Beaver Creek

Watershed Based Plan

Submitted by the
West Virginia Conservation Agency

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Watershed Based Plan for Beaver Creek

Submitted by: West Virginia Conservation Agency
1900 Kanawha Blvd.
Charleston, WV. 25305
(304) 558-2204
www.wvca.us

Local Project Office: Dennis Burns
Greenbrier Valley (GVCD)
179 Northridge Drive
Lewisburg, WV 24901
(304) 645-6172

Partners: 1) WV Department of Environmental Protection
2) USDA Natural Resources Conservation Service
3) Pocahontas County Health Department
4) Watershed Residents

Prepared by: Alvan D. Gale
PO Box 124
Marlinton, WV. 24954
(304) 799-2316
agale@wvca.us

COMMON ACRONYMS

TMDL	Total Maximum Daily Load
WLA	Waste load allocation
LA	Load allocation
LR	Load reduction
MOS	Margin of safety
BL	Baseline
USEPA or EPA	US Environmental Protection Agency
DEP	WV Department of Environmental Protection
WVCA	WV Conservation Agency
NRCS	Natural Resources Conservation Service
HD	Health Department
BPH	Bureau of Public Health
WAB	Watershed Assessment Branch
OSLP	On-site Loan Program
BMP	Best management practice
WQ	Water quality
ES	Environmental Specialist

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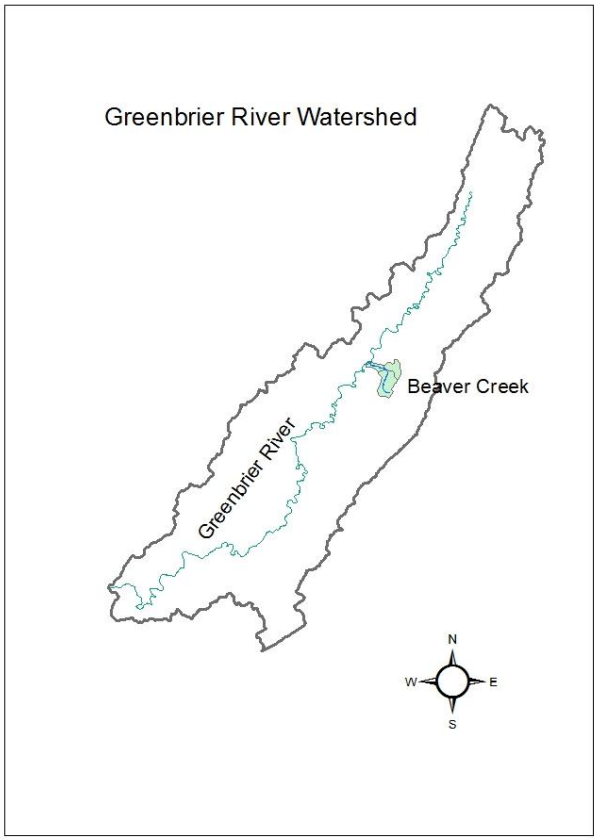
INTRODUCTION

The purpose of this watershed based plan (WBP) is to define the problems, resources, costs and course of action necessary to restore the impaired streams of the Beaver Creek watershed to full compliance with water quality standards. Following this watershed based plan will implement the Total Daily Maximum Load (TMDL) set for these streams by the WV Department of Environmental Protection (DEP).



Beaver Creek, stream code WVKNG 47, is a relatively small watershed, 10,294 acres, located in Pocahontas County, WV. It consists of three subwatersheds numbered 470,471 and 472. Upper Beaver Creek (472) and Lower Beaver Creek (470) are listed as impaired in the 2006 Section 303(d) list as impaired by fecal coliform bacteria. Pollutant load allocations are included in the Greenbrier River TMDL approved by EPA in 2008.

The predominant land use in the watershed is forest comprising 93.52% of the watershed. Grassland and pasture comprise 4.77% and 1.66% respectively. There is no karst in the watershed and the topography is typical of this region with relatively narrow valleys and steep hills.

The TMDL for Beaver Creek is included in the Greenbrier River TMDL. The TMDL calls for a 4.13% reduction in fecal coliform to restore water quality standards to Beaver Creek.

Table 1. Beaver Creek TMDL

Beaver Creek Watershed - Fecal Coliform TMDLs									
TMDL Watershed	Stream Code	Stream Name	Baseline LA (counts/yr)	LA (counts/yr)	Baseline WLA (counts/yr)	WLA (counts/yr)	MOS (counts/yr)	TMDL (counts/yr)	% Reduction
Beaver Creek	WVKNG-47	Beaver Creek	2.07E+13	1.99E+13	1.02E+10	1.02E+10	1.05E+12	2.09E+13	4.13

The West Virginia Conservation Agency will be the lead agency in implementing this WBP but will work closely with the WV Bureau of Public Health (BPH) and the Pocahontas County Water Resources Task Force (WRTF). The WVCA will work with contractors and disburse funds through the Conservation Districts and work with the WRTF to present the project to the public

and locate trouble spots. The WVCA will work closely with the BPH to maintain all quality standards during the projects.

CAUSES AND SOURCES

Section 303(d) of the federal Clean Water Act requires states to identify waterbodies that do not meet water quality standards and to develop appropriate TMDLs. A Total Maximum Daily Load (TMDL) establishes the maximum allowable pollutant loading for a waterbody to achieve compliance with established water quality standards. It also distributes the load among pollutant sources establishing load reduction goals from each source.

The TMDL for Greenbrier River watershed was approved by the U.S. Environmental Protection Agency (USEPA) in 2008. The TMDL model was based on extensive water quality monitoring from July 2004 through June 2005 by the DEP. The results of that monitoring were used to confirm the impairments to streams identified on previous 303(d) lists and to identify other impaired streams that were not previously listed.

Data obtained from pre-TMDL monitoring was compiled, and the impaired waters were modeled to determine baseline conditions and the gross pollutant reductions needed to achieve water quality standards. A TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS) that accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving stream. TMDLs can be expressed in terms of mass per time or other appropriate units. TMDLs are calculated by the following equation:

TMDL = sum of WLAs + sum of LAs + MOS

The determination of impaired waters involves comparing instream conditions to applicable water quality standards. West Virginia's water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, titled *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards*. Water quality standards consist of three components: designated uses; narrative and/or numeric water quality criteria necessary to support those uses; and an antidegradation policy.

In the Greenbrier River watershed, water contact recreation and public water supply are listed as the designated uses that have been impaired based on the water quality criteria for fecal coliform bacteria. The water quality standard for human health from 47 CSR, Series 2, *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards* is:

"**Human Health Criteria** Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not

exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month."

Table 2. Beaver Creek Load Allocations from the TMDL

Stream Name	Stream Code	Pasture/Crop-land Baseline Load (counts/yr)	Pasture/Crop-land Allocated Load (counts/yr)	Pasture/Crop-land Percent Reduction	Background & Other Nonpoint Sources Baseline Load (counts/yr)	Background & Other Nonpoint Sources Allocated Load (counts/yr)	Background & Other Nonpoint Sources Percent Reduction	Onsite Sewer Systems Baseline Load (counts/yr)	Onsite Sewer Systems Allocated Load (counts/yr)	Onsite Sewer Systems Percent Reduction
Beaver Creek	WVKNG-47	0.00E+00	0.00E+00	0.0	1.53E+12	1.53E+12	0.0	1.42E+10	0.00E+00	100
North Fork/Beaver C	WVKNG-47-A	1.45E+12	1.45E+12	0.0	2.69E+12	2.69E+12	0.0	3.44E+11	0.00E+00	100
Beaver Creek	WVKNG-47	8.47E+12	8.47E+12	0.0	5.73E+12	5.73E+12	0.0	4.98E+11	0.00E+00	100
Totals		9.92E+12	9.92E+12	0.0	9.96E+12	9.96E+12	0.0	8.56E+11	0.00E+00	100.0

The Greenbrier TMDL calls for reductions in the Beaver Creek watershed only from the category of on-site wastewater systems. The total reductions of fecal coliform in Beaver Creek from the TMDL were 8.2E+11 cfu, the total reduction needed from the on-site wastewater category is 8.56E+11 cfu. Obtaining a 100% reduction from failing septic systems will accomplish the TMDL. A 100% reduction from that category is required because the West Virginia Bureau for Public Health regulations prohibit the discharge of raw sewage into surface waters. Therefore, all illicit, non-disinfected discharges of human waste from failing on-site systems were reduced by 100 percent in the TMDL.

To calculate failing septic wastewater flows, the watersheds were divided into four septic failure zones during the source tracking process. Septic failure zones were delineated by geology, and defined by rates of septic system failure. Two types of failure were considered: complete failure and periodic failure. In the model a complete failure was defined as 50 gallons per house per day of untreated sewage escaping a septic system as overland flow to receiving waters. Periodic failure was defined as 25 gallons per house per day of untreated sewage escaping a septic system as overland flow to receiving waters. A base concentration of 10,000 counts per 100 mL was used as a beginning concentration for failing septics. The TMDL identifies only two types of septic failure zones in Beaver Creek: low and medium. The TMDL estimates the number of residences with some kind of failure by the percentages in Table 3.

In the TMDL the calculation for determining residences with failed systems can end with a fraction. In reality there can be no fractions, either a residences' system is failing or it is not. All fractions in the model are rounded up to the next whole number. The estimated number of residences with failing septic systems for the Beaver Creek subwatersheds is shown in Table 4.

Table 3. Percentages of Septic Failures

Type	% homes with seasonal failure	% homes with complete failure
Very Low	3.00	5.00
Low	7.00	10.00
Medium	13.00	24.00
High	19.00	28.00

Table 4. The Number of Residences with Failing Septic Systems

	Homes with septic systems by failure zone		Homes in Low Zone with Failing Septic Systems				Homes in Medium Zone with Failing Septic Systems					
SWS	Low	Medium	Low Zone		Low Zone Whole Residences		Medium Zone		Medium Zone Whole Residences		Total Failures	
			Periodic	Complete	Periodic	Complete	Periodic	Complete	Periodic	Complete	Periodic	Complete
470	0.00	2.70	0	0	0	0	0.4	0.6	1.0	1.0	1.0	1.0
471	16.74	57.78	1.2	1.7	2	2	7.5	13.9	8.0	14.0	10.0	16.0
472	0.00	94.50	0	0	0	0	12.3	22.7	13.0	23.0	13.0	23.0
Total Residences Needing Repair or Replacement of On-site Wastewater Systems											24.0	40.0

LOAD REDUCTIONS REQUIRED

The load reductions being called for in this watershed based plan are based on the TMDL for the entire Greenbrier River watershed. The TMDL is a load allocation that expresses what is allowed to enter the stream. Load reduction (LR) targets are determined by subtracting the TMDL from baseline load (BL) levels:

LR = BL – TMDL

LR is the accumulated reductions from practices installed during the implementation process. As such, it becomes the primary criteria for tracking environmental results.
The total maximum daily load allocated to Beaver Creek is 2.09E+13 but the baseline load is only 2.07E+13. However, monitoring by DEP resulted in enough violations of water quality standards to require that Beaver Creek be placed on the 303(d) list. If the MOS is ignored, then the TMDL allocation is 1.99E+13 cfu/yr. This will result in a load reduction of 8.20E+11 cfu/yr required, 4.13% (Table X). Complying with the 100% reduction that the West Virginia Bureau for Public Health regulations require will result in a load reduction of 8.56E+11.

Beaver Creek Septic Failure Zones

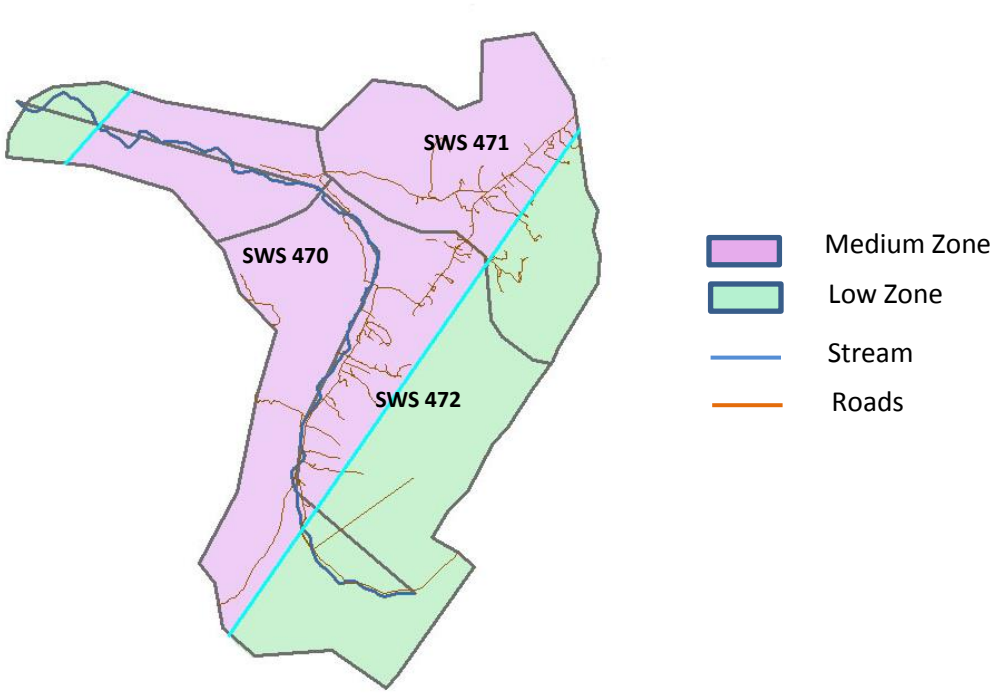


Table 5. Load Allocations with and without the MOS

Baseline LA	2.07E+13	**LA**	1.99E+13
Baseline WLA	1.02E+10	**WLA**	1.02E+10
		MOS	1.05E+12
Total Baseline	2.07E+13	**TMDL**	2.09E+13
		TMDL w/o MOS	1.99E+13
% Reduction with MOS	-1.09%	**% Reduction w/o MOS**	4.125%
		Reduction Required	8.20E+11

Table 5 shows that to achieve the necessary load reduction will require actions to correct 24 periodic systems and 40 completely failing systems. Using the 10,000 counts/100ml baseline for septic failures and the 25 gal/day loading of streams for a periodic or seasonal failure, repairing these 24 failures will result in a reduction of 8.3E+12 cfu/yr. Using the 50 gal/day estimated contamination of streams for a completely failing system replacing 40 systems will result in a reduction of 2.77E+13 cfu/yr. The total reduction for correcting all failed systems is expected to be 3.59E+13 cfu/yr. A 100% reduction of the entire on-site wastewater contribution would be 3.56E+13 cfu/yr. A total higher than that estimated in the TMDL is expected due to rounding up the fractions of residences used in the model.

MANAGEMENT MEASURES

Beaver Creek presents an implementation dilemma for the TMDL model. The TMDL estimates that a reduction of 8.21E+11 cfu/yr will bring Beaver Creek back into compliance with water quality standards. However, due the BHHS regulations the TMDL also calls for a 100% elimination in the on-site wastewater category or 3.56E+13 cfu/yr. The BHHS does not enforce these regulations on older housing so the implementation of the WBP will include technical and financial assistance for voluntary compliance by local residents. The WVCA will be the agency offering this assistance with the cooperation of the BHHS.

Fulfilling the reductions called for in the TMDL will greatly exceed the load reductions needed to restore Beaver Creek, by the model. But, leaving failures unrepaired could create a pollution hot spot which could cause the entire stream to remain on the 303(d) list.

Two categories of failing septic systems have been identified: completely and periodically failing systems. Completely failing systems usually indicates a lack of any system or one that is so antiquated or poorly maintained it fails on a year round basis. Periodically failing systems are usually septic systems that are not being properly maintained so that the drain fields are not functioning as they should and fail during the wet season. To determine the specific needs a field survey must be conducted first to identify problem sites. This will require the participation of the Pocahontas County Health Department (PCHD). Once a problem site has been identified a specific project plan can be developed and must be approved by the PCHD.

Completely failing systems usually require the installation of a new or upgraded system. New or upgraded systems will be installed in compliance with Health Department regulations based on home size and soil porosity and must be approved by the PCHD Sanitarian. The average cost for such a project is about $7500 but can range widely due to specific circumstances. Similar efforts in other watersheds throughout the state have used a combination of Section 319 grants administered through DEP and low interest loans from the On-Site Loan Program (OSLP) to fund these system replacements.

Periodically failing systems are usually systems where pumping the system combined with proper maintenance will solve the problem. One potential solution that has been used successfully in some Potomac watersheds is to offer residents partial payment coupons for septic tank pumping in combination with an educational effort to inform homeowners how to maintain their system in the future. In most cases this has cost less than $500 per home. Due to the sparse population density in the watershed cluster systems would not be cost effective. However, if the survey shows a grouping of failures in one location such a system could be an option.

TECHNICAL AND FINANCIAL RESOURCES

Technical Resources

1. **West Virginia Conservation Agency (WVCA) –** WVCA will be the applicant for CWA Section 319 grants on this effort and will provide the technical assistance needed for implementation. The WVCA coordinates statewide conservation efforts to conserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife and assist farmers with conservation practices. The WVCA Environmental Specialists (ES) will coordinate with other agencies and work directly with landowners to implement the practices called for in this watershed based plan. The WVCA ES will also conduct monitoring to determine the environmental results for the three impaired streams. They will also produce grant proposals and status reports.
2. **The West Virginia Department of Environmental Protection (DEP)** – WVDEP is the agency with primary responsibility for protecting the environment including stream water quality. The Nonpoint Source Program (NPS) within the WVDEP administers the Section 319 grants and the Basin Coordinators in the program work closely with project managers to accomplish the approved watershed based plans including assistance, if needed, with monitoring. The NPS also has experience and materials for outreach, education and volunteer monitoring. The Watershed Assessment Branch (WAB) includes the programs that develop the integrated watershed report with the 303(d) list of impaired streams, the TMDL and conduct water quality monitoring around the state. After completion of the installation of practices it will be WAB that makes the final determination if the TMDL has been fully implemented.
3. **The Pocahontas County Health Department (PCHD)** – PCHD has the primary responsibility of inspecting and approving all on-site wastewater systems in Pocahontas County. The PCHD will have to conduct the initial survey to locate failing on-site systems. Through their contacts with homeowners the education of how to maintain an on-site system will be affected. The PCHD Sanitarian will have to select, inspect and approve all practices to be used in the treatment of failing septic systems.
4. **The Pocahontas County Water Resources Task Force (WRTF)** – WRTF is a county based group with an emphasis for on surface and ground water quantity, issues of water quality and education.

Financial Resources

1. **Clean Water Act §319 Grants** – §319 funds are provided to the state by the US Environmental Protection Agency (USEPA). In West Virginia, these funds are distributed by WVDEP for agencies or organizations who are conducting projects related to nonpoint source pollution.
2. **WVCA** – provides the personnel for monitoring, contracting and oversight of the project.
3. **WRTF** – provides assistance in public notice and education.

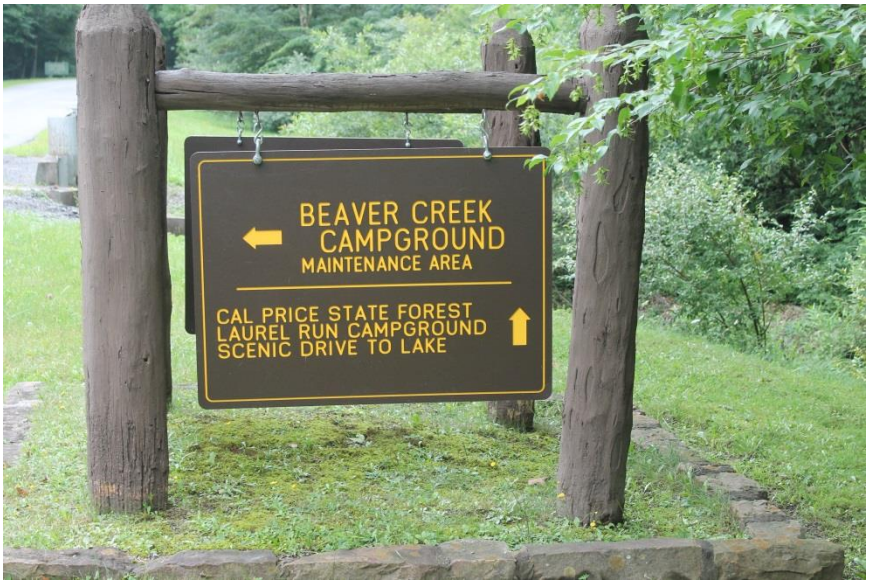
4. **The WV Onsite State Revolving Fund Program (OSLP) –** OSLP is administered through the WVDEP and WV Housing and Urban Development. The program can be used to provide loan funding for individual onsite systems as well as homeowner-owned components of decentralized systems.
5. **WV Infrastructure and Jobs Development Council** (IJDC) - Most sources of public funding for wastewater infrastructure are administered by the IJDC.
6. **Residents** – will provide up to 40% of the cost for projects based on project type and ability to pay.

Estimated Financial Needs

The estimated cost of each item is based on the average cost for this region. Actual costs may be different and exceed the estimates. Most personnel costs and other in-house expenses are not included in the budget because the participating agencies are contributing these costs. In each case the personnel who will manage this plan are already employed with the agency.

Table 6. Estimated overall budget for Beaver Creek WBP

Overall budget for the Beaver Creek TMDL Implementation			
Practice	Quantity	Cost @	Total Cost
Septic Replacement	40	$7,000.00	$280,000.00
Septic Repair	24	$500.00	$12,000.00
Monitoring	5	$1,000.00	$5,000.00
Education	5	$100.00	$500.00
Total Budget			$297,500.00



The headwaters of Beaver Creek are a part of Watoga State Park and Calvin Price State Forest.

SCHEDULES AND MILESTONES

Beaver Creek is a small watershed so it will be presented to the public as one project but will involve multiple grant applications. This will allow the project manager to manage reasonably sized projects spread over the schedule period. All public meetings and opportunities for participation will be open to the entire watershed. SWS 472 has the greatest number of residences and system failures and so there will be an emphasis to encourage participation in this subwatershed. The implementation schedule will start after the awarding of funds through the §319 grants expected to occur in the second quarter of 2017.

Table 7. Implementation schedule

IMPLEMENTATION SCHEDULE FOR THE BEAVER CREEK WATERSHED BASED PLAN																				
	2017				2018				2019				2020				2021			
	Quarters				Quarters				Quarters				Quarters				Quarters			
Actions	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Baseline Monitoring																				
Public Meetings																				
Contract Signing																				
Septic Replacements																				
Septic Repairs																				
Project Monitoring																				
Reporting																				

Efforts to organize the watershed effort and develop contracts with watershed residents will be the focus of actions in 2017. Monitoring to establish a baseline will also occur in 2017 (dark blue in schedule table). The installation and repairs to septic systems will begin in 2018. The implementation and environmental milestones expected are illustrated in Table 8.

Table 8. Implementation and environmental milestones

	2018			2019			2020			2021			
SWS	Repairs	Replacements	Reductions	Repairs	Replacements	Reductions	Repairs	Replacements	Reductions	Repairs	Replacements	Reductions	Total Reductions
470	1		3.46E+11		1	6.91E+11							1.04E+12
471	5	4	4.49E+12	5	5	5.18E+12		4	2.77E+12		3	2.07E+12	1.45E+13
472	5	5	5.18E+12	5	6	5.88E+12	3	7	5.88E+12		5	3.46E+12	2.04E+13
Totals	11	9	1E+13	10	12	1.18E+13	3	11	8.64E+12	0	8	5.53E+12	3.59E+13

Completion of the watershed based plan is expected in 2021.

MONITORING

The responsibility for monitoring will fall primarily on the WVCA who will enlist the assistance of WVDEP's Basin Coordinator, and any other state or federal agency as well as volunteers. The parameters to be monitored must fulfill the requirements of this plan and the reporting requirements of §319 grants reports. The parameters may include: temperature, flow, fecal coliform and any others that may be considered important. Monitoring stations will be located at the mouth of Beaver Creek and other strategic sites to determine the success of individual projects. If other stations need to be established to locate sources or for any other reason, such as determining project success, they will be located strategically to accomplish that goal.

The timing of sampling will be up to the local project managers but should include monthly samples within a year during different flow regimes for establishing the baseline. Afterward, two a year during different seasons and after practices have been installed should provide adequate data for progress assessment. To determine if stream or stream segments have been returned to water quality standards WVCA will conduct fecal coliform sampling of at least ten samples in a one-month period. The methods and location will correspond to DEP quality assurance standards and the data will be submitted to DEP.

Biological monitoring may be done as a part of WVDEPs volunteer monitoring program - WV Save Our Streams (WVSOS). WVSOS is an important educational tool for teaching citizens about the value of clean streams. It can also be a valuable monitoring tool. If suitable volunteer monitors are willing to sample these streams then WVCA, WRTF and DEP will facilitate their efforts. By using the WVSOS protocols a good biological assessment of the streams' conditions can be made. Another assessment will be made by WVDEPs WAB in 2020 following project completion, to determine final success or a need for further action.

In order to assure the data being collected is of good quality and usable for determining progress, a Quality Assurance Project Plan (QAPP) will be developed for this effort. The QAPP will be submitted to WVDEP's NPS Coordinator for review and approval at least 60-days in advance of monitoring. The Coordinator will forward the QAPP to USEPA for their review, comments and approval.

INFORMATION AND EDUCATION

In any watershed restoration effort informing and educating the residents of the watershed and all other stakeholders is vital. In rural watersheds a small population the most important form of that communication is done face to face. For the onsite wastewater issue the WVCA and WRTF will assist the PCHD in passing out information packets and brochures to the residents. Face to face contacts between the involved agencies and homeowners will be made to explain the problems and solutions. Public meetings to announce the project, the reasons for it and provide educational materials on septic system maintenance will be scheduled in the watershed.

The WRTF also has an educational component in its tasks including water related classrooms for the local schools, sponsoring WVSOS events and general outreach to the public. The educational effort in adjacent Knapp Creek will be a benefit as well. The WVCA and the WRTF will coordinate their educational efforts so as to avoid repetition and share resources.