 8-digit HUC level, it may, and likely will, need to develop a more detailed watershed-based plan at a smaller scale (e.g., HUC-12).

Appendix A: List of Watershed Based Plans Reviewed

Region 1		
State	*Contact*	*Watershed*
CT	Steve Winnett	Coginchaug River
MA	Warren Howard	Martins Pond
ME	Warren Howard	Spruce Creek
NH	Warren Howard	Webster-Highland Lake
RI	Margherita Pryor	Green Hill & Ninigret Ponds
VT	Warren Howard	Lake Carmi

Region 2		
State	*Contact*	*Watershed*
NJ	Donna Somboonlakana	Mulhockaway Creek
NY	Richard Balla	Chemung & Upper Susquehanna River
PR	Nesamarie Negron	Rio Grande De Loiza
VI	Donna Somboonlakana	Coral Bay

Region 3		
State	*Contact*	*Watershed*
DC		
DE	Fred Suffian	Indian River, and Indian River, Rehoboth and Little Assawoman Bay
MD	Fred Suffian	Lower Monocacy River
PA	Fred Suffian	Mill Creek
VA	Fred Suffian	Hawksbill & Mill Creek
WV	Fred Suffian	Martin Creek

Region 4		
State	*Contact*	*Watershed*
AL	Yolanda Brown	Indian Creek
FL	Yolanda Brown	Lower St. Johns River
GA	Yolanda Brown	Two Mile Branch
KY	Yolanda Brown	Corbin City Reservoir
MS	Yolanda Brown	Bee Lake
NC	Yolanda Brown	Smith Creek
SC	Yolanda Brown	May River
TN	Yolanda Brown	Oostanaula Creek

Region 5		
State	*Contact*	*Watershed*
IL	Amy Walkenbach (IL)	Bull Creek/Bull's Brook
IN	Andrew Pelloso (IDEM)	Salt Creek
MI	Robert Day (MDEQ)	Paw Paw River
MN	Thomas Davenport	Lake Independence
OH	Russ Gibson (OH EPA)	Bokes/Mill Creek

State
WI

State	Contact	Watershed
AR	Brad Lamb	Bayou Bartholomew
LA	Brad Lamb	Bayou Plaquemine Brule
NM	Brad Lamb	Jemez River
OK	Brad Lamb	Lake Eucha/Lake Spavinaw
TX	Brad Lamb	Plum Creek

Region 7

State	Contact	Watershed
IA	Suzanne Hall	Lake Hendricks
KS	Steve Schaff	Lower Big Blue River & Lower Little Blue River
MO	Peter Davis	Brush Creek
NE	Peter Davis	Carter Lake

Region 8

State	Contact	Watershed
CO	Marcella Hutchinson	Coal Creek
MT	Peter Monahan	Ruby River
ND	Peter Monahan	Beaver Creek and Seven Mile Coulee
SD	Peter Monahan	Belle Fourche River
UT	Peter Monahan	San Pitch
WY	Peter Monahan	Flat Creek

Region 9

State	Contact	Watershed
AS		
AZ	Jared Vollmer	Agua Fria
CA	Tina Yin	Agua Hedionda
Guam		
HI	Audrey Shileikis	Ko'olaupoko Moku
NMI		
NV	Stephanie L. Wilson	Carson River
TT		

Region 10

State	Contact	Watershed
AK	Rick Seaborne	Lower Kenai River
ID	Rick Seaborne	Pack River
OR	Rick Seaborne	Willamette River Basin: City of Lowell
WA	Rick Seaborne	Stillaguamish River

Appendix B: Best Component Examples from Watershed Plans

Puerto Rico's plan provides an excellent example of an approach to successfully implementing **component A**. Unlike most plans, model selection criteria are identified to guide model selection. Model input assumptions are clearly explained, and assumptions are supported with appropriate references. Explanation of the calibration process clearly lays out what information was used and data gaps that limited the analysis. The modeling results are presented by subwatershed, and each section includes a pollutant source assessment, priority ranking (with explanation), a breakdown of loading by source, and an analysis of seasonal variations or other critical factors that may exacerbate pollution issues. *Link: Rio Grande De Loiza, pp. IV-1 – IV-2; IV-18 – IV-28, V-2 – V-164*

The New Hampshire plan provides great examples for **components A-C**. The New Hampshire plan outlines different pollutant estimate approaches that apply to their watershed, clearly stating the limitations and assumptions of each. The pollutant source analysis begins with an in-depth study of the watershed completed several years ago using one of the more complicated approaches. Simplified approaches were then used to assess how conditions may have changed since the original study was completed.

STEPL was used to estimate the loads from individual sources of pollution in the watershed. All of the sources for information used in the modeling are listed, and while the model was not fully calibrated, an attempt was made to compare how the model results differed from monitoring results. Each possible pollutant source is further explored in the following sections, including relevant studies and visual evidence of problems that could not be taken into account using STEPL. Also included are measures to control the individual sources of pollution and estimated load reductions, explicitly linking pollutant control measures to specific sources of pollution. The information about pollutant source loads and control measures are summarized in a table as an easy reference. *Link: Coginchaug River, p. 7 – 47*

The Mill Creek plan from Pennsylvania does a good job of identifying NPS management measures that need to be implemented to meet the goals of the plan. Plan writers not only have an idea for which BMP's to install (**component C**), but where they should be installed and to what extent (acres treated by a cover crop, length of fencing, etc). This level of specificity suggests that plan writers are intimately involved in this watershed and provides confidence that the plan, once it is implemented, will succeed. The Mill Creek plan also provides a detailed cost estimate for each proposed BMP (**component D**). .Potential funding sources are also identified for the different types of BMP's. *Link: Mill Creek, p. 24 – 46*

The Coal Creek plan from Colorado addresses **component C** with a short table that summarizes the appropriate management measures and how those measures work to reduce pollution. The Coal Creek plan also uses a summary table to illustrate gaps in the monitoring data used for quantifying the causes and sources of pollution. *Link: Coal Creek, pp. 8 – 9; 49*

The Washington State Stillaguamish plan follows a similar format as New Hampshire to address **component C**, providing a section to discuss each source of pollution, specific problem areas and the management measures that should be used to address each source. The watershed characterization in this plan is very thorough and allows for the ability to very specifically target sources of pollution with management measures. This is also one of the few plans that addresses temperature, and does a great job explaining suspected causes of impairment and targeting specific areas for management actions.

The plan also does an excellent job identifying sources of technical assistance, which is part of addressing **component D**. Partners are identified from the federal to the local level and specific actions are identified for each partner. These expectations are described in text, and then summarized in an "Implementation Tracking Sheet" to easily keep track of the tasks that need to be accomplished by which partner. This differs from most of the plans reviewed; most identified partners but did not specify what these partners were expected to contribute. *Link: Stillaguamish River, pp. 14 – 87; D-3 – D-7*

The Agua Hedionda watershed plan from California does an excellent job describing the NPS management measures that will need to be implemented to meet the goals of the plan (**component C**). Each management measure includes a detailed explanation for why it was chosen and where exactly it would be implemented, and most measures also include a strategy for prioritizing implementation. Maps of critical implementation areas enhance the presentation of this information, and cost estimates are included. A discussion of potential funding sources is also included (**component D**). The education/information component identifies target audiences and activities to reach these audiences, and it outlines specific goals for outreach activities (**component E**). The monitoring component of this plan is very clear (**component I**). Monitoring indicators are specifically linked to plan objectives. The plan also lays out the groups responsible for the different pieces of the monitoring plan and recommends specific monitoring locations that would enhance the ability of watershed managers to determine if the implementation efforts are working over time. *Link: Agua Hedionda, see Chapter 6*

The implementation piece of Wyoming's plan for Flat Creek is very strong. The management measures are broken down by the goal the measure is meant to address along with cost estimates, possible funding sources, responsible parties and information/education activities that would be used to promote the adoption of the measure **(components D, E, F, G)** This made it very clear how every action proposed in the plan fit together. The implementation summary table also makes clear how the monitoring efforts will be used to ensure goals are being reached (**component I**). Many of the plans reviewed contained a lot of information, and it was not always clear how the information would be used to implement the watershed plan. By summarizing information in this way, it is clear how each and every piece of information in the plan fits into the overall watershed goals. The Flat Creek Plan also outlines a clear procedure periodically reviewing the plan to ensure progress is being made and that the plan is revised as new information is collected. *Link: Flat Creek p. 30 – 37*

The education/information section (**component E**) in the Lake Hendricks plan from Iowa is presented in a question and answer format that clearly illustrates the decision process the plan writers followed to choose information/education activities that would be effective. Unlike most other plans, barriers to practice adoption are identified in advance along with strategies to overcome those barriers. Also, plan writers interviewed landowners in person to get a better idea of how to target the information/education campaign. *Link: Lake Hendricks See Information & Education Section.*

The education and outreach strategy (**component E**) in the Bee Lake watershed plan from Missouri includes indicators for success, which is not present in other plans. The plan also assigns responsibility for each education/information activity to a specific party, and provides a detailed cost estimate for each activity. The Bee Lake plan also includes a good summary of data used for quantifying causes and sources of pollution. *Link: Bee Lake pp. 11 – 13; 40 – 51*

Tennessee's watershed plan for Oostanaula has a clear implementation schedule (**component F**) and does a good job describing measurable, interim milestones in addition to the implementation schedule and setting criteria that can be used to determine whether loading reductions are being met over time (**components G, and H**). *Link: Oostanaula Creek pp. 55 – 57; 60 – 62*

The Lower St. John's River Basin watershed plan from Florida contains one of the most detailed sections on how the monitoring component would be used to evaluate effectiveness of the plan over time (**component I**). An explanation why different modeling stations and parameters were chosen is included, in addition to a map of monitoring stations (that also illustrated which subbasins the stations corresponded to). Most other plans reviewed did not go very far beyond a map of stations, if a map was included at all. The monitoring efforts are summarized in a table that listed the monitoring stations, what parameters would be monitored at each station and how often, and who would be responsible for carrying out the monitoring. The plan also explains how the monitoring database would be managed, which is another factor missing from most other plans. The plan also includes a thorough discussion of the assumptions made in the analysis of causes and sources of pollution. *Link: Lower St. Johns River, pp. 8 – 12; 80 - 90*

Indiana presents its causes and sources of pollution in a table, complete with an explanation for suspecting each source. It is very clear what previous monitoring was used to verify/quantify each pollutant source. *Link: Salt Creek, p. 97 – 101.*

Hawaii developed a unique way to prioritize project implementation in the Koolaupoko watershed plan that takes into account factors such as landowner support, as well as factors such as BMP efficiency. This plan also includes a really good discussion of the model used for watershed analysis that includes assumptions and limitations. *Link: Ko'olaupoko Moku, p 3-7 – 3-11; Appendix B*

The Carter Lake plan from Nebraska is one of the only plans that included an economic valuation of the waterbody. *Link: Carter Lake, p. 8 – 11*

The Chesapeake Bay Tributary strategy from New York has a very detailed section discussing the information needed to refine the plan in future iterations. *Link: Chemung & Upper Susquehanna River , p. 76 – 83*