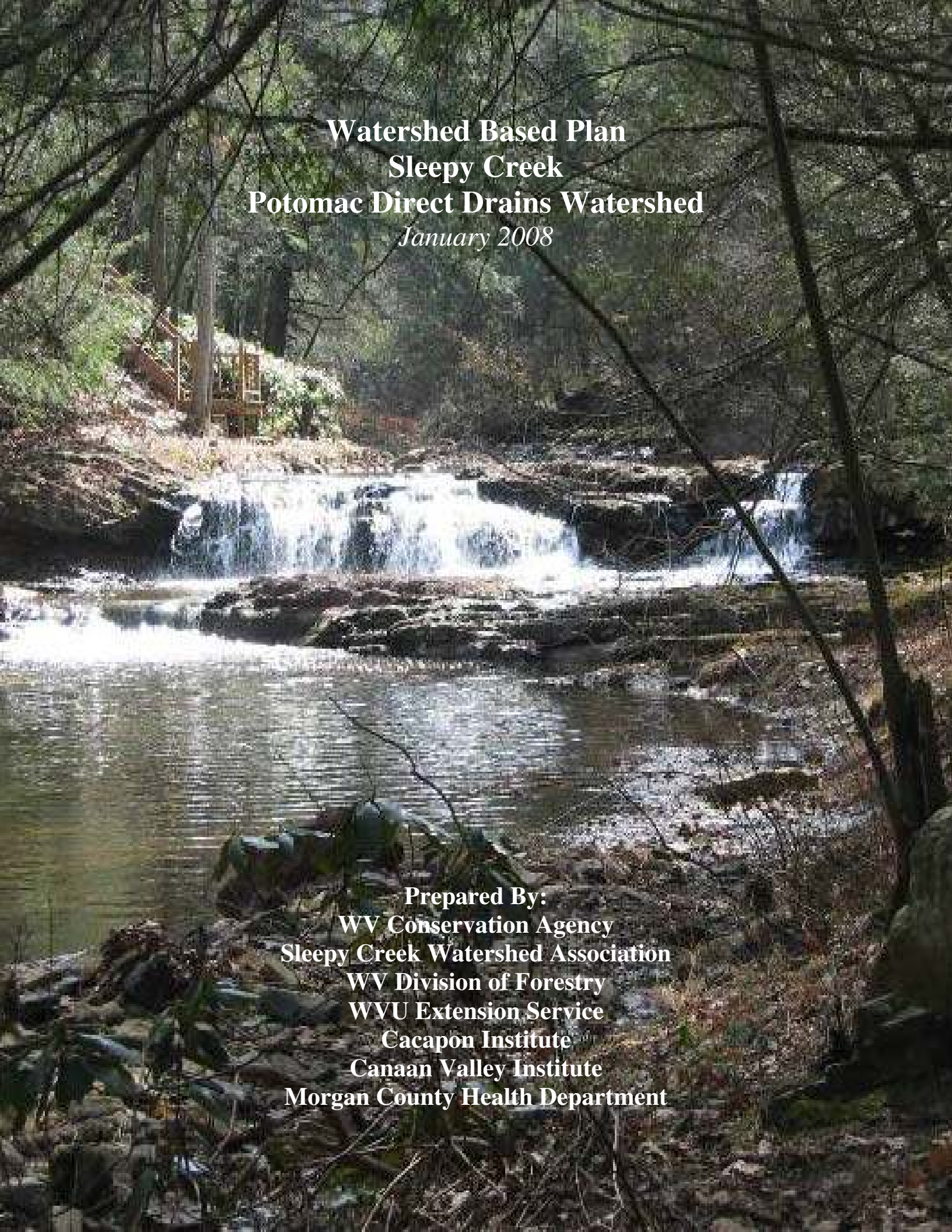


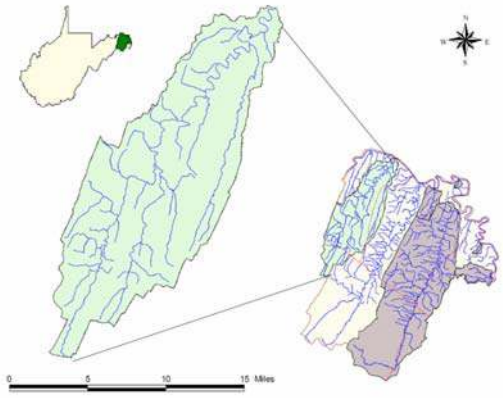
Watershed Based Plan
Sleepy Creek
Potomac Direct Drains Watershed

January 2008

Prepared By:
WV Conservation Agency
Sleepy Creek Watershed Association
WV Division of Forestry
WVU Extension Service
Cacapon Institute
Canaan Valley Institute
Morgan County Health Department

Introduction

Sleepy Creek watershed is located in Morgan County, West Virginia (87%) and Fredrick County, Virginia (13%). The drainage area is approximately 145 square miles, 92,916 acres. Dominant land use in the watershed consists of 75% forest, 14% grassland, 5% urban/residential, and 3% pasture. Within the watershed two streams have a TMDL, Total Maximum Daily Load. These streams are Sleepy Creek and Indian Run. Both Sleepy Creek and Indian Run are impaired "relative to numeric water quality criteria for fecal coliform bacteria." TMDL, 2007



The Sleepy Creek watershed was selected by the Potomac Tributary Strategy Implementation Committee as the second priority for their efforts toward the Chesapeake Bay Restoration. The designation of being the second priority for the Implementation Committee signifies the commitment from the stakeholders in the watershed, as well as the commitment from the conservation partners working to improve the health of the Chesapeake Bay.

A. Identification of Causes & Sources

The TMDL for Sleepy Creek identifies fecal coliform bacteria as the major pollutant. Fecal coliform bacterium enters the waters through one of two sources, point sources or non-point sources. Point sources are permitted. In the Sleepy Creek watershed there are 10 sewage treatment facilities operated under the General NPDES Sewage Permit.

According to the TMDL, non-point source accounted for the majority of the fecal coliform bacteria. The WVDEP source tracker identified areas of high population density without access to public sewers in the watershed. The TMDL estimates 6,400 homes were not connected to a publicly owned treatment facility. Of all the homes in the entire watershed 14.18% are estimated to have failing individual sewer systems. Human sources of fecal coliform bacteria from these failing systems impact the level of fecal coliform bacteria entering the waters.

Failing or inadequate home Individual Sewer Systems are not the only source of fecal coliform bacteria. A significant loading is associated with agricultural land uses and urban/residential runoff in Morgan County. The TMDL estimates four percent (4%) of the fecal coliform bacteria in West Virginia's portion of the watershed are contributed by agricultural land uses.

> The TMDL defines urban/residential runoff as "Sources of fecal coliform bacteria in residential/urban areas include wildlife and pets, particularly dogs. Much of the loading from urban areas is due to an increase in impervious surfaces relative to other land-uses, and the resulting increase in runoff. In estimating the potential loading of fecal coliform bacteria from residential/urban areas, accumulation rates are often used to represent the aggregate of available sources.

Residential/urban lands contribute nonpoint source fecal coliform bacteria loads to receiving streams through the wash-off of fecal coliform bacteria that build up on both pervious and impervious surfaces in industrial areas, on paved roads, and in residential areas (from failing septic systems, straight pipes contributing raw sewage, and wildlife). Residential/urban areas were consolidated into two landuse categories—residential/urban pervious and residential/urban impervious."

In March 2006, the Sleepy Creek Watershed Association published an assessment of the watershed. This document provides a detailed description of the watershed, and can be found as Appendix D of this document. The following are two tables describing land use in the watershed (Table 1) and the current farm statistics (Table 2). The current number of livestock in the Morgan County is 2,000 head. This includes both beef and dairy cattle. The majority of the farm land in Morgan County is located in the Sleepy Creek Watershed. This information was taken from the 2007 West Virginia Agricultural Statistics Bulletin Number 38.

Table 1: Land Use in Sleepy Creek Watershed, Sleepy Creek Watershed Assessment, March 2006

Table 5: Land Use in the West Virginia portion of Sleepy Creek Watershed	1979 (in acres)	2003 (in acres)
Forest (Private)	38,605	29,655
Forest (Public)	8,950	8,966
Cropland and hayland	14,214	9,052
Pasture	6,240	1,207
Orchard	330	200*
Other agriculture (farmsteads, buildings, idle land, etc.)	2,625	1,800*
Urban, subdivisions, commercial, and industry (includes all subdivision area including area used for roads and right of ways)	990	8,000
Wetlands		1,900
Roads (1979 includes only federal and state roads, 2003 includes all roads including subdivision roads)	1,090	1,230
Non-agricultural (parks, utilities, and other miscellaneous land use)	2,434	2,450
Data for 1979 is from the *WV Agricultural Water Management Quality Plan June 1979*. Data for 2003 is from Farm Service Agency farm reports. * Estimated based on land use trends in Morgan County.		

Table 2: Farm Statistics in Sleepy Creek Watershed, Sleepy Creek Watershed Assessment, March 2006

Table 7: Current farm statistics in Sleepy Creek Watershed in Morgan County.	
Number of farm tracts	373
Average farm tract size in Morgan County	120 acres
Average amount of cropland and pasture per farm	27.5 acres
Number of farms with cropland	295
Amount of cropland acres	9052
Average crop field size	7.5 acres
Maximum / Minimum crop field size	56.5 acres / 0.3 acres
Number of farms with permanent pastures	68
Amount of permanent pasture	1207 acres
Average permanent pasture size	9.1 acres
Maximum / Minimum permanent pasture field size	42.4 acres / 0.5 acres

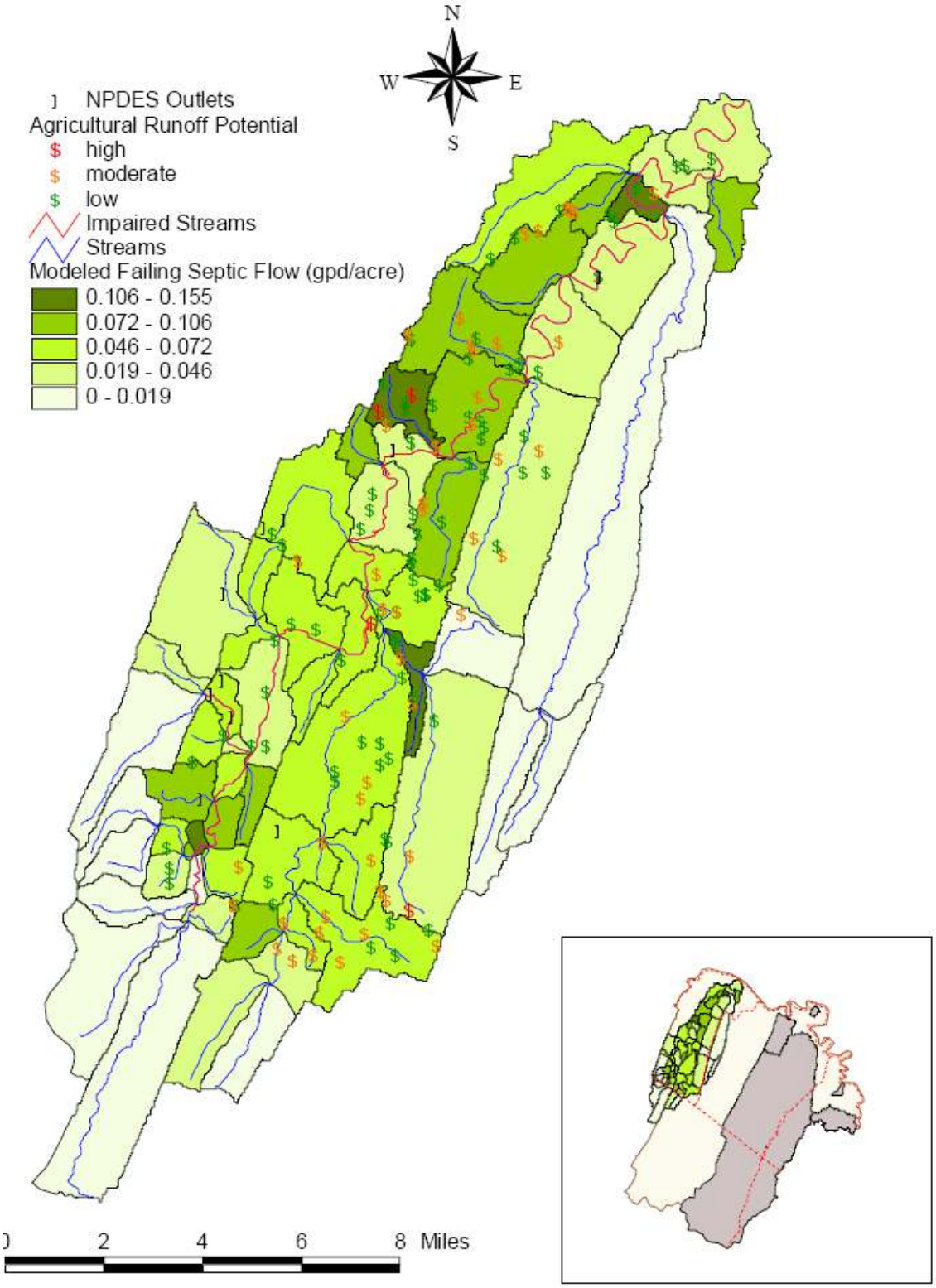
Table 3: Fecal coliform bacteria TMDLs for the Sleepy Creek watershed, Dave Montali, WV DEP

PDD Fecal Coliform TMDL - Sleepy Creek Nonpoint Source Load Reductions by State

Indian Run			
	Baseline LA	LA	LA % Red
West Virginia Component	1.43E+14	2.28E+12	98.4
Virginia Component	5.49E+11	3.34E+10	93.9
Total	1.43E+14	2.31E+12	98.4

Sleepy Creek (Inclusive of Indian Run)			
	Baseline LA	LA	LA % Red
West Virginia Component	5.51E+15	5.90E+13	98.9
Virginia Component	2.55E+14	7.27E+12	97.1
Total	5.77E+15	6.62E+13	98.8

Fecal Coliform Sources, TMDL, 2007



B. Estimate of the Load Reductions Expected

A consensus of the work group, based on experience and review of the TMDL material, determined the potential baseline load from sewer was approximately half the estimated annual load listed in the TMDL. ("Sewer" as used in the TMDL and WBP refers to individual homeowner waste treatment including septic tanks.) As stated in Section H, the workgroup based on aerial photographs and local residents' knowledge, concluded only 1/3 of the "residences" counted in the TMDL were likely to contain sewer systems (See Appendix C). Favoring the TMDL information the group did not reduce the sewer load by 2/3 but only by half. Half of the sewer load estimated in the TMDL was then reallocated to pasture, cropland, and rural/urban. Loads were redistributed as a ratio of the load for each category as estimated in the TMDL. Load reallocation is shown below:

TMDL Adjusted Baseline Load Baselines Adjusted for WBP

	Baseline Loads (Colony forming units, CFUs)						
	Background	Residential/ Urban	Cropland	Pasture	Sewer	VA Load	TOTAL
TMDL	2.90E+13	4.58E+13	1.41E+12	6.27E+13	5.36E+15	2.52E+14	5.75E+15
Adjustment	0.0%	+20.8%	+0.6%	+28.5%	-50.0%	0.0%	0.0%
WBP	2.90E+13	1.16E+15	3.58E+13	1.59E+15	2.68E+15	2.52E+14	5.75E+15

WBP Annual Baseline Loads and Reductions for West Virginia

	Riparian Acres	WBP Adjusted Baseline Load	Percent Reduction	Reduction	Resulting Load	Allocation	Difference
Residential Urban	4819	1.16E+15	39%	4.57E+14	7.06E+14	1.91E+13	6.87E+14
Pasture	1056	1.59E+15	85%	2.39E+14	1.35E+15	1.04E+13	1.34E+15
Cropland	64	3.58E+13	70%	2.51E+13	1.08E+13	7.47E+11	2.51E+13
Sewer	n/a	2.68E+15	100%	2.68E+15	0.00E+00	0.00E+00	0
Background	62238	2.90E+13	0%	0	2.90E+13	2.90E+13	0
VA	n/a	2.52E+14	0%	0.00E+00	2.52E+14	7.03E+12	2.45E+14
TOTAL		5.75E+15		3.38E+15	2.37E+15	6.63E+13	2.30E+15

The TMDL reported agricultural land use in each subwatershed based on agricultural census landowner reports. Reviews of Digital Ortho Quarter Quad (DOQQ) imagery and the landuse/landcover GIS shape file by the WBP workgroup found major discrepancies between the agriculture land use information in the TMDL and actual land use as indicated by the latter two data sources. For example, in subwatershed 9055 the DOQQ imagery and landuse/landcover data suggests substantially more "pasture" than the 8.8 acres reported in the TMDL. In order to prioritize areas for action the WBP workgroup began by assuming that only bacteria deposited on lands within 200 feet of the major streams are likely to contribute to impairment in Sleepy Creek. Therefore only the "riparian acres" of pasture and cropland are included in the load reduction spread

sheet. The NHD stream layer and the "landuse/landcover" GIS shape file provided in the TMDL were used to generate the acres in each category within 200' of the stream.

In the subwatersheds the WBP work group reallocated "pasture" and "cropland" loads based on the acres reflected in "grassland" and "cropland" within 200' of the streamline (See Appendix C). Pasture load reduction was kept at 85% as recommended in the TMDL. Cropland reduction is projected 83% reduction (60% grass buffer at 75% reduction and 40% forest at 95% reduction). Acres reflect only West Virginia land area. Residential/Urban acres and reductions remain as projected in TMDL. Background remains unchanged from the TMDL.

The TMDL listed as impaired the full length of Sleepy Creek's main stem and a tributary of Sleepy Creek named Indian Run. The TMDL reported that the current annual fecal count is 5.51×10^{15}. The annual load allocation for Sleepy Creek is 5.90×10^{13}cfu. This is a reduction of 98.9%. This information can be found in Table 3 on page 4.

C. Description of Non-Point Management Measures

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.

Conservation Plans: A combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality; the plan must meet agency technical standards.

CREP: The Conservation Reserve Enhancement Program or CREP is a federal-state land retirement conservation program targeted to address state and nationally significant agriculture-related environmental problems. The West Virginia CREP involves additional financial incentives to encourage the restoration of riparian and other natural habitats to protect the vitally important soil, water and wildlife resources of the Potomac, New, Greenbrier, and Little Kanawha Rivers. The goal of the West Virginia CREP program is to help reduce the occurrence of runoff, sediment, and nutrients from agricultural enterprises into the designated watersheds.

Dry extended detention: Dry extended detention ponds or basins that provide for a gradual release of storm water in order to increase settling of pollutants and to reduce storm water volumes downstream at a given time; and that are usually dry between rainfall events.

Erosion and sediment control: Practices that protect water resources from sediment pollution and increases in runoff associated with land development activities. By retaining soil on-site, sediment and attached nutrients are prevented from leaving disturbed areas and polluting streams. *Examples:* Silt fence, slope drain, permanent vegetation

Fence: Will be constructed on the stream bank to keep livestock from stream. This practice may be applied on any area where management of animal or people movement is needed.

Filtering practices: Practices that capture and temporarily store storm water then pass it through a filter bed such as sand, organic matter, soil or other media. These can include rain gardens, swales, sand or peat filters, etc. Maintenance plan is usually key.

Individual Sewer System Best Management Practices: Best Management Practices for correcting failing individual sewer systems are outlined in Appendix A, WATERSHED WASTEWATER PROTECTION PLAN, Canaan Valley Institute. Another consideration is that several small lots located near each other might be best served with a cluster or community system rather than individual onsite systems. Small lots, with no room for replacement systems may be served by piping the effluent to a nearby landowner or common area with better soil or terrain. Several nearby lots with failing or inadequate systems would also benefit from a shared solution.

Cluster systems use the same technology for treatment and dispersal as onsite systems, but are sized to handle more than one house. They introduce two complexities over onsite systems, though: easements and required maintenance. Legal easements are required for houses served by cluster systems to insure that the treatment system remains functional through time and ownership changes. These easements insure that treatment is always available to the lot. Maintenance agreements, usually a contract with a qualified third party, are also required to insure the sustainability of the treatment system.

Infiltration practices: Practices such as a trench, basin or porous pavement that capture and temporarily store storm water before allowing it to infiltrate into the soil. Promote groundwater recharge.

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

Riparian Forest Buffer: A tree and shrub buffer of at least 35 feet will be established and maintained along the stream corridor and/or water body to reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow. The location, layout, width, and density of the riparian forest buffer will be selected to accomplish the intended purpose and function. A tree and shrub buffer of at least 35 feet will be established and maintained along the stream corridor and/or water body by planting species suited to the site. Brush and noxious weeds, such as multiflora rose, autumn olive or tartarian honeysuckle will be controlled by spot mowing or chemical weed control on areas where these species will interfere with planting or seedlings. Mowing or chemical applications should not occur during the primary ground-nesting season (March 15 – July 15). All applications of pesticides will follow label precautions. Saplings and trees will be protected to ensure natural succession of the desired species.

Riparian Vegetative Buffers: Linear strips of grass or other non-woody vegetation maintained along stream banks help filter bacteria, nutrients, sediment and other pollution from runoff. During high water and flooding events, vegetation holds soil in place and can trap some excess nutrients from upstream waters flowing over it. A 35-foot minimum width is necessary to achieve significant benefit from this measure (Strategy, Appendix 6). A non-woody buffer can be maintained at minimal cost by mechanical methods or flash-grazing. However, flash-grazing should be performed according to the NRCS Standards (approved protocol October 2000).

Stream Crossing or Access: A stream crossing will be constructed to improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream and educe stream bank and streambed erosion. The stream crossing will be constructed according to an engineering design based on NRCS standard. NRCS will be contacted prior to construction. Stream crossing will be maintained according to the Operation and Maintenance Plan in the design.

Tree Planting: Growing trees and converting the land use from agricultural to forest, targeting lands that are highly erodable or identified as critical resource areas. Does not include forested riparian buffers.

Urban nutrient management: Reduction of fertilizer applications to lawns, golf courses, parks and other pervious surfaces in urban areas. This practice involves taking a soil sample to determine the appropriate amount of nutrients needed.

Wet ponds and wetlands: Wet ponds and constructed wetlands that have a permanent pool (always contain water), extend detention, and treat water quality.

D. Estimate of Cost for Financial and Technical Assistance

Best Management Practice	**Planned Units**	**Cost/Unit**	**Total**
Upgrade/fix failing/ Individual Sewer Systems	*450 residences*	*$7,500*	*$3,375,000*
Stream Crossing	*50*	*$3,400*	*$170,000*
Alternative Watering System	*50*	*$4,200/system*	*$ 210,000*
Forest Buffer Establishment	*164 ac*	*$3055/ac*	*$501,020*
Grass Buffer Establishment	*198 ac*	*$30/ac*	*$5,820*
Fence	*101,690 ft*	*$2.50/ft.*	*$254,225*
Urban Stormwater Management Practices	*24 ac*	*$20,000/ac*	*$480,000*
Education Outreach	*7*	*$6,138/conference*	*$42,970*
Monitoring	*12 months*	*$1183.33/mo*	*$14,200*
		Total:	***$4,799,010***

The West Virginia Conservation Agency (WVCA) will be the state agency coordinating the implementation of BMPs, reporting, and the management of the 319-Incremental Grant. The Eastern Panhandle Conservation District will administer funding

for this Watershed Based Plan, and sequential 319-Incremental Grants. These organizations will work together to oversee project installation as well as work with the partnering organizations to ensure success of the project. Cacapon Institute (CI) will implement a fecal coliform monitoring program and the Quality Assurance Project Plan QAPP development. The West Virginia Department of Agriculture, Cacapon Institute and Sleepy Creek Watershed Association will assist in monitoring in the Sleepy Creek Watershed. West Virginia Department of Agriculture currently implements a monthly sampling regiment for nutrient and sediment analysis. Cacapon Institute will perform fecal testing in the focus sub-watershed prior to and following the implementation of the project. The TMDL section of the DEP will monitor water quality in three years. The West Virginia Department of Environmental Protection (DEP) will oversee the reporting for this project. Canaan Valley Institute (CVI) will design and coordinate programs to install individual onsite systems and provide homeowners instruction on proper septic maintenance. Outreach will be conducted through the Morgan County Health Department with assistance from the Canaan Valley Institute. The efforts of these two organizations will introduce the public to the goals and plans of the project. The Morgan County Health Department and Canaan Valley Institute will provide training to the Public Service Districts and similar organizations. The USDA-Natural Resource Conservation Service will provide technical assistance in designing the agricultural best management practices and urban nutrient management and storm water management ponds. Along with CVI and Morgan County Health Department, the WVCA, CI, DEP, Sleepy Creek Watershed Association, WV Division of Forestry, WVU Extension Service, and the Eastern Panhandle Conservation District will also implement education and outreach within the watershed. The Sleepy Creek Watershed Association is vital to the success of this project. The watershed association is active in education of best management practices to landowners and residents in the watershed. The Sleepy Creek Watershed Association has pledged their support to this project.

Creating a fund from grant money will provide incentive and encourage participation in the management program With a grant of $100,000, $5,000 grants can be made available to assist homeowners with repairs or replacements of substandard systems. Low-interest loans, funded from other state programs, can be used to supplement additional costs. A large advantage to this approach is that homeowners are encouraged to identify problems and report them. As a part of this program, technical assistance, from an organization like Canaan Valley Institute could be offered for inspecting the selected sites and assisting with determining the proper upgrade or replacement technology. (Appendix A)

E. Educational Component

Education will be a key component to implementing the watershed based plan. Partnering with the Sleepy Creek Watershed Association (SCWA) will allow educational opportunities to reach the watershed association

Example of one of the Stream Stabilization Projects Sponsored by the Sleepy Creek Watershed Association.

membership as well as members of the community. The Sleepy Creek Watershed Association has committed to partnering in educational efforts to improve water quality within the watershed.

As mentioned in the mission statement of the Sleepy Creek Watershed Association, education and outreach play a vital role in their mission and sustainability. They have a history of outreach and education in the local community and make use of a variety of media.

In order to achieve the non-point source management measures, Sleepy Creek Watershed Association and other local and state organizations have and will conduct a number of activities to educate watershed residents and users about the problems and potentials of the watershed. These activities will also be used to communicate the goals and progress of the WBP:

• *WV Make It Shine Program*: Each Spring SCWA participates in this program. They hold three stream clean-ups collecting solid waste and litter around and on Sleepy Creek and its tributaries.

•*Newsletter and Newspaper Articles:* The SCWA will continue to publish and distribute a quarterly newsletter to members and interested parties, currently numbering over 120. This acts as a tool to encourage community involvement, update on-going projects and provide environmental "helpful hints". SCWA will also continue publishing newspaper articles highlighting activities and events the association promotes.

• *Local Fairs and Festivals*: SCWA has joined with other conservation organizations at the yearly Apple Butter Festival in Berkeley Springs to present an "environmental alley" of conservation programs and activities throughout Morgan County. The Sleepy Creek Watershed Associations has set up a booth at the Morgan County Fair during summers of 2000 through 2006, both to support the local 4-H program and to highlight the activities of the watershed group.

•*SOS Workshops*: Every year SCWA has Stream monitoring workshops to attract the interest of citizens and educate on the process of defining a healthy stream.

• Public Meetings: SCWA hosts two public meetings every year to discuss current events in the watershed and invite guest speakers to discuss local questions and concerns.

Since the increase of population to the watershed, Sleepy Creek Watershed Association wants to branch further out into the community. They have many ideas for more education and community outreach that would benefit the existing and new residents. Some of their outreach activities would be:

•Pay for a qualified, professional speaker to present a program to the community on environmental issues.

•Offer workshops for those responsible for management of small public sewer treatment plants.

•Provide funding to plant trees in agriculturally disturbed areas.

•Provide funding to pay an educational specialist to present programs in the elementary grades on environmental issues.

Educating the public is fundamental to the success of the watershed based plan implementation. Another avenue for this education will be through a more technical approach. Working with consultants and technical providers, education efforts will be made available for the public and the county administrators in Morgan County. Canaan Valley Institute (CVI) has been vital in the development of the watershed based plan. Their educational expertise will be crucial to the success of educational efforts to the community.

Canaan Valley Institute focuses on improvements to wastewater treatment systems to reduce pollution to the region's beautiful rivers and streams caused by inadequate wastewater treatment. CVI has considerable experience in the development of regional comprehensive wastewater plans typically focusing on four components: community engagement; assessment; identifying options; and assisting and coordinating design and implementation. They also provide consultation and training for public service and wastewater management personnel to enhance Individual Sewer System reliability and performance. CVI has extensive experience in hosting public workshops on wastewater issues. Such workshops are developed to inform local citizens on:

- The effects of wastewater pollution on a watershed
- Proper maintenance and care of an onsite wastewater (septic) system
- Alternative options to traditional wastewater systems
- Available financial assistance programs

F, G, H. Schedule for Implementation

Submit Watershed Based Plan to West Virginia Department of Environmental Protection and U.S. Environmental Protection Agency	December 2007
Begin Project Proposal Determination	February 2008
Submit Project Proposal to WV DEP to address failing Individual Onsite Sewer Systems and fecal coliform From agriculture activities	May 2008
Public Outreach and announcement of 319 Incremental Funding	Upon approval by EPA, 2009
Accept applications for project participants	Sept. - Dec. 2008
Implement project to address failing Individual Onsite Sewer Systems and fecal coliform from agricultural sources	September 2009
Hold 2 educational workshops	September 2009
Reduce fecal coliform by 1.18×10^{13}cfu*	September 2009
Assessment of fecal coliform reduction to Sleepy Creek	December 2009

Contract with 90 landowners	December 2009
Hold 2 educational workshops	September 2009
Reduce fecal coliform by $1.18x10^{13}$cfu*	December 2010
Assessment of fecal coliform reduction to Sleepy Creek	December 2010
Contract with 90 landowners	December 2011
Hold 2 educational workshops	September 2011
Reduce fecal coliform by $1.18x10^{13}$cfu*	December 2011
Assessment of fecal coliform reduction to Sleepy Creek	December 2011
Contract with 90 landowners	December 2012
Hold 2 educational workshops	September 2012
Reduce fecal coliform by $1.18x10^{13}$cfu*	December 2012
Assessment of fecal coliform reduction to Sleepy Creek	December 2012
Contract with 90 landowners	December 2013
Hold 2 educational workshops	September 2013
Reduce fecal coliform by $1.18x10^{13}$cfu*	December 2013
Assessment of fecal coliform reduction to Sleepy Creek	December 2013

** reductions were calculated by taking the reduction called for in the TMDL, $5.90x10^{13}$ cfu and divided by five (five) years*

Prioritization Rationale

The goal in this WBP is to achieve the water quality standard in the watershed. In order to achieve that goal an implementation plan has to be developed. The sub-watersheds were prioritized through the information given by the Sleepy Creek Watershed Association and WBP working group. The local knowledge and concerns within the watershed is a considering factor in project determination. The Modeled Failing Septic Flow Map will be used to prioritize the areas, starting with the top five. The areas that have the most agriculture will also be considered to decrease agricultural coliform. A landowner's septic survey was developed to determine the sub-watersheds that need the most assistance with their failing septic systems. The data received from the

survey will be broken down by sub-watersheds. Indian Run will be monitored first, due to the new management in Cacapon South. The working group is confident that this area will achieve the water quality standards first.

Subwatershed Sorted by Failing Septic Flow Rates

Rank	Stream Code	GPD/AC- Failing Septic Flow	Ag Percentage
1	9024	0.155483	9 %
2	9006	0.136471	2.06 %
3	9053	0.122137	0
4	9017	0.106127	16.59 %
5	9032	0.1	2.35 %
6	9051	0.0985292	0
7	9048	0.095137	0
8	9015	0.089163	4.3 %
9	9002	0.087719	0
10	9013	0.087442	6.09 %
11	9019	0.081081	0
12	9011	0.080693	10 %
13	9005	0.079929	23.99 %
14	9016	0.078726	8.06 %
15	9045	0.063776	0

Outreach will be conducted through the Morgan County Health Department with assistance from the Canaan Valley Institute. The efforts of these two organizations will introduce the public to the goals and plans of the project. The Morgan County Health Department and Canaan Valley Institute will provide training to the Public Service Districts and similar organizations.

The outreach campaign will consist of mailing a survey to all landowners in the targeted sub-watershed. The survey will address the landowners' knowledge of their septic system's location and maintenance. Following the completion of the survey, the landowner will be eligible for a coupon to have their septic system maintained.
West Virginia Department of Agriculture and Cacapon Institute will be monitoring. West Virginia Department of Agriculture currently implements a monthly sampling regiment for nutrient and sediment analysis. Cacapon Institute will be perform fecal testing in the focus sub-watershed prior to and following the implementation of the project.

The West Virginia Conservation Agency will administer and oversee the grant. Funding will be administered through the Eastern Panhandle Conservation District.

These organizations will work together to oversee project installation as well as work with the partnering organizations to ensure success of the project.
The West Virginia Department of Environmental Protection (DEP) will oversee the reporting for this project. In addition, staff will assist in education and outreach in the watershed. The TMDL section of the DEP will monitor water quality in three years.
The Sleepy Creek Watershed Association is vital to the success of this project. The watershed association is active in education of best management practices to landowners and residents in the watershed. The Sleepy Creek Watershed Association has pledged their support to this project.

The WBP working group was comprised mainly of residents and professionals who knew the watershed and the land use practices. In review of the TMDL document, the group had concerns with several portions of the document. The group concluded the expectation of 100% reduction of failing septic systems was not a realistic goal to meet water quality standards. After a detailed examination of the watershed by an environmental engineer and the Morgan County Health Department Sanitarian, these professionals agreed the majority of the fecal coliform in Sleepy Creek was not from failing onsite individual sewer systems, but permitted facilities. As found in Appendix A, "The nitrogen data from Sleepy Creek also suggests point source contamination is of more concern than non-point sources are." Another point the working group did not agree with was the estimation of failing septic systems leaking at a rate of 50 gallons/day into the stream. A third concern was the listing of Indian Run. At the present time the housing development within the Indian Run Watershed and the additional facilities have NPDES permits, and no longer have individual onsite sewer systems.

In regards to land use and residents, the working group found the number of residents was greatly over estimate. Approximately 1/3 of the structures used for determining residential structures were actual houses. The remaining 2/3 of the structures were barns, garages, storage buildings, etc., that do not have an individual onsite sewer system. The group also noted an incorrect number of farms identified in the TMDL.(See Appendix C)

I. Monitoring

West Virginia Department of Environmental Protection has a holistic approach to TMDL development where they set pre-TMDL sample sites in areas where previous sampling efforts (targeted sampling based on their 5-year rotating plan) show even a single 'hit' for fecal. In Sleepy Creek's case, a single sample (out of 11 pre-TMDL samples) had a result of 560 cfu/100ml. The pre-TMDL data was deemed sufficient to list the stream for the first time on the 2006 303(d) list. Data collected for the purpose of supporting TMDL development was put into the WVDEP 'decision database' that is used to track assessment decisions. This decision database produced the following description: *List for fecal from mouth to RM 18.0 and again from RM 26.7 to headwaters 2003/2004 TMDL data had 1/11 violations near mouth, 2/11 at RM 8.0, 0/12 at RM 18, 1/12 at RM 26.7, and 2/11 at RM 36.8.* (John Wirts, WVDEP, personal communication).

- A QAPP for all water quality monitoring will be prepared and submitted to West Virginia Department of Environmental Protection and the United States Environmental Protection Agency by Cacapon Institute.

- Indian Run had the greatest number of exceedences during the TMDL monitoring period, with 3 out of 13 samples in excess of 400 cfu/100ml. Information from the Morgan County Health Inspector indicates that the fecal coliform contamination in Indian Run may have been associated due to a known problem with a community septic system; this problem has been resolved. Sampling in Indian Run will determine if fecal coliform contamination remains an issue in that stream and, if so, will seek to find the source. Sampling will occur twice per month for six (6) months upon approval of the watershed based plan by the U. S. EPA.
- The data noted above indicated that exceedences of the fecal coliform standard (400 cfu/100ml) in Sleepy Creek were infrequent. Weather data indicates that the exceedences occurred during rainy periods, and it is possible that the specific locations of the exceedences provide little useful information as to likely sources of contamination. Sampling at set number of locations in Sleepy Creek and its tributaries, approved by the watershed-based-plan work group, will be conducted in an effort to locate sources of fecal coliform contamination. Sampling locations will be based on results of previous sampling and local knowledge of conditions on the ground. Sampling will occur twice per month for six (6) months beginning upon approval of the watershed based plan by the U. S. EPA.
- Based on the initial six months of sampling twice monthly "hot spots" will be identified where possible, new sampling sites identified where necessary, and a new monthly sampling regiment established. The sampling regiment will be reviewed and modified annually as needed.

The West Virginia Department of Agriculture (WVDA) will continue to monitor six (6) sites on Sleepy Creek. WVDA monitors these sites monthly for Nitrate, Nitrite, Ammonia, Total P, Ortho-P, TSS, Turbidity, pH, and Conductivity. West Virginia Department of Agriculture will also continue to monitor flow at one of the sites.

In addition to the monitoring that will be conducted by Cacapon Institute and the WVDA, WVDEP will monitor the watershed once every five (5) years as part of their watershed monitoring program.

Monitoring will also be done through the use of Save Our Streams. The Sleepy Creek Watershed Association performs a Save Our Streams survey with the local school groups and monitors before and after any stream restoration projects. The volunteers of SCWA have regularly monitoring sites. This local resource will help measure water quality

Monitoring Protocol

Cacapon Institute will conduct plan development monitoring for fecal coliform bacteria. The purpose of monitoring is to gather additional data that is necessary to identify "hot spots" and possible sources of fecal pollution entering the main stem of Sleepy Creek. Better data will lead to more informed decisions and a stronger watershed based plan.

The monitoring and sampling project will be used as a mapping exercise to identify the areas with the largest need for assistance and improve the accuracy of the watershed based plan. Eight (8) sites will be identified for twice monthly monitoring for

six months and episodic higher flow sampling during runoff events if possible (not to exceed 2 additional sampling days). Monitoring points will be revaluated after six months based on monitoring results and a monthly sampling regiment established to be continued as necessary until TMDL requirements are met. Samples will be collected sites with public access or landowner permission.

Partners and Working Group Members:

- **Cacapon Institute**: Frank Rodgers, W. Niel Gillies
- **Canaan Valley Institute:** Kristin Mielcarek, Ed Winant
- **Eastern Panhandle Conservation District:** Jim Michael
- **Morgan County Health Department :** Lee Fowler, Bob Stumpff
- **Sleepy Creek Watershed Association**: Gale Foulds
- **West Virginia Conservation Agency:** Gretchen Cremann, Barbara Elliott
- **West Virginia Division of Forestry:** Herb Peddicord
- **West Virginia Department of Environmental Protection:** Alana Hartman
- **West Virginia Department of Health and Human Resources:** Rick Hertges
- **West Virginia University Extension Service:** Bob Knight

Appendix A

WATERSHED WASTEWATER PROTECTION PLAN

Sleepy Creek Watershed
Wastewater Management Study
Morgan County, West Virginia

Prepared by:

Canaan Valley Institute

P.O. Box 673
Davis, WV 26260

Tel: (800) 922-3601
(304) 463-4739
Fax: (304) 463-4759
http://www.canaanvi.org

October 30, 2007

Principle Author:

Edward H. Winant, Ph.D., P.E.
Environmental Engineer

Canaan Valley Institute
WORKING FOR THE SUSTAINABILITY OF THE MID-ATLANTIC HIGHLANDS SINCE 1995

Background:

Sleepy Creek is included on West Virginia's 303(d) list for fecal coliform bacteria impairment. The data used to support this listing was collected by the WV Division of Environmental Protection. A Total Maximum Daily Load (TMDL) study for Sleepy Creek and other impaired watersheds in the Potomac Direct Drains area was published in February 2007. WVDEP performed additional monitoring to refine impairment listings. As a result, the TMDL listed as impaired the full length of Sleepy Creek's mainstem and Indian Run.

The watershed comprises three branches of Sleepy Creek which join to form the mainstem, as well as numerous other tributaries. In total, it drains 93,000 acres. Development has been identified as the major threat to water quality in Sleepy Creek, with agricultural practices also noted. Growth in Morgan County has been rapid during the past 20 years at about 24%. Current land use includes over half the acreage as forest, then agricultural uses (crops, pastures and orchards), but land use for development has grown considerably in recent years.

The majority of houses and other facilities in Sleepy Creek Watershed use individual, onsite sewage treatment systems, though there are new subdivisions and existing communities that rely on treatment plants and effluent discharge directly into the waters of Sleepy Creek. In addition, much new development is occurring in planned subdivisions, so the reliance on community treatment is increasing. .

Individual wells also account for the majority of drinking water in the watershed. Typical wells are 120 to 400 feet deep, cased and grouted to prevent contamination from surface water or the unprotected soil aquifer, tapping deeper, protected aquifers instead.

Sleepy Creek Water Quality Data (WV Dept. of Ag)

	Average	**Median**	**Min**	**Max**
pH	8.00	8.10	6.80	8.80
Temp ©	13.20	12.40	0.00	29.40
DO	14.80	11.60	5.60	
TKN	0.17	0.19	0.06	0.23
Ammonia	0.10	0.08	0.00	0.32
Nitrate	0.26	0.20	0.00	2.50

In general, these water quality data look quite good. The dissolved oxygen is high, in general, and even at its minimum value is decent. The ammonia values are quite low, while the nitrate is good in general but can get higher than desirable.

However, Sleepy Creek was listed as impaired in terms of fecal coliform contamination. Various samples taken from 1998 and 2003 show a range of contamination.

Sleepy Creek Bacterial Contamination Survey

ID and River Mile	Creek	Date	CFU/100ml
WVP-9 26.7	Sleepy Creek	8/26/2003	14000
WVP-9 35.6	Sleepy Creek	6/10/1998	290
WVP-9 36.8	Sleepy Creek	6/10/1998	560
WVP-9 37.0	Sleepy Creek	8/26/2003	360
WVP-9-B 0.1	Meadow Branch	8/26/2003	580
WVP-9-B 12.8	Meadow Branch	6/3/1998	420
WVP-9-D 2.6	Mountain Run	6/10/2003	220
WVP-9-E 7.0	Middle Fork/Sleepy Creek	6/10/1998	230
WVP-9-E-1	South Fork/Sleepy Creek	6/4/1998	280
WVP-9-G 0.6	Indian Run	8/26/2003	2000
WVP-9-I	Hands Run	6/10/1998	1100

TMDL Analysis:

After reviewing the accumulated data and reports, CVI staff toured the watershed with the Morgan County Sanitarian, Lee Fowler. The data suggests that fecal contamination is occurring in the headwaters, specifically Indian Run and Hands Run, with less concern for Middle Fork and South Fork, but that a large spike occurs in Sleepy Creek between river miles 35.6 and 26.7. This suggests a point source on that segment. Additionally, Indian Run enters Sleepy Creek in that stream segment, but the high results in Sleepy Creek mean some other source is adding to the contamination besides the load from Indian Run. With no additional source of contamination, the fecals from Indian Run would be diluted in the larger flow of Sleepy Creek.

The nitrogen data from Sleepy Creek also suggests point source contamination is of more concern than non-point sources are. For these reasons, the most important step in planning improvements is to review documentation for wastewater treatment plants in the watershed for the past few years. This documentation should include Discharge Monitoring Reports (usually filed monthly, and referred to as DMRs) installation permits and WVDEP inspection reports, as well as any compliance letters. Some of the fecal contamination in Sleepy Creek is certainly the result of wastewater treatment plant discharges in need of improvement.

This is not to suggest that failing septic systems are not part of the problem. There are certainly a number of failing systems in the watershed, as well as systems not yet failing but in need of improvement. Identification of these systems is the key to a repair or replacement program, but in general, the overall functioning of septic systems is best insured with adequate management.

Thus, any plan for reducing contamination from onsite wastewater sources must include a management component. This component, of course, can then address other needs like inspection and repair. There are many methods and styles of managing onsite systems, from voluntary participation and minimum oversight to treating onsite systems as a utility with full service and monthly bills. It would be the province of the Sleepy Creek Watershed Association to suggest a

likely management program and the local residents, or the County Commission, to adopt it legally.

What should be done to provide a carrot and encourage participation in the management program is create a fund from grant monies to assist homeowners with systems repairs and replacements. As an example, the conservation district could secure $100,000 and make $5,000 grants available to any homeowner willing to upgrade or replace a failing or substandard system. Low-interest loans, funded from other state programs, could be used to make up the rest of the system repair or replacement costs. A large advantage to this approach is that homeowners are encouraged to self-identify problems and report them. As a part of this program, technical assistance, from an organization like Canaan Valley Institute could be offered for inspecting the selected sites and assisting with determining the proper upgrade or replacement technology.

Another consideration is that several small lots located near each other might be best served with a cluster or community system rather than individual onsite systems. Small lots, with no room for replacement systems may be served by piping the effluent to a nearby landowner or common area with better soil or terrain. Several nearby lots with failing or inadequate systems would also benefit from a shared solution.

Cluster systems use the same technology for treatment and dispersal as onsite systems, but are sized to handle more than one house. They introduce two complexities over onsite systems, though: easements and required maintenance. Legal easements are required for houses served by cluster systems to insure that the treatment system remains functional through time and ownership changes. These easements insure that treatment is always available to the lot. Maintenance agreements, usually a contract with a qualified third party, are also required to insure the sustainability of the treatment system.

The management system should also incorporate an educational component. Again this could be approached in several different ways, from making informational brochures and handouts available, to hosting homeowner workshops or providing technical assistance for inspection and repair work.

Education, management, word-of-mouth and public support are the keys to building a program of healthy onsite wastewater systems. The most probable management style for this watershed is voluntary, with reminders to perform maintenance, financial assistance and education. Thus, it will be a many-avenued system of approach relying on the participation and activity of the local homeowners and support from the watershed association.

A final note on septic system inspections is that the majority of inspections occurs during the sale of a property and are requested by the lending institution. Currently, there are no state laws certifying qualified septic system inspectors, so these inspections are usually done by home inspectors. A county regulation to require special certification for the inspections of onsite systems would help immensely in determining the extent and nature of the failing septic system problems in the Sleepy Creek watershed. There is a course offered by the WV Bureau of Public Health to train onsite wastewater system inspectors.

Other threats to the watershed, in terms of fecal contamination, occur from agriculture and wildlife. These include not only animals in the stream, but run off from fields fertilized with manure. This report will not cover an assessment of the magnitude of these components, other than to suggest that they be studied and addressed. One activity that might provide insight into the cause of fecal contamination is Bacteria Source Tracking, where fecal samples are further analyzed to determine if they come from a human (wastewater) domestic animal (agricultural) or wild animal (wildlife) source.

Recommendations:

In conclusion, it is our determination that the sources of fecal contamination are largely from surface discharging wastewater treatment plants (WWTPs). The chief activity for dealing with these would be a review of documentation on each WWTP, identifying necessary improvements, and securing technical and financial assistance for the owners of those plants to make the required upgrades. Reviewing the documentation to find problems, visiting the troubled WWTPs and determining upgrades would be the work of a few days, costing perhaps $1,500 for the review team. Each identified upgrade, of course, is unknown, and could create repair projects requiring hundreds of thousands of dollars.

Secondly, to deal with the failing onsite systems in the watershed, a management program should be researched and implemented to insure the long-term functioning of all onsite systems as well as the upgrade and replacement of failing or substandard systems. At a minimum, this management entity would remind homeowners when to have their septic tanks pumped, remind them of other maintenance needs, and assist them with finding service providers for alternative systems. Part of this should be provided in an educational campaign aimed at homeowners and offered through workshops and literature. Hopefully, the management entity would also serve as a grantor of funds for repairs and help to provide technical assistance for upgrades, replacements and new systems. The total cost of repairing all the failing septic systems depends on how many there are, and would be a multiple year project. As noted above, however, any money secured could be used as a start. An average estimate for septic system upgrades is $7,500, with a range of $500 to as much as $20,000. But, of course, the project could be set up to provide grants of $5,000 per home (or some other amount) with the rest of the money being provided by the homeowner. At $5,000 per home, a grant of $100,000 would fund 20 failing systems.

In locations with several failing or inadequate systems, cluster systems should be considered. Identifying these locations will require the input of the county Health Department, and technical assistance would be provided by CVI. In general, there are some cost savings associated with cluster systems, so the cost per house is similar or slightly less than individual repairs and an estimate of $7,500 per house is still valid.

Finally, it would be a good idea to require inspections of onsite systems during property transfer by certified onsite wastewater inspectors. These requirements would have to be adopted by the County Commission, but the Sleepy Creek Watershed Association could push for their adoption.

Appendix B

Surface Discharges in the Sleepy Creek Watershed
Edward Winant, Environmental Engineer
Canaan Valley Institute
November 27, 2007

There are 8 identified wastewater treatment plants in Morgan County, WV that have surface discharges into the Sleepy Creek Watershed. Altogether, they are permitted to discharge 206,200 gallons per day, though the actual discharges are much below this. Most of the plants are governed by secondary discharge limits, though three plants have more stringent limitations. Secondary levels call for normal biological treatment and disinfection, with the main parameters being Biological Oxygen Demand (BOD) of 30 mg/l, Total Suspended Solids (TSS) of 30 mg/l, and fecal coliforms at 200 colony forming units per 100 ml (cfu/100 ml) and reporting only of other parameters. Two plants have advanced secondary standards, with BOD limited to 10 mg/l and ammonium nitrogen limited to 6 mg/l, and one plant has tertiary standards with BOD at 5 mg/l and ammonium nitrogen at 3 mg/l. All told, the fecal load of these plants at permit levels is:

$$\frac{206{,}000\ \text{gal}}{\text{Day}} \times \frac{3.9\ \text{L}}{\text{gal}} \times \frac{1000\ \text{ml}}{\text{L}} \times \frac{200\ \text{cfu}}{100\ \text{ml}} = 1.6 \times 10^{9}\ \text{cfu/day} = 5.8 \times 10^{11}\ \text{cfu/yr}$$

This is less than the TMDL reported wasteload allocation of 1.25×10^{10} cfu/day because it accounts for only 8 current plants, rather than the 10 mentioned when the TMDL was done, and also does not account for any stormwater or combined sewer discharges.

For the most part, these small wastewater treatment plants perform very well, meeting their discharge limitations by wide margins. However, due to heavy storms, they may be flooded out, or with a lack of maintenance, fail to perform as intended. In either case, under-treated sewage is discharged directly to the watershed.

As can be seen in the following list of plants and their list of notable violations and permit exceedences, there are three major violators: Valley Dale Maintenance, Valley View Nursing Home, and the Wayside Market. Please refer to the attached map for locations of the plants, with the violators marked in red. To understand the magnitude of these violations, consider the example of one day of permit exceedence.

Valley View Nursing Home, discharging 21,000 cfu/100 ml with a measured flow of 8,800 gpd would put:

$$\frac{8{,}800\ \text{gal}}{\text{Day}} \times \frac{3.9\ \text{L}}{\text{gal}} \times \frac{1000\ \text{ml}}{\text{L}} \times \frac{21000\ \text{cfu}}{100\ \text{ml}} = 7.2 \times 10^{9}\ \text{cfu/day}$$

This is almost five times the daily allowed load for all 8 plants. The raw discharges from Valley Dale Maintenance would yield:

$$\frac{10{,}000\ \text{gal}}{\text{Day}} \times \frac{3.9\ \text{L}}{\text{gal}} \times \frac{1000\ \text{ml}}{\text{L}} \times \frac{1{,}000{,}000\ \text{cfu}}{100\ \text{ml}} = 3.9 \times 10^{11}\ \text{cfu/day}$$

This is two-thirds of the yearly allotment for all 8 plants, and twice the daily TMDL. It should be easy to see how even small problems with surface discharging plants can result in large problems with the health of the watershed. It should also be noted that the treatment plants submit effluent quality data to the West Virginia Department of Environmental Protection quarterly in these cases. That is, one grab sample of effluent is taken each three months and sent to a certified laboratory for analysis. Thus, each permit exceedence could extend in time for days or weeks, greatly increasing the amount of under treated wastewater in the watershed. On the other hand, the raw discharges are self-reported incidences that are limited in time to the storm event and the subsequent runoff.

For the TMDL, the total load of fecals is 2×10^{11} cfu/day, broken down between the load allocation (non-point sources) of 1.8×10^{11} and the waste load allocation (point sources) of 1.25×10^{10}. This allocates 90% of the load to non point sources, 6% to point sources, and 4% to a margin of error. However, this is largely due to the high bar that point sources are required to meet, and when they fail to meet that bar, the consequences are enormous.

WVG550694 522 Industrial Park: very low flow, lack of maintenance noted, but never enough flow for DMRs 25,000 gpd design flow, secondary limits

WVG551222 Cacapon South: small maintenance issue, very good quality effluent 38,000 gpd design flow, secondary limits

WVG551181 Cacapon State Park: maintenance issues with sand filter, very good coliform counts and BOD/TSS readings; 50,000 gpd design flow, secondary standards

WVG550387 TriLake MHP: leaking lagoon, no discharge, 31,500 gpd design flow, secondary standards

WVG550862 Valley Dale Maintenance: under compliance order March 4, 2005 for numerous Notices of Violations (NOVs) from 2002 to 2004; fined $11,000 roughly, 10,000 gpd, design flow, tertiary limits: BOD 5 mg/l TSS 30 ammonia 3

2Q 2005 fecals 22000
3Q 2005 fecals 510

Raw discharges April 2004 x2
Sept, 2004

WVG550373 Valley View Nursing Home: permit revoked April 2006; order of compliance April 2005 for numerous NOV including empty chlorinator; fined for $10,500, flow permitted 35,000 gpd, secondary standards; permit reinstated

1Q 2003 BOD 35.4
4Q 2003 BOD 140
TSS 36.4
Fecals 21,000
1Q 2004 BOD 68.8
TSS 80
2Q 2004 BOD 140
TSS 120
2Q 2005 BOD 42
TSS 36
3Q 2005 BOD 65
TSS 106
1Q 2006 BOD 38.4
TSS 68
3Q 2006 BOD 35
TSS 33

WVG550673 Waugh's MHP: maintenance issues, low DO, no chlorine or dechlorination tablets, 14,700 gpd design flow, advanced secondary standards: BOD 10 mg/L TSS 30 mg/L ammonia 6 mg/L (winter)

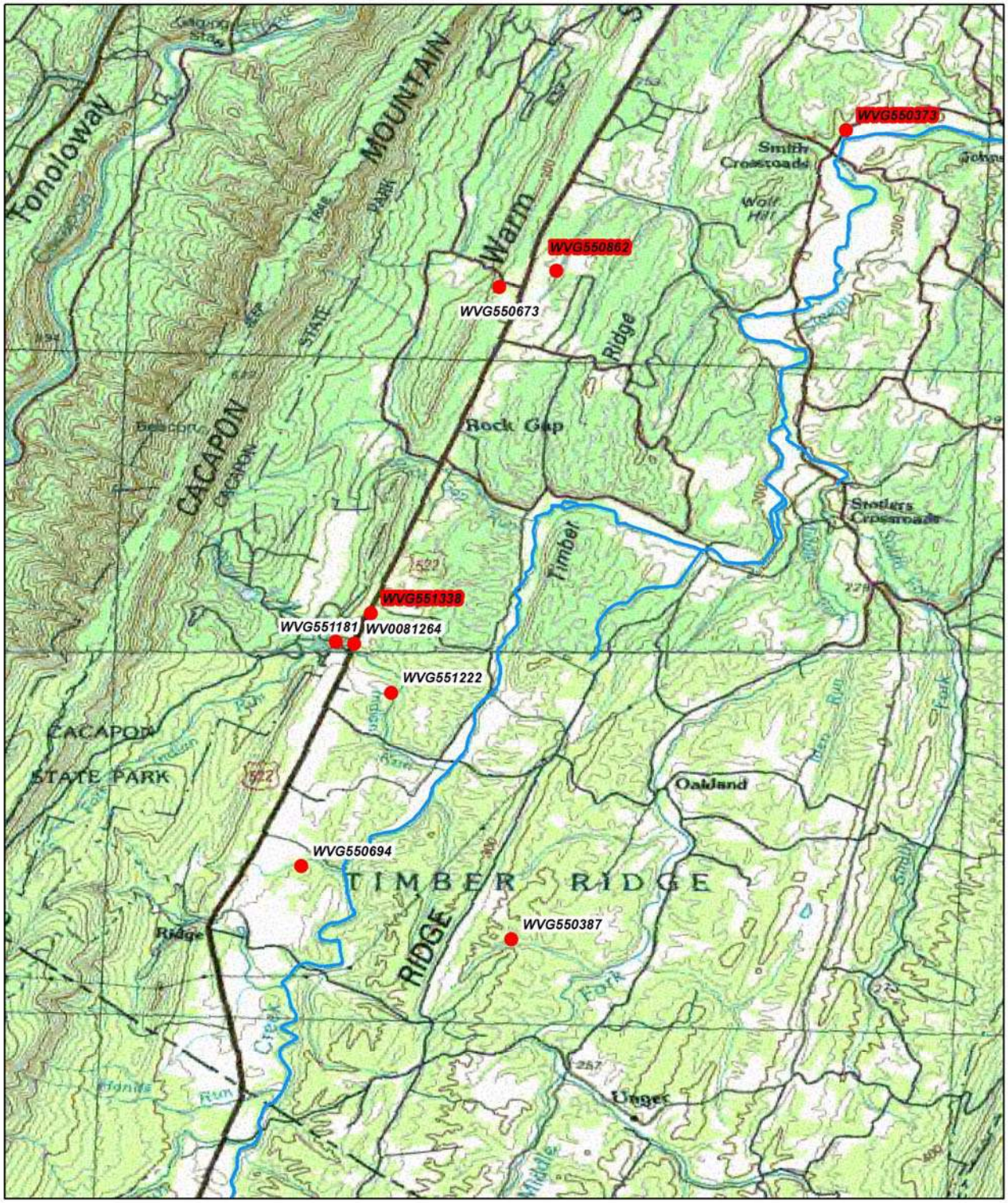
4Q 2005 Fecal 700
1Q 2006 Fecal 6000

WVG551338 Wayside Market: cited for denying access to inspectors, flow permitted is 2000 gpd, advanced secondary standards: BOD 10 mg/L TSS 30 mg/L Ammonia 6 mg/L

2Q 2005 BOD 18
Fecals 26,000

These plants are privately owned (except for the State Park) but permitted and regulated by the WV DEP. Clearly, the responsibility for meeting the permitted standards lies with the owners, but equally clearly, enforcement actions to date have not yielded adequate improvements.

It seems clear that one of the best ways to repair the water quality of the Sleepy Creek Watershed is to extend technical assistance, and help find financial assistance for the wastewater treatment plants that are out of compliance.



NPDES Permits in the Sleepy Creek Watershed

N

0 0.5 1 2
Miles

Appendix C **Explanation of Adjustments to Annual Load Baseline**

Frank Rodgers, Cacapon Institute

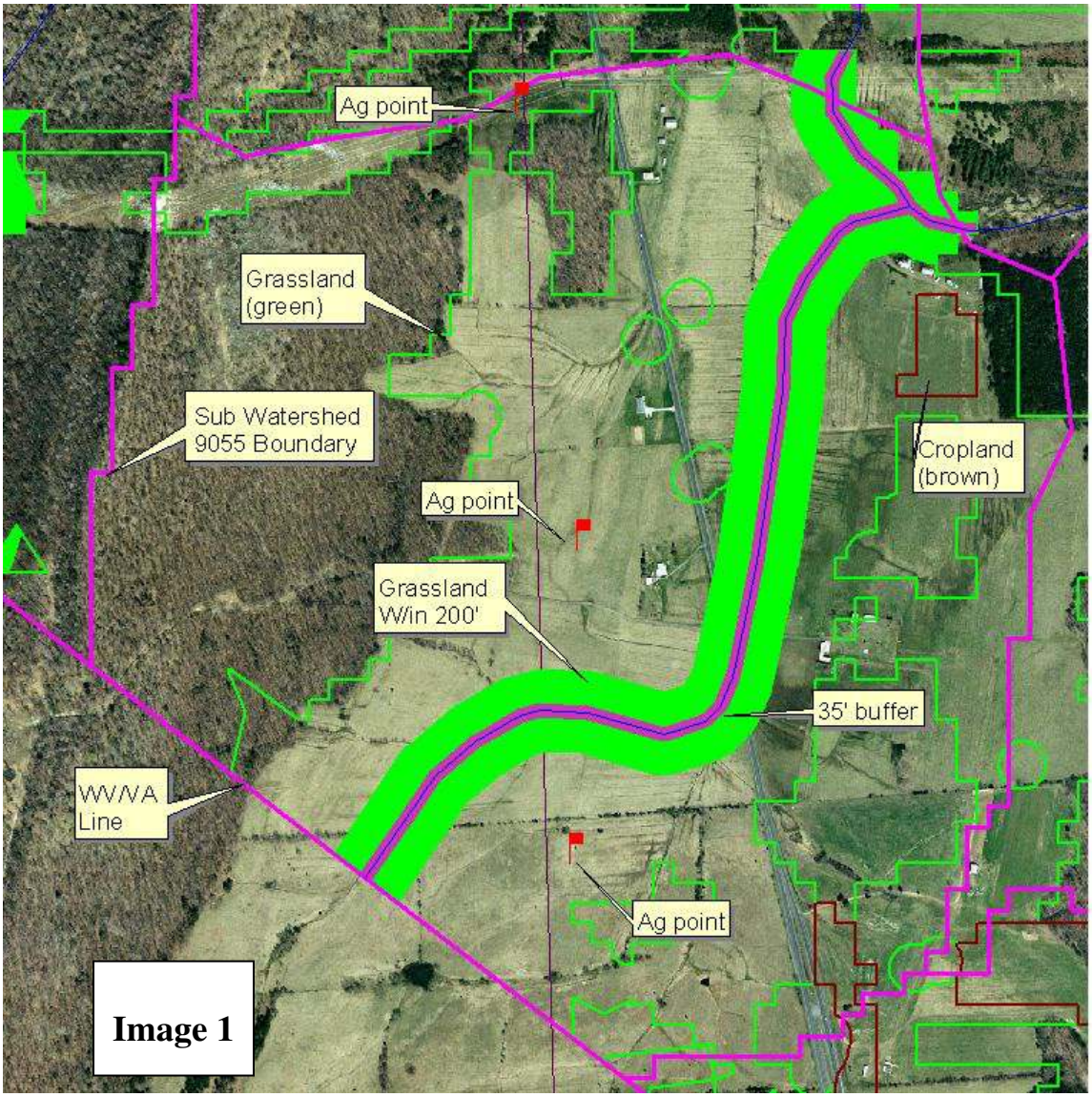


Image 1 is an aerial view of subwatershed 9055 from the 2003 WV Digital Ortho Quarter Quads. It indicates far more than the 8.8 acres of "pasture" indicated in the TMDL. The National Hydrological Dataset's stream line a 200' stream buffer (shown in green) indicates 46 acres of agricultural land adjacent to the stream alone. Because of similar discrepancies in estimated landuse the TMDL estimates were set aside in favor of landuse/landcover estimates. The WBP used GIS landuse/landcover sets to estimate the acres of "pasture" and "cropland" in each subwatershed, then the acres of each landuse within 200' of the stream. The total reallocated bacterial load for pasture and cropland was distributed into those acres.

The aerial photograph, image 2, is an example of the 911 data set showing structures as reported in the TMDL (red dots). The information used to estimate "residences" in each subwatershed by the TMDL, as mentioned in Section H of the WBP, shows that there is likely less "sewer" (septic) systems then the TMDL estimated. Local residents and 2003 aerial images demonstrate that as many as 2/3 of points on each property are out-buildings and not residential or inhabited commercial structures. On farm properties the ratio of out-building to residences was higher. In this image of a typical suburban development most houses were accompanied by at least one garage, barn, or other structure not likely to be accompanied by a "sewer" system. The WBP working group, based on this finding, conservatively reduced the expected number of "sewer" systems and their associated loads by 50%. The reallocated load was moved to pasture, cropland, and residential/urban as noted in the load allocation spread sheets in the WBP.