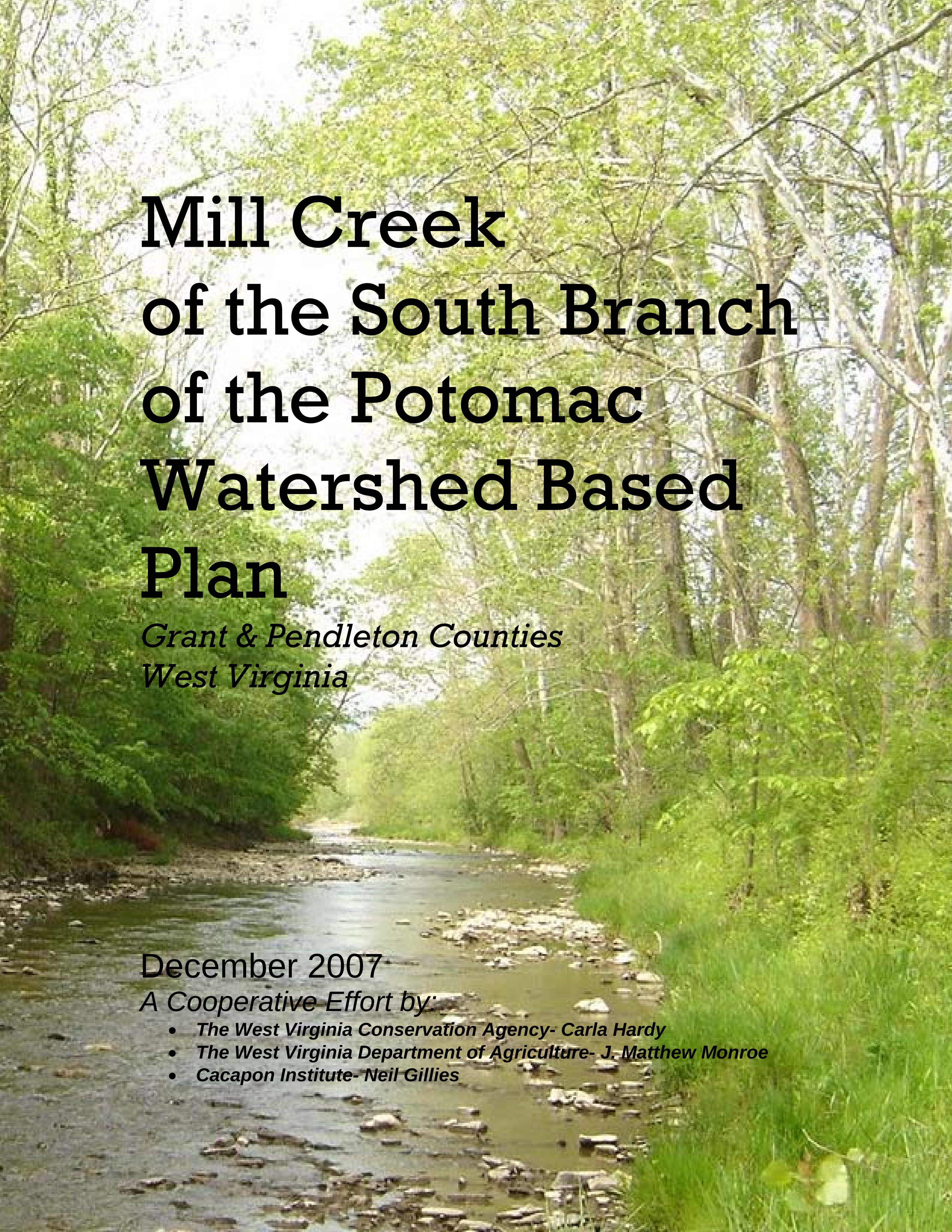

Mill Creek of the South Branch of the Potomac Watershed Based Plan

Grant & Pendleton Counties
West Virginia

December 2007

A Cooperative Effort by:

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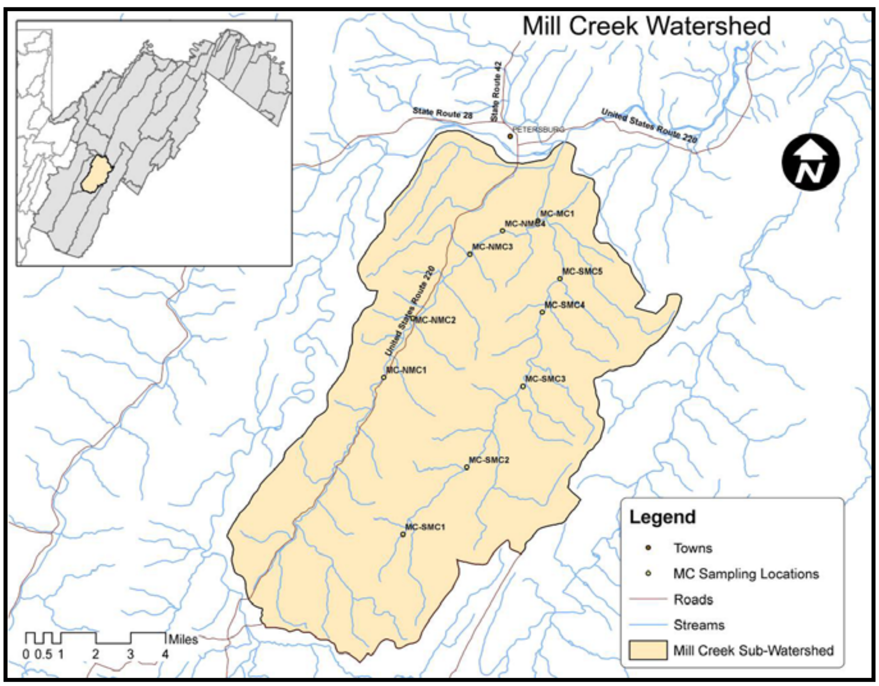
Introduction

This document serves as a broad overview of the 103.9 square mile Mill Creek watershed that lies within Grant and Pendleton Counties, West Virginia. It will serve as a foundation document that can be used (and supplemented if necessary) to seek funds of all types from federal, state, local or private sources to make improvements to the water quality within the drainage area. This document will address the 1998 TMDL developed by the US Environmental Protection Agency and will address the required load reductions of fecal coliform as well as addressing other nonpoint source pollutants as appropriate.

The Mill Creek watershed was chosen as a "priority watershed" by the West Virginia Chesapeake Bay Implementation Committee. The decision to concentrate implementation efforts in this drainage was based upon several factors including a history of impaired water quality with a strong baseline of monitoring data, other water quality enhancement efforts currently going on within the watershed, the rural nature of the watershed, and the strong agricultural presence.

Geographical Extent



The Mill Creek Watershed, which includes North and South Mill Creeks, as well as the Mill Creek main-stem, originates in Pendleton County, West Virginia. Both of the tributaries flow northeast, and converge into Mill Creek just north of Dorcas, in Grant County. Mill Creek then flows approximately 2.4 miles further until it joins the South Branch of the Potomac River. This River continues north until it joins the North Branch to form the Potomac River which ultimately flows into the Chesapeake Bay.

The Mill Creek Watershed lies in an area of West Virginia characterized by unique Ridge and Valley topography. This topography is characterized by long, even ridges, with long, continuous valleys in between.

These curious formations are the remnants of an ancient fold-and-thrust belt, west of the mountain core that formed in the Alleghenian orogeny (Stanley, 421-2). Here, strata have been folded westward, and forced over massive thrust faults; there is little metamorphism, and no igneous intrusion.(Stanley, 421-2) The ridges represent the edges of the erosion-resistant strata, and the valleys portray the absence of the more erodible strata. Smaller streams have developed their valleys following the lines of the more easily eroded strata. But a few major rivers, such as the Delaware River, the Susquehanna River, and the Potomac River are evidently older than the present mountains, having cut water gaps that are perpendicular to hard strata ridges. The evidence points to a wearing down of the entire region (the original mountains) to a low level with little relief, so that major rivers were flowing in unconsolidated sediments that were unaffected by the underlying rock structure. Then the region was uplifted slowly enough that the rivers were able to maintain their course, cutting through the ridges as they developed.

Land use in the watershed is predominantly in agricultural production and forestland with minimal urban presence. Agricultural activity in the Mill Creek watershed consists mainly of beef cattle and poultry production.

While the watershed is rural, it includes several small communities such as Landes, Rough Run, and Dorcas. Dorcas Elementary is a small school situated near South Mill Creek. There are also a handful of housing developments in the watershed with plans for additional developments in the future. The West Virginia Division of Natural Resources operates two fish hatcheries/rearing facilities; one on Spring Run and the second on Johnson Run. Grant County operates a small airport in the easternmost section of the watershed and Allegheny Wood Products, a hardwood lumber production company, is located adjacent to Johnson Run.

There are four watershed dams located within the drainage. They are sponsored and maintained by the Grant County Commission and the Potomac Valley Conservation District. They include:

- N/S Mill Creek #3 located on Rough Run Road , east of Petersburg, 105' in height
- N/S Mill Creek #4 located on County Rt. 9, west of Petersburg, 82 ' in height
- N/S Mill Creek #16 located in Gum Hollow, west of Petersburg 67' in height
- N/S Mill Creek #7 County Rt. 9. Dorcas 75" in height

TMDL Discussion

The U.S. Geological Survey (USGS) conducted a study from March 1994 to August 1995 for the Potomac Headwaters (PHIWQP, 1996). The USGS reconnaissance survey provided the best long-term multi-year data set at that time. The results indicated that more than 25% of the Mill Creek samples had fecal coliform concentrations greater than 200 cfu/100 ml. Based on this data, Mill Creek was considered threatened and placed on West Virginia's 303(d) list of water quality impaired streams for fecal coliform bacteria contamination. (Note: since the sampling frequency was less than 5 per month, it was not possible to determine whether Mill Creek was in compliance with the 200 cfu/100 mL State standard for fecal coliform.) A TMDL was developed (EPA, 1998) that reported the need for fecal coliform contamination to be reduced by 37.7% to achieve the State water quality standard of not exceeding 200 cfu/100 mL for a 30-day geometric mean of five or more samples or not exceeding 400 cfu/100 mL for an instantaneous sample.

The TMDL (EPA, 1998) described the load reduction needed for the non-point source pollutants to be as follows:

Table 1. Non-point Source Load Reductions to Meet TMDL Allocation (EPA, 1998)

Land Use	Annual Allocation (cfu)	% Reduction
Agriculture and Pasture	9.1869×10^{14}	37.7
Urban	1.6429×10^{12}	0
Forest	4.3364×10^{13}	0

The TMDL did not consider fecal coliform bacteria from failing septic systems, or urban or forest land uses to be significant contributors to the Mill Creek's fecal coliform problem.

The TMDL was developed based on a fairly limited data set. Since that time, Mill Creek was the focus of an intensive six-year water quality monitoring project by the West Virginia Department of Agriculture. 3,783 samples were collected at 10 sites, which provided a much more detailed understanding of Mill Creek's water quality, and assisted in deciding on areas in need of particular focus, by this WBP.

The water quality section of the Division of Water and Waste Management conducts monitoring in the South Branch Watershed on a five year cycle through its Watershed Assessment Program. The Program will not be back in the watershed again until possibly 2011 to monitor. The WVDEP website states that a new updated TMDL is possible in 2014 or 2019.

A. Causes and Sources of Impairment

Fecal coliform bacteria are found in the intestines of warm blooded animals. When excreted, these bacteria have the potential to cause impairment of water bodies in violation of fecal coliform bacteria water quality standards. No permitted point sources with effluent containing fecal coliforms exist in the watershed, so the entire bacteria load in Mill Creek is non point in origin. Non point sources of fecal coliform bacteria can enter the stream through direct deposition or via surface runoff from the watershed's lands. The non point sources identified in the Mill Creek TMDL (USEPA, 1998) included animal agriculture, human, wildlife, and domestic animals.

The Mill Creek Watershed is rural, with a human population distributed at low density throughout the watershed. Approximately 2,350 residents use septic systems; some of these may be straight pipes. Failing septic systems and straight pipes can discharge fecal contamination into water bodies and contribute to the fecal coliform loads.

The Mill Creek Watershed is home to abundant wildlife due to the small human population, the large amount of forestland, and high quality forage "supplied" by agriculture. The TMDL estimated that wildlife contributes to the fecal coliform loads entering Mill Creek. It allocated wildlife bacteria to forest lands, and considered these bacteria to represent a background condition not subject to control. The TMDL document estimated the numbers of common wildlife living in or migrating through the watershed to be: deer- 2547, geese- 60, and ducks 30, along with a small number of bear.

The TMDL documented cattle and poultry production. Within the Mill Creek Watershed, at that time, there were 38 broiler houses and 2 breeder houses, housing approximately 1,064,000 broilers and 18,000 breeders, respectively. The estimated number of cattle in the watershed was 740, distributed between pasture and 24 cattle feedlots and winter feeding areas. The density of cattle was assumed at 1 cow per 4 acres.

Table 2. Potential non point fecal coliform production in the Mill Creek watershed (summarized from TMDL 1998, Table 4.1.6)

Potential Source cfu/day						
Poultry	**Cattle**	**Ducks**	**Geese**	**Deer**	**Septic**	**Total**
2.597E+14	**3.996E+12**	**3.3E+11**	**2.94E+12**	**1.274E+12**	**1.555E+09**	**2.682E+14**
96.831%	**1.490%**	**0.123%**	**1.096%**	**0.475%**	**0.001%**	**100%**
Potential Source cfu/yr (extrapolated from TMDL)						
Poultry	**Cattle**	**Ducks**	**Geese**	**Deer**	**Septic**	**Total**
9.47905E+16	**1.45854E+15**	**1.2045E+14**	**1.0731E+15**	**4.6501E+14**	**5.67575E+11**	**9.7893E+16**
96.831%	**1.490%**	**0.123%**	**1.096%**	**0.475%**	**0.001%**	**100%**

The 1998 TMDL estimated potential fecal coliform production in the watershed from each of the major identified sources (Table 2). Integrated poultry agriculture produced 97% of the potential fecal coliform bacteria in Mill Creek, followed distantly by cattle and Canadian geese. Waste generated by cattle and poultry was assumed to be applied to agricultural lands within the sub watersheds where it was produced, either as fertilizer for pasture and crops or direct deposition by cattle. The TMDL allocated waste generated by wildlife to forest lands. The septic failure rate was estimated at 2.5% of all households, with 100% of failed loads reaching receiving waters (at 10,000 cfu/100 ml with 70 gallons per capita per day).

However, the TMDL noted a distinction between the potential sources of fecal coliform bacteria and sources of bacteria loads that actually reach the receiving waters. Bacteria deposited as agricultural or other waste on the land can die through natural attenuation processes, and some of the remaining bacteria loads can be prevented from reaching the streams through land management practices. The annual baseline in-stream bacteria load reported in the TMDL was 1.552% of the potential load, allocated across agriculture, forest, urban and septic source categories (Table 3).

Table 3. Annual Baseline and Allocation Loadings. (data from TMDL)

	Agriculture	Forest	Urban	Septic	Total	% of Potential Bacteria
Baseline Load	1.4737E+15	4.3364E+13	1.6429E+12	5.6758E+11	1.519E+15	1.552%
Allocation Load	9.1869E+14	4.3364E+13	1.6429E+12	5.6758E+11	9.643E+14	0.985%
Difference	5.5501E+14	0	0	0	5.55E+14	
% reduction	37.66%	0	0	0	0.3653125	
% allocated	95.274%	4.497%	0.170%	0.059%	100.000%	

The TMDL proposed that reducing the baseline load by 37.7% from agricultural sources would be required to meet water quality standards (the allocation load, Table 3). It did not suggest that reductions in bacteria from human or wildlife sources would be of use. However, the TMDL provided no guidance on the modeled fate of the various potential sources (other than failed septic which is assumed to flow without attenuation to the stream). In other words, the TMDL did not provide a baseline load that translated gross potential fecal coliform production from each of the major fecal coliform bacteria producers into their estimated contributions to the baseline load.

The Watershed Based Plan working group considered proximity of <u>any</u> potential fecal coliform source to a receiving water to be the most important indicator that a potential source could become an actual cause of fecal coliform impairment in Mill Creek, and considered all reasonable sources in the stream corridor rather than limiting its focus to either agriculture in general, or poultry in specific.

Table 4. Estimating Agricultural Lands Contributing to Fecal Coliform Impairment	
Miles of Streams	27.6
sq miles with 400' corridor	2.1
Corridor acres (sq mi x 640)	1337
Total Agricultural Acres (from TMDL)	19168
% stream corridor to total	7.0%

The TMDL spread agricultural loads evenly across all agricultural lands. In order to segregate farm land with a high likelihood of delivering fecal bacteria to the stream from farm land that is unlikely to contribute, the working group began by assuming that only bacteria deposited on lands within 200 feet of the major streams are likely to contribute to impairment in Mill Creek, and bacteria deposited on other lands are not. The working group then developed a rough estimate of the amount of land in the "high likelihood" category by adding the length of south and north Mill Creeks, plus the Mill Creek itself, and multiplied times 400 feet. This resulting number, when divided by the total amount of agricultural land in the watershed, estimated that seven percent of total agricultural land falls in the "high likelihood" category (Table 4).

As the TMDL assumed poultry waste was spread across all agricultural lands in the watershed, the "likely" poultry contribution to the baseline load was obtained by multiplying the potential poultry load (Table 2) by seven percent (the high likelihood percentage).

Calculation of a "likely" cattle load was more complicated than poultry because cattle move and are moved across the landscape. Two components of the cattle load were considered of particular concern for bacterial impairment: direct deposition in streams and manure deposited in concentrated feeding areas located beside streams. Information developed for the Naked Creek (Virginia) TMDL (VA DEQ, 2002) was used to estimate the percentage of time cattle spend in streams and the percentage of the potential cattle load that might be direct deposited and not subject to attenuation. The calculated percentage was 6.4% (see Appendix A). It was assumed that 50% of the cattle in the watershed spend four months per year in concentrated feeding areas (feedlots and winter feeding areas), that 50% of these feeding areas are located beside streams and that 20% of fecal bacteria from these sites is direct deposited or runs off into streams. This is based upon the working group's best professional estimate. The percentage of the potential cattle load in the above two categories (direct deposition and feedlot direct runoff) is considered the most directly identifiable, quantifiable and addressable bacteria source in the Mill Creek watershed. The remaining balance of the cattle load was multiplied by seven percent (the high potential percentage) to obtain a "likely" stream corridor cattle load.

Table 5 Relevant Loads		Percent Baseline Agriculture and Forest Load
	Cattle Direct Deposited	5.1%
	Feedlot Runoff	1.6%
Stream Corridor Deposits	Cattle manure	1.2%
	Poultry Litter	84.6%
	Geese deposited 50%	6.8%
	Deer deposited 10%	0.6%
Total		100.0%

The "forest" wildlife load as defined in the TMDL is, in fact, not strictly a forest load. Wildlife are often drawn to feed on high quality forage provided by agricultural lands, geese and deer in particular, and prime agricultural land in this area is generally located in or near the floodplain. For much of the year, woodlands in this area offer little in the way of browse due to the large deer population. Since the potential goose and deer fecal coliform production (Table 2) are quite significant relative to cattle, and since both species spend significant amounts of time feeding and resting on agricultural lands near streams, then land management practices (vegetative buffers) that impede the transport of agricultural bacteria to the stream will work equally well for bacteria from these animals. For the purpose of calculating the relevant loads, it was assumed that 50% of the potential goose production and 10% of the potential deer production was direct deposited on the "relevant" agricultural lands defined above. Again, this was based upon the best professional estimate of the working group. This calculation makes geese, in particular, an important component of the baseline load (Table 5).

WVCA/WVDA watershed resident survey. Table 6		
	Score	Ranking
GW/well protection	264	1
Fecal coliform	355	2
Failing septic	430	3
Erosion/ sediment	424	4
Agriculture	440	5
Fish kill/intersex	475	6
Nutrients	492	7
Development pressure	494	8
Forest management	515	9
Decline recreation	576	10

Although the TMDL did not indicate that failing septic contributes a significant fecal coliform load to Mill Creek, a landowner survey conducted by the WVCA/WVDA (Table 6) identified failing septic tanks as a concern to the residents of the Mill Creek watershed. As even a small source can readily cause fecal coliform impairments in small streams, the WBP working group also considered failing septics as potentially important. However, as most residences in the Mill Creek watershed are not located adjacent to the river or drainage features, only those in reasonable proximity to drainage features and streams will be assessed as possible threats of septic and other "urban" contamination.

Since the TMDL was developed, significant funding has been allocated to this watershed to address water quality concerns related to agricultural operations. The USDA-NRCS PL-534 project was able to provide $1,029,900.00 with 40% of this cost, $411,960.00 coming from the landowner. Through this program and other Farm Bill funding, farmers have been able to implement manure storage facilities, relocate feedlots from stream sides, and install alternative watering sources. Approximately 53,353 feet of streambank fencing was also installed. Although past programs have provided considerable assistance to the agricultural producers in the watershed, there are still many landowners who need additional assistance to reduce agricultural runoff, limit livestock access to the river, and stabilize the river's banks.

The practice of transporting litter out of the watershed is not likely to reduce the use of litter on prime agricultural lands in the floodplain, and therefore did not figure into reductions in the "likely" bacterial source category.

As noted above, the USGS reconnaissance survey conducted from March 1994 to August 1995 provided the best long-term multi-year data set of fecal coliform bacteria for use in developing the Mill Creek TMDL. The USGS study had a single site on Mill Creek. Fecal indicator data from that site indicated that the source of bacteria were likely not human. Since that time, however, a six-year study by the WVDA collected numerous data at ten sites in the watershed: one below the confluence of North and South Mill Creeks, four along North Mill Creek, and five along South Mill Creek (Table 7).

Table 7. Summary of fecal coliform bacteria data for sites in the North and South Mill Creek watersheds, 1998-2005. (from WVDA, 2006)

SAMPLING SITE	Number of Samples	Statistics					
		25%	50%	75%	90%	Max	Mean
North MC@Landes (MC-NMC1)	309	38	78	200	568	20400	328
North MC@Rt 220 Bridge (MC-NMC2)	233	55	170	418	778	22000	418
North MC@2nd Bridge (MC-NMC3)	304	32	91	239	609	34000	454
North MC@1st Bridge (MC-NMC4)	230	35	91	230	552	34000	439
South MC@S. MC Church (MC-SMC1)	234	133	420	1560	2732	692000	5261
South MC Below Dam (MC-SMC2)	309	24	90	283	716	5400	293
South MC@Rough Run (MC-SMC3)	231	28	77	183	420	4600	220
South MC@1st Bridge (MC-SMC4)	300	35	104	265	760	7300	368
South MC@Spring Run (MC-SMC5)	233	30	82	196	538	9200	249
Mill Creek Below Forks (MC-MC1)	310	60	190	468	802	11200	427

The WVDA report noted that: "At least 10% of the data at all sites exceeded 400 cfu/100 ml, many by a considerable amount. 25% of the data at all sites except SMC3 and SMC5 exceeded 200 cfu/100 ml. Site SMC1, located at the headwaters region of South Mill Creek, has exponentially higher bacteria concentrations than the other sites in the sub-watershed, including the next sampling site (SMC3) less than 3 miles downstream. A flood control lake just downstream from SMC1 likely reduces farther downstream impacts from bacteria found at this sampling site; however, their origin is cause for concern."

Overall, this data indicated that delivery of fecal coliform bacteria in excess of water quality standards to the receiving stream occurs episodically throughout the watershed, but that some areas might require special attention. For example, the SMC1 site that was notable for consistently elevated bacteria counts has, in the vicinity of the sampling site, a large swine farm located on a small tributary of South Mill Creek, a cluster of houses near the stream, and a cluster of poultry houses located some distance off the stream. Any or all of these potential sources may have contributed to the high bacteria levels seen at that site.

The TMDL was written as a result of the listing of Mill Creek for fecal coliform impairment and does not identify other non point pollutants to be of concern. However, the community (Table 6) has additional concerns that will also be addressed in this plan. The community is concerned with, in ascending order, source water protection, failing septic tanks, excess erosion and sedimentation, agriculture, the regional problem of unexplained fish kills and intersex, nutrients, development pressure, forest management, and a perceived decline in recreation. Regionally, there is a push to reduce sediment and nutrient loads in area streams that feed the Chesapeake Bay. Fortunately, many of the same techniques used to reduce the transport of fecal coliform bacteria into streams, such as riparian buffers and fencing, also reduce movement of sediment and nutrients.

B. Estimate of Load Reductions

Load reductions were estimated using a simple accounting spreadsheet with pollution reduction efficiencies based upon those. According to spreadsheet calculations, if the below listed BMP's are installed at the projected numbers, the percent fecal reductions will be 31.71%. Please refer to Appendix A for the complete calculations of the load reduction model. Septic upgrades and wetland restoration have also been included in this mitigation project based upon community concern and interest. Conversations with county sanitarians identified at least six potential septics within the floodplain that are possibly out of compliance. The working group feels that these are a contributing source and should be addressed.

Table 8. Estimates of Load Reductions

BMP	**New Planned Units**	**Fecal Coliform Reduction**
Re-location of Feedlots	3 systems/ 150 head	6.899 E+12
Barnyard Runoff Control	2 systems / 50 head	2.300 E+12
Riparian Buffers	400 acres	2.963 E+14
Fencing w/Alternative Water Sources	200 acres / 150 head (of the above 400 acres)	1.703 E+13
	Post TMDL but Pre WBP Practices	
Fencing	245 acres	1.815 E+14
TOTAL REDUCTION		**5.040 E+14 (33.17%)**

C. Non-point Source Management Measures

The working group recommends use of the following nonpoint source (NPS) management measures to reduce fecal coliform and nutrients, from entering Mill Creek. Where USDA/NRCS standards apply, they should be followed.

- *Animal Waste Storage Facility*- A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure. The purpose of this BMP is to temporarily store wastes such as manure and contaminated runoff and prevent runoff from entering near water bodies.

- *Re-location of Feedlots*- This involves moving the feeding area away from the river so that the waste deposited on the fields is further removed from the river.

- *Barnyard Runoff control*: a facility for collecting and disposing of runoff water from roofs. Such facilities include but are not limited to erosion resistant channels or subsurface drains with rock-filled trenches along building foundations below eaves, roof gutters, downspouts, and appurtenances.

- *Riparian Buffers*– Vegetation planted or natural regeneration of trees or and/or shrubs along the stream banks which filter bacteria, nutrients, sediments, and other pollutants from runoff as well as removing nutrients from groundwater. During high water and flooding events, tree roots keep soil from washing away. A 35-foot minimum width is necessary to achieve significant benefit from this measure. This practice is one of the most effective for reducing sediment entering a waterway, but it is very difficult to establish because of the current high density of white-tailed deer in the region (estimated at 75 deer per square forested mile, using figures from the TMDL). All attempts to establish this type of buffer should include use of 6-foot translucent tubes to protect young trees from damage from grazing. In areas of low deer density, un-maintained vegetative buffers could eventually grow into woody buffers.

- Alternative watering sources
    - *With fencing:* To eliminate instances of cattle coming into direct contact with a stream, a narrow strip of land along the stream bank can be fenced off. Alternative watering sources, such as troughs or tanks, must then be provided for the cattle. Cattle are thus prevented from physically disturbing the river banks, thus decreasing sediment entering the river, and decreasing bank erosion. They are also prevented from defecating in or close to the river.
    - *Without fencing:* Instances of cattle in the river can be reduced by providing alternative sources of water (as described above) and shade that are removed from the river. The benefits mentioned above (with fencing) would still apply to a lesser degree.

  - *Alternative watering sources with fencing and rotational grazing:* This practice combines riverbank fencing and alternative watering with cross fencing systems to create paddocks to enable flash rotational grazing (according to NRCS standards) of small areas in sequence. Flash grazing in riparian areas can be allowed under tightly controlled circumstances, allowing agronomic benefit to the farmer while also maintaining much of the value of that riparian land as a buffer. It is beneficial in restricting access of animals from the river, but increases animal stocking rate and manure concentration per acre, which may adversely impact the quality of surface water runoff (Strategy, Appendix 6).

- *Nutrient Management Plans:* Farm operators develop a comprehensive plan that describes the optimum use of nutrients to minimize nutrient loss while maintaining yield.

- *Animal Waste Management Systems:*- Poultry and livestock operators design practices for proper storage, handling, and use of wastes generated from confined animal operations. This includes a means of collecting, scraping, or washing wastes and contaminated runoff from confinement areas into appropriate waste storage structures. For poultry operations, litter sheds are typically used. For livestock, moving feedlots away from the streamside is an effective strategy.

- *Wetland Restoration* : Re-establish the natural hydraulic condition in a field that existed prior to the installation of subsurface or surface drainage. Any wetland classification including forested, scrub-shrub or emergent marsh .

- *Septic upgrade:* Identification of non-complying septic systems by the County Sanitarian located adjacent or within close proximity of the stream. Installation of new or upgrades for existing home systems.

D. Technical and Financial Assistance

The West Virginia Conservation Agency (WVCA) will be the state agency coordinating the implementation of the BMPs, reporting, and the management of any future 319-Incremental Grants as well as offering support for education and outreach efforts.

The West Virginia Department of Agriculture (WVDA) will assist the WVCA with implementation and reporting as well as coordinate the water quality monitoring of Mill Creek.

Cacapon Institute (CI) will assist in education and outreach as well as monitoring, as appropriate.

USDA Natural Resources Conservation Service NRCS) will provide technical assistance for BMP implementation.

WVU Extension Service will assist in education and outreach activities to promote implementation.

The Potomac Valley Conservation District (PVCD) will administer funding for the implementation of this watershed based plan. Low interest loans will be pursued through the State Revolving Loan Program as appropriate.

West Virginia Department of Environmental Protection's Division of Water and Waste Management will provide technical assistance in the implementation of the watershed based plan through the Watershed Assessment Program and the Nonpoint Source Program. The water quality section of the Division of Water and Waste Management conducts monitoring in the South Branch Watershed on a five year cycle through its Watershed Assessment Program. The program provides information on the severity of existing or potential pollution sources, evaluates the potential for cleanup, and supports stakeholders in the implementation of management and control measurers. The NPS Program is funded primarily by the Clean Water Act Section 319 Grants in order to:

- Educate the public and land users on non-point source issues
- Support citizen based watershed organizations
- Support enforcement of non-point source water quality laws
- Restoration of impaired watersheds

Another technical assistance program within WVDEP is the WV Save Our Streams Program. This is a volunteer monitoring program that trains West Virginia citizens of all ages, how to monitor and become watchdogs over their local wadeable streams and rivers. This program has proven to be an invaluable asset in educating members of the general public and watershed associations.

The financial assistance to carry out the findings of this watershed based plan is estimated to be **$931,500.00** total. These costs are based upon FY 2007 EQIP Costs approved by the Potomac Valley Local Work Group as well as other current, ongoing conservation programs being implemented in the Potomac Valley. Existing Farm Bill Programs such as the Conservation Reserve Enhancement Program (CREP), Environmental Quality Incentive Program (EQIP), Wetland Reserve Program (WRP), West Virginia Onsite System Loan Program, US Fish & Wildlife Partners for Fish & Wildlife, Trout Unlimited Home Rivers Initiative Potomac Headwaters Restoration Project, and WV Section 319 Program are all options for funding the implementation necessary to meet the fecal coliform reduction goals. It is anticipated that the Clean Water State Revolving Fund Loan Program will also be utilized as an incentive for participation.

Table 9. Costs Associated with Implementation

BMP	Planned Units	Cost/Unit	Total
Animal Waste Storage System and/or Relocation of Feedlots with Runoff Control	**5 systems**	**Avg~$75,000**	**$375,000.00**
Riparian Buffer Establishment	**400 acres**	**$1,000.00/ac**	**$400,000.00**
Fencing with Alternative Water	**200 of the above 400 acres of fencing. 10 alternative watering sources**	**$2.50/acre for fencing. Alternative watering varies based upon situation. Using average of $3,000 per watering BMP.**	**$30,500.00**
Wetland Restoration	**2 acres**	**$3,000.00**	**$6,000.00**
Septic upgrade	**6**	**$7,500.00**	**$45,000.00**
Project Management	**$15,000.00 per yr X 5 yrs**	**$15,000.00**	**$75,000.00**
			`
			$931,500.00

E. Education

During the spring of 2007, the project team conducted a voluntary survey within the watershed to all landowners. Mailings were directed to the participants informing them of the upcoming project and seeking their input on environmental concerns and issues. Voluntary surveys were mailed to all watershed landowners earlier in the project year requesting that they rank personal environmental concerns. These have been tallied and are reflected in Table 6. These results will be used to bring educational opportunities into the area as the project team progresses. Informational packets have been mailed out to over 96 respondents who have expressed an interest in soil/manure testing, water quality analysis of the watershed, and information on how to monitor local stream and training opportunities, as well as cost-share opportunities.

Spring Run, a spring fed stream in the Potomac Highlands of West Virginia, is recognized as one of the best "wild" rainbow trout fisheries in West Virginia. Since the early 1960's, landowners and other interested parties have installed and maintained various structures to form hiding and feeding habitat for trout along a one mile long section of the stream, and managed it for catch-and-release only fly fishing. In recent years, fishermen have noted a decline in the fishery, a decline in aquatic insects, and an increase in algae. The Spring Run Trout Hatchery (SRH - a WVDNR trout rearing facility) is located upstream of the managed fly fishing section. SRH was cited in 2004 for discharging excess biochemical oxygen demand and total suspended solids into Spring Run in violation of their NPDES permit. In response, SRH installed an effluent treatment process at the facility that became operational in June 2007. An ongoing study is investigating the response of Spring Run's biological communities to changes in water quality following installation of effluent treatment at the hatchery. Data include water quality, stream flow, benthic macroinvertebrates, and fish surveys by WVDNR and fisherman catch records. The workgroup will continue to partner with Friends of Spring Run's Wild Trout (FSRWT) on a particular stretch of stream and also to offer hands-on educational opportunities to the community. FSRWT has hosted benthic macroinvertebrates field days annually and will continue to offer this section of Mill Creek as an "outdoor classroom" for learning.

Dorcas Elementary School is located in the heart of this watershed and will be targeted for outreach activities including watershed stewardship fairs, and a possible rain garden development in cooperation with the Master Gardner program.

The Project Team will visit local schools, organizations, and civic groups to present relevant environmental educational programs as appropriate.

Through workshops, mailings and news articles, the residents of this watershed will continue to be targeted as appropriate and will gain an understanding of the resource challenges within Mill Creek. Public outreach activities will also inform landowners of cost-share opportunities and how non-point source pollutants can be reduced from their property.

F, G, H. Schedule for Implementation, Milestones, and Criteria

Submit watershed based plan to WV DEP and US EPA	1/2008
WVDA will commence sampling	1/2008
Identification of feedlots/feeding areas in need of assistance	5/2008
Identification of agricultural land in need of streambank fencing, riparian buffers, tree plantings, and alternative water	5/2008
Develop and propose Section 319 funding proposal for agricultural NPS measures, and septic upgrades to WVDEP	6/2008
Propose Section 319 funding proposal to USEPA	8/2008
Receive project funding	Summer 2009
Public education of projects and funding availability	9/2009
Provide 2 educational opportunities on NPS management	**(yearly after funding award)**
Implementation of NPS BMP's	**12/2009**
Contract w/ 2 landowners to install NPS ag. BMPs	
Contract w/ 2 homeowners to install septic upgrades	
NPS management measures will reduce fecal coliform 6.34%.	
Implementation of NPS BMP's	**12/2010**
Contract w/ 2 landowners to install NPS ag. BMPs	
Contract w/ 2 homeowners to install septic upgrades	
NPS management measures will reduce fecal coliform 6.34%.	
Implementation of NPS BMP's	**12/2011**
Contract w/ 2 landowners to install NPS ag. BMPs	
Contract w/ 2 homeowners to install septic upgrades	

NPS management measures will reduce fecal coliform 6.34 %.

Implementation of NPS BMP's **12/2012**

Contract w/ 2 landowners to install NPS ag. BMPs

NPS management measures will reduce fecal coliform 6.34%.

Implementation of NPS BMP's **12/2013**

Contract w/ 2 landowners to install NPS ag. BMPs

NPS management measures will reduce fecal coliform 6.34%.

The milestones are projected for a five year time period. WV Department of Environmental Protection has tentatively set a revision schedule for the Mill Creek TMDL for 2014. The goal of this plan is to reduce the fecal coliform bacteria concentrations to the levels the 1998 TMDL projected in a 5 year time span. Monitoring by the West Virginia Department of Agriculture and Cacapon Institute will determine the results of the NPS management measures that have been installed.

The TMDL has set a fecal coliform reduction goal of 37.7%. According to the model used by the Watershed Planning Workgroup, a reduction of 31.7% is a more realistic goal based upon data uncertainties used in the development of the TMDL. The working group considers it practical to implement the practices as stated in this document and measure the results through water quality monitoring. It is recommended by the workgroup that the TMDL be revised to reflect the current water concentrations of fecal coliform within the Mill Creek watershed.

I. Monitoring

A significant amount of water quality monitoring data has been collected in the Mill Creek Watershed over the past several years by various organizations. From 1998 to 2005, the West Virginia Department of Agriculture collected and analyzed 3,783 water quality monitoring samples on North and South Mill Creeks. The West Virginia Department of Environmental Protection has also collected many samples in this watershed. The United States Geological Survey studied this area in the mid 1990's and is proposing to return to do follow up sampling in this area post BMP implementation from past cost-share programs.

As BMP's are installed in the watershed, The West Virginia Department of Agriculture will begin monitoring North and South Mill Creeks again to study the bacteria and nutrient reductions that are made as a result of the installation.
This sampling effort will commence January 2008 and will involve collecting samples once per month at all ten designated sites used in the original sampling program from 1998 to 2005. This will continue through the life of the project. WVDA will adhere to an EPA approved QAPP. These samples will be analyzed for the following parameters:

- pH
- Conductivity
- Temperature
- Dissolved Oxygen (May through September)
- Fecal Coliform
- Nitrate
- Nitrite
- Ammonia
- Total Phosphorous
- Ortho Phosphorous
- Total Suspended Solids
- Turbidity

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USDA Natural Resources Conservation Service and the West Virginia Watershed Resource Center have provided invaluable resources for the development of this watershed based plan. Laurie Olah with the WVDA also served as a valuable player in the early development stages of this document.

Appendix A

Load Reduction Calculations

Prepared by W. Neil Gillies, Cacapon Institute

A large amount of water quality data has been collected in the Mill Creek watershed, beginning in 1997. However, this data was not collected for the purpose of estimating loads, and is not directly suitable for load analysis. In its place, the modeled fecal coliform bacteria loadings from the Mill Creek Total Maximum Daily Load document (September 1998) and load allocations by land uses were used.

Numeric loads for fecal coliform bacteria were calculated per land use category and acres of land use in each category as described in the main document. This data was used to develop a delivered load of fecal coliforms per acre of land for each land use category (such as forest, tilled land, etc.), with a breakout loading for pasture and hay in the floodplain – which became important in considering load reductions from BMPs installed in the floodplain, as noted below. This provided the “starting loads” for nutrients, sediment and fecal coliform bacteria.

Load reductions were calculated using an Excel spreadsheet. To the best of the working group’s knowledge, a “consensus opinion” on BMP efficiencies related to fecal coliform bacteria does not currently exist, and the literature is equivocal on this subject. Most papers indicate reductions from 70% to 100% in narrow filter strips (Edwards, 1997; Coyne and Blevins, 1998; Klapproth et. al., 2000). One paper found that “fecal coliform numbers in the pulse of applied wastewater did not decline as water moved down slope regardless of vegetation type or season of the year” (Entry et. al., 2000). However, the Entry (2000) paper also noted a 10-fold decrease in bacteria numbers between the source and their first sampling point, which may have been caused by removal of bacteria in the first several meters of the filter strip - Dr. Entry confirmed this may have been the case via email.

The literature on reductions in fecal coliform concentrations in waste lagoons or sediment ponds is also variable. However, generally, the literature indicates two factors come into play. The first is simple settling of viable bacteria to the bottom of the water column reduces the concentration of bacteria in the water column. The second is actual die-off, which apparently occurs at a much lower rate than occurs in field applications and manure piles. Polprasert et al. (1983) reported a 78% to 97% reduction in fecal coliform recovered in the effluent of a single stage waste stabilization lagoon.

For the purposes of the MCWBP fecal coliform load reduction analysis, and subject to revision, we used 70% as the reduction efficiency for vegetated filter strips as the lower end of the values typically reported. We used a very conservative 85% reduction efficiency for a sediment pond/swale in combination with a vegetated filter strip as a practice to reduce bacterial contamination from a feedlot/winter feeding area.

The reduction efficiency for fencing was based 100% removal of an animal unit from direct deposition of fecal matter to a stream, with 10% of the non direct-deposited manure being available to runoff from the uplands – leaving a 90% efficiency for this practice when applied to a known number of head. When applied to the category of “fenced post TMDL Pre Watershed Based Plan” (see table A1 below) with an unknown number of head, the efficiency was reduced to 70%.

Table A1. Fecal bacteria load reduction calculations.	Total load	Efficiency	Annual Load per animal	Number Head	Reduction	Remaining Load
Direct Deposition	7.80319E+13		1.261E+11	Max 740 head		
Fencing		90%		150	1.703E+13	6.100E+13
Feedlot Runoff (370 head)	2.4309E+13		6.570E+10	Max 370 head		
Buffer		70%		50	2.300E+12	
Sediment pond/swale with buffer		85%		0	0.000E+00	
Relocation		70%		150	6.899E+12	
						1.511E+13
General River Corridor	General River Corridor Load		Load per acre (=218' of stream frontage)	Acres Treated (max 1337)		
Farm Land near Stream	1.41472E+15		1.05813E+12			
Fenced post TMDL Pre WBP		70%		245	1.815E+14	
Buffer		70%		400	2.963E+14	
						9.370E+14
Total Baseline	1.51927E+15				5.040E+14	1.013E+15
					33.17%	66.68%

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Appendix B

West Virginia Potomac Tributary Strategy Implementation Plan

Prepared by the
West Virginia Potomac Tributary Strategy Implementation Committee

<u>Including representatives of:</u>
West Virginia Department of Environmental Protection West Virginia Conservation Agency West Virginia Department of Agriculture Cacapon Institute The Conservation Fund - Freshwater Institute

Photo by Neil Gillies: Spring 2005 riparian buffer demonstration planting beside the Cacapon River

Submitted to the Chesapeake Bay Program December 16, 2005
Overview

The Chesapeake Bay is a national and local treasure, and an important source of livelihood, recreation and cultural heritage for the region. However, after receiving pollution from the surrounding landscape for many years, the Bay is in trouble. The states in the Chesapeake Bay watershed – Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia – the District of Columbia, and the U.S. Environmental Protection Agency have come together to find solutions to the Bay's problems. They have determined that the key to restoring the Bay's health entails reducing the flow of nutrients (nitrogen and phosphorus) and sediment flowing from the Bay states into the Bay, and have set maximum amounts for nitrogen, phosphorus and sediment, known as Cap Load Allocations (CLAs), for each of the jurisdictions.

Bay program partners agreed to develop and carry out cooperative and voluntary Tributary Strategies to reduce current pollutant loads to the CLA levels by the year 2010, an approach that allows innovation and flexibility. The West Virginia Potomac Tributary Strategy was developed with the help of a Potomac Basin stakeholders process. This provided the framework for a comprehensive planning process to equitably reduce the flow of nutrients and sediment loads to the Potomac River, and ultimately to the Chesapeake Bay. The complete text of the Tributary Strategy appears at www.wvnet.org and the implementation deck associated with the strategy includes practices implemented from 1985 through those expected to be implemented by 2010. The West Virginia Potomac Tributary Strategy Implementation Plan summarizes actions to be taken from 2004 through 2010 to meet our cap load, plus a note about "cap maintenance" that explains how cap loads will continue to be honored in the face of population growth and other expected changes in the region.

Everything in this plan is dependent upon four things, funding, human resources to carry out and track these Best Management Practices (BMPs) and basin-wide strategies, the ability to engage a sufficient number of private landowners in the process so that they agree to adopt voluntary BMPs, and the political will to carry out any government-level strategies.

Point Source Implementation Plan

The point source strategy was developed as a potential suite of actions rather than an exact description of new regulations. Details like exact limits on nutrient outputs depended on outside factors.

The Point Source Innovations Workgroup (PSIG) was formed with a six- to eight-month goal to develop a long-term plan. Representatives of the West Virginia Department of Environmental Protection (WVDEP) hosted the first meeting in October 2004 and provided subsequent support to the group, but the members are point source stakeholders. They proposed and investigated innovative solutions to reducing the overall nutrient load contributed by West Virginia sources to the Potomac Basin. The PSIG focused on the need for compliance with Maryland's Chesapeake Bay Water Quality Standards, because Maryland's portion of the Chesapeake Bay is downstream from West Virginia, thus West Virginia must address Maryland's standards under the requirements of the Clean Water Act.

Nonpoint Source sectors (agriculture, urban/mixed open, and forest)
Nonpoint source pollutants will be addressed both on a basin-wide basis and by watershed (HUC10 level watersheds; there are 24 of these in the Potomac Basin of West Virginia) according to their level of priority. Project Teams will be developed in priority watersheds to oversee nonpoint source projects.

Implementation Plan

During the implementation phase two things will be happening. We will be focusing on priority watersheds and working on the development of the basin-wide issues, or activities to be implemented across watershed boundaries, and possibly throughout the entire Basin.

Basin-wide Focus

Funding analysis
All of our activities are contingent upon our ability to secure resources.

Participate in Chesapeake Bay funding committees ("Chesapeake Bay Funding Network" and Chesapeake Bay Finance Committee)

Work with congressional delegation and state legislature to secure funding

Coordinate with University of Maryland Environmental Finance Center to identify funding for priority watersheds

Assist counties and municipalities in obtaining funding to draft development ordinances, develop conservation plans, manage stormwater, and track urban BMPs

Translating Chesapeake Bay goals into local planning and implementation
Broad Potomac Basin and watershed-based Tributary Strategy objectives will be implemented and achieved largely by cumulative small measures taken at the parcel level. Local municipal and county comprehensive plans, along with regional economic development plans, must coordinate with other units of government and be consistent with West Virginia's commitments to Bay restoration efforts. Counties and municipalities should incorporate language consistent with the State's commitment to achieve the goals of the West Virginia Potomac Tributary Strategy in the development of subdivision and improvement location ordinances, public health codes, farmland protection programs, land use, zoning and overlay ordinances, and water, wastewater and storm water utility infrastructure and public capital facilities plans. West Virginia's legislature recently (2004) passed county comprehensive planning legislation, and Section 8A appears to support the above recommendations. The code requires inter-governmental-unit coordination and states, "sprawl is not advantageous to the community" (Section 8A 1-1-4).

Create a framework of specific measurable objectives that will be incorporated as elements across all local and regional planning bodies

Ensure that state funding for infrastructure is tied to implementation of cap load allocation achievement and maintenance of strategic objectives

Develop templates for comprehensive planning goals and implementation ordinances that can be incorporated at the local level

Provide counties with nutrient reduction goals and the type and amount of BMPs that could be implemented to achieve these goals, with timely updates on local progress

Public Agency Focus and Cooperation

Coordination among public agencies is necessary to implement the Potomac Tributary Strategy. Public agencies that implement BMPs on state-owned land will serve as examples for private landowners.

Encourage implementation of BMPs on state-owned land (i.e. the riparian buffer and stream restoration project at the Reymann Memorial Farm in Wardensville, a WVU experimental farm; upgrading the trout-rearing facility on Spring Run; etc.)

Coordinate activities and existing funding sources for targeted projects in priority watersheds

Record and report all BMP implementation to the Chesapeake Bay Program

Point Source

The Point Source Innovations Workgroup (PSIG) held its first meeting in Romney, WV October 29, 2004. The workgroup was charged with developing implementable plans and concepts for point source dischargers to meet nutrient and sediment limits needed to protect and restore downstream water quality in the Chesapeake Bay. It was anticipated that by working collaboratively within the point-source sector, and through possible cooperative relationships with other nutrient contributing sectors, there would be cost and efficiency opportunities found to bring both economic and environmental benefits. Included below are recommendations that the PSIG formulated during their deliberations. The agency will take these recommendations into consideration as permit modifications and reissuance occur. The workgroup's proceedings are recorded at www.wvnet.org. The group suggests that DEP should:

a. Modify all discharge permits, regardless of scale of discharge, to incorporate TN and TP monitoring. There is no current basis for accurately projecting actual point source nutrient discharges in the absence of performance information. It is important to create an accurate, real world base-line of nutrient loads to fairly credit progress and to assist in Bay watershed model calibration. In addition to the immediate imposition of monitoring, accelerated handling, or electronic submission of DMRs should be made near real time and in concert with national or regional permit compliance systems. Transparency and timeliness are important.

b. Begin to incorporate nutrient load limits into all new and existing discharge permits. Priority should be on permit reissuance and major modifications based on facilities likely to discharge nutrients, discharge scale and proximity to the Bay.

c. Expand point source sector cap load allocation. All identifiable point sources, irrespective of scale, should be consolidated into the point source sector for Bay modeling and reporting purposes. Currently discharges of <50,000 gpd are lumped into a general land use of mixed open and urban and treated as non-point loading by assumption. The new version of the Bay model provides for specific extraction and modeling of all point sources down to the individual on-site level. Changing land use patterns in West Virginia will favor dramatic expansion of smaller decentralized or cluster treatment systems. The nutrient control implementation strategy must capture the broadest possible base of potential nutrient discharge actors.

d. Assign nutrient load allocations (NLA). Nutrient load allocations should be the mechanism for point source dischargers to benchmark individual facility nutrient control performance over an assigned time period. Nutrient load allocations should be based on effluent averaging and reflect that seasonal removal performance will vary and that total annual load is more important than instantaneous concentration. Annual NLA can be achieved by some combination of actual discharge and the use of offsets or credits through partnership with others. Assignment of NLA may also be based on prospective performance drawn from the Best Available Demonstrated Control Technology (BADCT) literature.

e. Develop a framework for watershed permitting or nutrient trading as part of an inter-state Potomac Basin strategy. In the absence of an in-place and articulated watershed permitting or trading program it appears that West Virginia point sources will seek technological upgrades as a near-term response to nutrient reduction objectives. Sustained maintenance of cap load achievement goals in the context of double digit population growth and rapid land use conversion will require the development of a framework system of offsets and/or credit trading within and, more likely, with actors external to the point source sector. Critical to such a framework is the certification and monitoring of trades, the creation of a credit reserve buffer for excursions and new projects, flexibility in capital and operational financing of trading investments and coordination with local planning to assure offset consideration.

f. Develop nutrient-based pretreatment requirement or treatability standards. A generalized approach to nutrient prevention should be created through development of pre-treatment state standards for nutrients similar to the approach for toxics. These standards would require the connecting customer (including residential) to maintain a waste stream that is cost-effective and equitable to treat and that would not lead to WWTP violations or loss of nutrient load allocation capacity. Making nutrient limitations a condition of wastewater treatment service will place part of the responsibility for the treatability cost in the hands of the generator.

Agriculture

a. Human Resources: Natural Resources Conservation Service (NRCS) and West Virginia Conservation Agency (WVCA) staff indicated they would need additional staff resources to sign people up for cost-share programs, to oversee agricultural BMP implementation and to assist with the development and maintenance of nutrient management plans if, as a result of the Potomac Tributary Strategy Implementation, the number of people needing such assistance increases. They cited the recent PL534 program as an example of this phenomenon. Additional staff needs for other agencies, especially the USFWS and the Conservation Districts, should also be investigated.

Evaluate the number and type of staff needs of each agency

Seek funding and consent for these positions

b. Litter Transport: NRCS in cooperation with WVCA and the West Virginia Department of Agriculture (WVDA) initiated a cost-share program in 2004 to offset the costs of transporting litter out of the Potomac Valley Conservation District (Hardy, Grant, Hampshire, Mineral and Pendleton counties) into other areas of West Virginia with nutrient deficient soils. The program is being funded through the USDA Farm Bill Agricultural Management Assistance (AMA) Program. It is estimated that over 7,000 tons of litter annually will be exported out of the Chesapeake Bay Drainage.

Develop nutrient management plans on both the sending and receiving ends of the contract

Write 166 contracts for a span of three years

Perform outreach efforts to both producers and purchasers on the value of proper nutrient management

Post a website which will allow resource personnel as well as buyers to access up-to-date information on litter availability, average analysis for nutrient management planning, trucking vendors, and resource documents. The link is accessible at www.wvca.us

Encourage priority watershed Project Teams to enhance litter transport efforts through alternative use such as composting poultry litter for use as a soil amendment

Partner with the Potomac Valley Conservation District to market their active composting demonstration project for the development of research and demonstration projects with local golf courses utilizing composted poultry litter

c. Conservation Reserve Enhancement Program: USDA and West Virginia are sponsoring a 25 million dollar Conservation Reserve Enhancement Program (CREP) to protect water quality and wildlife in selected watersheds in the state, including much of the Potomac Basin. Twenty two million dollars are currently available statewide on a first come first serve basis. There is a statewide goal to enroll 9,160 acres in CREP. There are currently 1,006 acres enrolled in the program in the Potomac Basin.

Promote and synchronize West Virginia's CREP program efforts with a CREP Program Coordinator

Coordinate with the USDA Farm Service Agency to set annual enrollment goals

Enroll producers in CREP to convert highly erodible cropland from agricultural production to the planting of native grasses, trees, and other vegetation to improve water and soil quality and wildlife habitat

Provide rental payments and other financial incentives to encourage producers to voluntarily enroll in 10 to 15 year CRP contracts. Rental payments go to those producers who convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as riparian buffers, filter strips, and/or wetlands

d. Other Farm Bill Programs – West Virginia depends greatly upon USDA Farm Bill Programs to fund the implementation of agriculture BMPs. Approximately $12,000,000 is available to agriculture producers statewide for cost share programs such as the Environmental Quality Incentive Program, Wetland Reserve Program, Wildlife Habitat Incentive Program, Grassland Reserve Program and the Farmland Preservation Program.

Educate farmers on the availability of this cost share funding

Coordinate with agriculture agencies to set annual enrollment goals

Develop contracts with farmers for installation of agriculture BMPs

Track BMPs for inclusion in Bay Program reporting

Support Bay Program efforts to regionalize and target Farm Bill funds to watersheds including the Chesapeake Bay

Support Bay Program efforts to institute other Farm Bill reforms as identified by the Chesapeake Executive Council in November 2005

e. Concentrated Animal Feeding Operation: West Virginia is required to regulate runoff from large animal feeding operations. WVDEP is the regulating agency of the Concentrated Animal Feeding Operation (CAFO) water quality permit. At this time there is only one regulated CAFO in West Virginia's portion of the Chesapeake Bay Drainage area.

Educate farmers on West Virginia's CAFO regulations and BMPs that could be installed to avoid being subject to the permit

Work with partner agencies to provide technical assistance to identified CAFOs

f. Nutrient Management Planning: The coordinated effort of Conservation

Districts, WVDA, WVCA, NRCS, WVU Extension Service, and poultry integrators will continue to assist landowners with operation and maintenance for existing nutrient management plans.

g. Non Cost Shared BMPs: Assess and document non cost shared BMPs within the Potomac Basin.

Prioritize agricultural based watersheds for assessment

Perform a door to door voluntary survey and document existing BMPs on pilot watershed(s)

Continue documentation as funds allow

Urban

a. Human Resources: Technical assistance is identified as a key feature of West Virginia's urban strategy. Additional features of the strategy imply the need for increased staffing in agencies and county and municipal governments.

Supply counties and municipalities with the capacity to develop and follow comprehensive stormwater management plans and to follow state stormwater regulations

Supply state agency(ies) with personnel responsible for the oversight of stormwater programs

Supply Public Service Districts with capacity to manage onsite and decentralized wastewater treatment

Increase personnel in county and local governments to enable better tracking of urban BMP implementation

b. Stormwater: A comprehensive approach to stormwater management will be developed for the Potomac Basin, managed by watershed boundaries, and integrated with county planning efforts. In addition, the status and coverage of all existing stormwater management systems will be identified in order to assess gaps in the current stormwater management framework, and determine the effectiveness of its implementation.

Identify locations of current stormwater ponds and other stormwater infrastructure

Consult with county governments to predict where future growth will occur

Identify Combined Sewer Overflow (CSO) problems and develop solutions

Develop a statewide stormwater management design manual

Improve State stormwater regulations

Coordinate with MS4 communities to form stormwater utilities and charge user fees

c. Nutrient Management Plans: An inventory of urban land uses that result in excessive nutrient runoff will be conducted and prioritized. An appropriate nutrient management plan education and assistance program will be developed.

Develop urban criteria with an emphasis on water conservation to reduce runoff

Modify the West Virginia Nutrient Management Training and Certification Program to include urban criteria

- Conduct inventory of urban land uses that result in excessive nutrient runoff
  - Airports
  - Grasslands and golf courses
  - Homeowners

Prioritize and develop education program for targeted land uses

Assist willing landowners with nutrient management plan development

d. Septic Systems: Of particular concern are the effects of septic system discharges on water quality in the karst areas of the state. Another significant issue is that of residences and other facilities that have non-existent or failing septic systems.

Work with county health departments to adopt a program that promotes regular pumping and advanced on-site systems, and create infrastructure for septage reception and treatment that minimizes nutrient release

Develop homeowner education packets that cover operation and maintenance (pumping) of septic systems, targeting areas that have concentrations of failing septic systems

Pursue incentives to fix failing septic systems

Coordinate with State Groundwater Program and county health departments to better track location of septic systems for Chesapeake Bay Program reporting

e. Development Practices: The impacts of new development on water quality can be reduced through the implementation of onsite measures and land use planning to manage overall development patterns.

- Develop a Potomac Basin Conservation Plan to identify sensitive lands and incorporate measures to protect or manage these lands relative to pollutant loads within a particular watershed. Develop Conservation Plans for counties or individual watersheds, based upon this document
  - o Seek funding to contract with independent researcher to develop plan
  - o Implement plan on smaller scales

Inventory existing county ordinances

Encourage adoption of local ordinances that approach net zero impact from stormwater (require offsets if necessary)

Encourage adoption of local ordinances that protect existing riparian buffer areas and require the establishment of riparian buffer areas where none exist

- Train builders and developers on Low-Impact Development and Smart Growth principles
  - o Emphasize minimization of impervious area
  - o Emphasize conservation of existing forested tracts within developments

Seek funding for greater enforcement of development codes

Forestry

The following actions come directly from the West Virginia Potomac Tributary Strategy, but are appropriate here as next steps to take in implementing nutrient reductions in the forestry sector.

a. Harvesting

Provide logger education regarding BMP standards and water quality

Provide technical assistance to timber operators

Maintain current level of logging inspections by the West Virginia Division of Forestry (WVDOF)

Establish a toll free message center so loggers can easily and rapidly notify the WVDOF when they are within a week of completing a logging operation or are forced to move due to adverse weather conditions and/or equipment difficulties

Provide education to landowners of timber operations on the importance and necessity of BMP maintenance post-harvest

b. Wildfire

Fire Prevention - contact every fourth grader to apprise them of the dangers of wildfire and its potential. Increase public awareness through Firewise West Virginia Initiative

Fire Preparedness - train and equip volunteer fire departments (VFD). Continue education for current staff in the fire sciences

Fire Suppression -Better initial attack and response times. We will strive to have fires under control within one burning period (12 hours)

Reduce sediment potential from fire line construction via the stabilization practice under the new Forest Land Enhancement Program (FLEP)

c. Landowner Assistance Improvements

Increase landowner education on managing the forest resource

Implement practices to ensure protection of Streamside Management Zones, including tree planting initiative

Increase awareness of available cost-share programs that can be utilized on their property

Wildlife

The following actions come directly from the West Virginia Potomac Tributary Strategy, but are appropriate here as next steps to take in implementing nutrient reductions in the wildlife sector.

White–tailed deer: continue to recommend to the Natural Resources Commission a liberal harvest objective for the 8 counties in the Potomac Basin of West Virginia

Educate and encourage private landowners (using a joint effort between the agriculture agencies, landowners/farmers, and West Virginia Division of Natural Resources) to facilitate the legal harvest of antlerless deer

Canada geese: continue to support the maximum hunting opportunity available, including days in the hunting season and numbers in the bag limits

Increase education about and opportunities for Canada goose hunting on private land

Increase utilization of available Canada goose nuisance and damage control programs

Protect, promote, and create forested or scrubby riparian buffers to reduce the preferred open habitat of Canada geese and to discourage fecal matter deposition in streams

Education

a. Forest buffers: Promote the importance of retaining existing forest buffers when building new residential areas, when making any land use changes on farms, and when logging.

Educate people about the slowness and difficulty of regeneration, and about the fact that buffers are one of the best practices for nutrient and sediment reduction.

Emphasize Forest Legacy Program

b. Urban: The multitude of residents, landowners, and land managers in the West Virginia Potomac Basin will be targeted for education and outreach in order to resolve stormwater management, nutrient management, on-site wastewater treatment, and development concerns in a comprehensive, systematic manner. Visitors and non-resident landowners will be targeted for education as to how they can help reduce the impact of their activities on local waterways.

Encourage Community Environmental Management

Conduct education programs on karst geology, the use of BMPs, septic system maintenance, and lawn fertilization

- Educate and work with county governments regarding this Implementation Plan
  - Assist them in obtaining funding to carry out the recommendations contained herein
  - Suggest ways to track BMPs most efficiently and completely
  - Conduct a one-day workshop for local government representatives to attempt to develop a Basin-wide approach toward urban issues related to the West Virginia Potomac Tributary Strategy

c. Agriculture: Stakeholders met in November 15, 2004 to determine what needs there were for education about environment-based challenges for the agricultural community. The group discussed both producers' need to be better informed about proposed regulations, and policy and decision makers' need to be better informed about practices that agricultural producers already use to improve water quality. The group identified existing programs that educate agricultural producers about water quality issues, and expressed a desire to expand upon these rather than duplicate efforts.

Encourage policy and decision makers to become better informed by developing fact sheets and conducting farm tours

Develop "farmer friendly" educational fact sheets, including one that outlines all BMPs relevant to West Virginia in addition to all incentive programs

Present PowerPoint presentation on incentive programs

Repeat efforts of the successful past education campaign by the West Virginia Poultry Water Quality Advisory and Technical Committee to encourage nutrient management and voluntary BMPs for the poultry community

d. Article Series: The purpose is to educate the public about West Virginia's Potomac Tributary Strategy concepts, issues and process. Use this effort to keep the process in the public eye and help to build consensus and public support for the measures required.

Write a series of concise articles to be submitted to area media outlets

Prepare presentations on these topics that members of the Implementation Committee and others can take on the road to meetings

Watershed Focus

The purpose of this component of the Implementation Plan is to concentrate efforts on priority watersheds. Watershed priority will be determined using the prioritization method discussed below. Project Teams, formed in the priority watersheds, will be provided with the information necessary to guide them through the process of optimizing BMP implementation based on multiple criteria.

Prioritization of Watersheds

Uncertainty arose during the stakeholder process as to which watersheds should receive priority in a timeline for implementation of the Tributary Strategy. Some felt that the watersheds with the most nutrient and sediment impairment should be addressed first. Others raised the point that some of these areas might be saturated with certain BMPs, e.g. because of cost-share programs in the agriculture sector. Other issues might make a certain watershed a less efficient choice for action. Most agreed that at least some combination of factors should be used when developing the schedule of work. We decided that we needed to employ a "prioritization decision matrix" to show how the values (weights) we placed on individual decision factors affected the overall rank of each watershed. Appendix A discusses how the prioritization decision matrix was developed, details on each of the nine decision factors, how the watersheds were delineated, and the results of the public input on this process.

How the matrix is used

Resultant values in the far right column were calculated for each of the 24 watersheds. The watersheds having the top two scores began a more intensive implementation of the West Virginia Potomac Tributary Strategy in 2005. The watersheds having the highest scores will be priorities. Additional watersheds will be addressed with somewhat less intensity throughout the period from 2005-2010.

Project Teams will be developed in these priority watersheds to identify the potential nonpoint source projects. The teams will be charged with identifying and engaging stakeholders, surveying and mapping the watershed to target project sites, developing watershed based plans, coordinating activities and programs recommended within this Implementation Plan, securing funding sources, overseeing implementation, and measuring success.

Watersheds not specifically addressed through a Project Team by 2010 will benefit from activities outlined in the basin-wide plan above. In addition, portions of the West Virginia Potomac Tributary Strategy will be implemented by default as county and local governments become involved through the work of the other project teams. Many other voluntary, unassessed activities will contribute to pollutant load reductions throughout the Potomac Basin.

Cap maintenance

While this Implementation Plan is intended to meet West Virginia's Cap Load Allocation, ensuring that nutrient and sediment loads remain at these levels for perpetuity will require a significant amount of planning. Population growth and related projections show that urban and residential land uses will pose the greatest challenge because of increased loads from human activity; this challenge extends as well to the point source sector because of increased wastewater treatment requirements. State and county governments will be essential partners for developing cap maintenance strategies.

Obstacles to implementation of West Virginia Potomac Tributary Strategy

1 There is a need for stronger political leadership and support of local and state ordinances. The eight-county region of the Potomac Basin consists of a small fraction of the total land area of West Virginia. It will be difficult to get state legislators to establish statewide legislation to protect a resource that is so far downstream from this eight-county region. Related is the tension between private property rights, long-held respect for local land use determination and the broad need for integrated action to achieve nutrient and sediment reduction goals resulting from State commitments.

2 Funding is increasingly limited. A specific funding issue is the ineligibility of watersheds for Federal 319 funds if they are not listed on the state's 303(d) list of impaired streams. Opening this source of funding to any watershed within the Chesapeake Bay drainage (which is subject to its own "limits") would be helpful to the implementation of the West Virginia Potomac Tributary Strategy.

3 Public wastewater utilities have an obligation to serve and in some cases to provide new service consistent with missions to protect public health and promote economic development. This utility mission may be in conflict with voluntary State targets for cap loads and cap maintenance. Current procedures for determining the common benefit and need for private or public wastewater utility projects (PSC-Certificate of Need and Convenience, or DEP- Community Infrastructure Certificate of Appropriateness) place more decision weight on financial impact analyses and lack

specific metrics for determination of consistency with the Tributary Strategy.

4 West Virginia as a headwater state receives a very small portion of the overall funding allocated to the Bay States proper and none for on-the-ground initiatives.

5 Many of the practices that need to occur in order to successfully achieve the goals of the Tributary Strategy are voluntary. One of the greatest challenges in gaining broad-based acceptance and implementation of BMPs is the cost to the landowners. The agricultural community strongly supports a change in current cost share rates to cover 100% of implementation of any practice that does not provide any economic return to the landowner.

Appendix A: The Prioritization Decision Matrix

How the Prioritization Decision Matrix was developed

The Matrix was developed as a tool to help prioritize watersheds for a schedule of work. A subset of the West Virginia Potomac Tributary Strategy Implementation Committee developed the matrix during the summer of 2004. Our goal was to have it ready to present to stakeholders at public meetings in September 2004.

The decision factors – (column headings of the matrix) "Factors" to be used as headings for the matrix columns were contributed by the entire Implementation Committee, with consideration given to stakeholders' comments gathered throughout the Tributary Strategy development process. One factor, Source Water Protection Areas, was added after stakeholders requested it during September 2004 meetings. In the nine factors chosen, we tried to capture not only scientific data indicating nutrient pollution in each of the watersheds, but also various social factors that might either contribute to or detract from any water quality improvement efforts planned in the Tributary Strategy. Using sediment load as factor was considered but was rejected because the workgroup realized that sediment loads were minor compared to nutrient loads, and many BMPs that remove nutrients also remove sediment. A cost-effectiveness factor was considered but rejected because the BMP implementation data was incomplete at the time.

The watersheds –(row labels in the matrix) We chose to base the matrix on HUC 10 fifth-level watersheds because they represented manageable units and approximated the boundaries of a majority of the Phase V Chesapeake Bay Watershed Model segments. Descriptive names of these 24 watersheds were listed down the left column of the matrix, thus serving as labels for the rows.

The matrix is in the form of a spreadsheet (Microsoft Excel). Along the left side are listed the 24 HUC 10 watersheds. Across the top are nine factors. Values from 0 to 1 are entered in each cell, so that numbers can be added together across the columns. The totals, on the right-hand side, show which watershed has the greatest overall value, and should be given the highest priority. Each of the factors can be weighted, or emphasized, so that it will influence the result more than the other factors. We asked the public for input in determining what these weights should be. We provided a form on which they entered weights from 1-10 for each factor. We averaged all responses, including those of members of the West Virginia Potomac Tributary Strategy Implementation Committee.

Some stakeholders wished to see numbers in the cells before deciding on weights for the decision factors. We had researched and calculated values for the cells to the best of our abilities in the short time we had. The nine decision factors and notes on how the values were obtained are included here:

1. Nitrogen impairment index:

This is an average of 3 values: the number of impaired stream miles according to the 2004 303d list, water quality data from various sources, and an estimated load. Only those streams listed as impaired in biological and fecal coliform categories were used in the analysis.

Water quality data came from various sources. The Department of Agriculture is committed to the most comprehensive collection of data within the Potomac Basin, as part of the Non-Tidal Water Quality Monitoring Network. Total phosphorus, nitrate and nitrite water quality parameters were used in the analysis. Gaps in coverage were filled with data from WV Department of Environmental Protection's (WVDEP) Watershed Assessment Program. These data were collected during the program's five-year monitoring cycle and monthly monitoring for the development of TMDLs. Additional data from the Cacapon Institute were used, primarily for the North River.

The load estimate was derived in the following way: Chesapeake Bay Watershed Model (CBWM) Phase V Land Use acres were multiplied by model segment specific loading rates from the CBWM. Point source and septic system loads were also included. Septic system loads were derived from the USGS SPARROW v2.0 model.

The average of these three values was then *normalized*, which means that each of the 24 watershed's resultant values was divided by the highest value. Thus, the highest value became 1 and all others were between 0 and 1.

2.Phosphorus impairment index: This value was derived in much the same way as the nitrogen impairment index. It, too, is an average of 3 values: the number of impaired stream miles according to the 2004 303d list, water quality data from various sources, and an estimated load. Only those streams listed as impaired in biological and fecal coliform categories were used in the analysis.

Water quality data came from various sources. The primary source was from the Department of Agriculture's Non-Tidal Water Quality Monitoring Network. Total phosphorus, nitrate and nitrite water quality parameters were used in the analysis. Gaps in coverage were filled with data from WVDEP's Watershed Assessment Program. These data were collected during the program's five-year monitoring cycle and monthly monitoring for the development of TMDLs. Additional data from the Cacapon Institute were used, primarily for the North River.

The load estimate was derived in the following way: CBWM Phase V Land Use acres were multiplied by model segment specific loading rates from the CBWM. Point source loads were also included, but septic system loads were not, as they lack a modeled phosphorus load. The average of these three values was then normalized, as described in the nitrogen impairment index section, above.

3. **Impaired high-quality stream miles:** This value was calculated from WVDEP's 2004 303d list and West Virginia Division of Natural Resources' list of high quality streams, 6th ed., 2001. The criteria used for high quality stream designation according to this publication is as follows: 1) All streams which are stocked with trout or that contain native trout populations. 2) Warmwater streams over 5 miles in length with desirable fish populations and public utilization thereof. This value was then normalized, as described in the nitrogen impairment index section, above.

4. **TMDL miles:** This value is simply the number of miles of streams with Total Maximum Daily Load requirements, and was derived from WVDEP's 2004 303d lists for biological and fecal coliform impairment. Because West Virginia lacks water quality standards for nutrients, these impairments were used because they provide the best available approximation of nutrient impairment. This value was then normalized, as described in the nitrogen impairment index section, above.

5. **Agricultural BMP saturation/likelihood of participation:** Watersheds were rated on a scale of 1-5, where 5=very little saturation of BMPs, so future BMP implementation is very possible, and 1=virtually saturated with BMPs. This value was then normalized, as described in the nitrogen impairment index section, above. When asked to weight this factor, the public was referred to pp. 32-37 of West Virginia Potomac Tributary Strategy for proposed BMPs. This was one of the most subjective factors used in the decision matrix, but one that many stakeholders felt was important to include. One issue complicating this concept is that landowners might be more inclined to implement BMPs if more cost share money were available. Another issue is that some areas have a high percentage of landowners that wish to implement BMPs, but the supporting agencies are understaffed.

6. Watershed group activity:

Watersheds were rated on a scale of 0-5, with 5=watershed group's scope is equal to watershed being considered, and group is very active, and 0=no watershed groups working in this watershed. This value was then normalized, as described in the nitrogen impairment index section, above.

7. Population growth:

This value was calculated by determining population growth as percentages using census tract data from 1990 and 2000 census data from the U.S. Census Bureau. Census tract boundaries were reconciled to watershed boundaries using geographic information system software. This value was then normalized, as described in the nitrogen impairment index section, above. This factor may help address the point source/urban needs of a watershed, and also future pollution potential.

8. Nitrogen Delivery Factor:

The nitrogen delivery factor for each watershed was taken from the CBWM. This value was then normalized, as described in the nitrogen impairment index section, above. This is a way of factoring in the impact a given watershed has on the Chesapeake Bay, mostly because of physical proximity to the Bay. The impact of pollution on the Bay decreases the farther away a watershed is from the Bay, because nitrogen can be lost from streams through pathways in the nitrogen cycle. Sediment and phosphorus delivery factors are equal across all watersheds in the Potomac Basin.

9. Source Water Protection Areas:

Source water protection areas were totaled by watershed for all surface water facilities and groundwater facilities considered to be "under direct influence" of surface water. This factor was added as a result of the September 2004 public meetings, when stakeholders expressed a desire for this addition. This value was then normalized, as described in the nitrogen impairment index section, above.

The average weight of each factor was calculated from user input obtained during the stakeholder meetings and public comment period (Table 1). The weights were then normalized (all divided by 8.72) so that Population Growth's weight would be "1" and all others would be less than 1.

Table 1. Average of the weights for each decision factor, as recommended by public comment.

Factor	**Weight**	**Normalized Weight**	**Stakeholder Responses**
1. Nitrogen Impairment Index	8.04	0.92	28
2. Phosphorus Impairment Index	8.00	0.92	27
3. Impaired High-Quality Streams	5.50	0.63	26
4. TMDL Miles	5.63	0.65	27
5. Agriculture BMP Saturation/ Likelihood of Landowner Participation	6.78	0.78	27
6. Watershed Group Activity	5.86	0.67	29
7. Population Growth	8.72	1.00	29
8. Nitrogen Delivery Factor	4.71	0.54	24
9. Source Water Protection Areas	7.33	0.84	3

Decision Matrix for Watershed Prioritization WV Potomac Tributary Strategy

Major Basin	Watershed (HUC-10)	Nitrogen Impairment Index	Phosphorus Impairment Index	Impaired High Quality Stream (miles)	TMDL (miles)	Agricultural BMP Saturation / Likelihood of Landowner Participation	Watershed Group Activity	Population Growth	Nitrogen Delivery Factor	Source Water Protection Areas	Total Score (unweighted)	Total Score (weighted)
	Weight>>>	0.92	0.92	0.63	0.65	0.78	0.67	1.00	0.54	0.84		
02070004-Potomac Direct Drains	0207000409 - Opequon Creek	1.00	1.00	0.90	1.00	0.80	1.00	0.41	0.95	1.00	8.06	6.11
02070004-Potomac Direct Drains	0207000402 - Sleepy Creek	0.35	0.32	0.72	0.57	0.60	1.00	0.66	0.95	0.00	5.17	3.75
02070004-Potomac Direct Drains	0207000412 - Rockymarsh Run-Potomac River	0.57	0.56	0.06	0.06	1.00	0.90	0.42	1.00	0.21	4.79	3.64
02070001-S. Branch Potomac	0207000106 - Outlet South Branch Potomac River	0.66	0.58	0.55	0.49	0.70	0.80	0.19	0.72	0.13	4.81	3.56
02070001-S. Branch Potomac	0207000105 - South Fork South Branch Potomac River	0.67	0.67	1.00	0.79	0.50	0.00	0.22	0.72	0.02	4.60	3.39
02070007-Shenandoah	0207000703 - Bullskin Run-Shenandoah River	0.39	0.37	0.37	0.00	0.80	0.90	0.38	0.76	0.42	4.40	3.31
02070004-Potomac Direct Drains	0207000410 - Harlan Run-Camp Spring Run-Potomac River	0.44	0.21	0.08	0.14	0.80	0.00	1.00	0.95	0.31	3.94	3.14
02070001-S. Branch Potomac	0207000101 - North Fork South Branch Potomac River	0.52	0.48	0.81	0.49	0.20	1.00	0.07	0.72	0.00	4.28	3.02
02070003-Cacapon	0207000303 - Lost River	0.37	0.29	0.38	0.28	0.40	1.00	0.24	0.88	0.00	3.84	2.72
02070003-Cacapon	0207000304 - North River	0.22	0.18	0.00	0.00	0.80	0.90	0.62	0.88	0.00	3.60	2.69
02070004-Potomac Direct Drains	0207000404 - Back Creek	0.14	0.06	0.00	0.00	0.80	1.00	0.69	0.95	0.00	3.64	2.69
02070003-Cacapon	0207000307 - Cacapon River	0.28	0.12	0.00	0.00	0.50	1.00	0.63	0.88	0.00	3.42	2.54
02070003-Cacapon	0207000302 - Little Cacapon River	0.18	0.14	0.10	0.00	0.60	0.90	0.54	0.88	0.00	3.35	2.45
02070007-Shenandoah	0207000702 - Long Marsh Run-Shenandoah River	0.04	0.02	0.00	0.00	0.80	0.90	0.56	0.76	0.00	3.07	2.24
02070001-S. Branch Potomac	0207000103 - Headwaters South Branch Potomac River	0.40	0.37	0.22	0.00	1.00	0.00	0.10	0.72	0.12	2.94	2.22
02070001-S. Branch Potomac	0207000104 - South Mill Creek-Mill Creek	0.25	0.31	0.03	0.03	0.80	0.60	0.07	0.72	0.00	2.81	2.04
02070002-N. Branch Potomac	0207000202 - Stony River-N. Br. Potomac River	0.47	0.50	0.00	0.00	0.60	0.60	-0.15	0.73	0.04	2.78	2.03
02070002-N. Branch Potomac	0207000207 - Patterson Creek	0.50	0.33	0.34	0.00	0.50	0.00	0.15	0.73	0.06	2.62	1.97
02070001-S. Branch Potomac	0207000102 - Lunice Creek	0.24	0.24	0.24	0.08	0.60	0.00	0.45	0.72	0.00	2.57	1.95
02070004-Potomac Direct Drains	0207000405 - Warm Spring Run-Cherry Run-Potomac River	0.15	0.16	0.00	0.00	0.40	0.20	0.37	0.91	0.19	2.37	1.74
02070002-N. Branch Potomac	0207000204 - New Creek-N. Br. Potomac River	0.19	0.14	0.00	0.00	1.00	0.00	-0.04	0.73	0.19	2.21	1.60
02070003-Cacapon	0207000308 - Willett Run-Potomac River	0.07	0.09	0.00	0.00	0.40	0.00	0.33	0.88	0.01	1.79	1.28
02070002-N. Branch Potomac	0207000208 - Green Spring Run-N. Br. Potomac River	0.10	0.10	0.00	0.00	0.80	0.00	0.02	0.73	0.01	1.76	1.23
02070006-N. Fork Shenandoah	0207000601 - Little Dry River-N. Fork Shenandoah River	0.16	0.11	0.00	0.00	0.40	0.00	0.25	0.76	0.00	1.68	1.22

Rank

Lowest

Highest

17