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Watershed plans

This section will provide a summary of select watershed plans, primarily those aligned with the watershed project highlight section and success stories. Table 8 shows the current list of watershed plans.

Table 9. WV Watershed plans; those indicated will be highlighted in this report

HUC8 watersheds	Plan name	Status	Date	Pollutants
Cacapon	Lost River	Active	2006	B, S
Cheat	Lower Cheat (R)	Active	2005	M, P
	North Fork Blackwater (R)	Not-active	2005	M, P
Coal	Lower Coal River	New	2014	B, S
Elk	Upper Elk (Protection)	Active	2012	NA
Greenbrier	Knapp Creek	Active	2013	B, S
	Milligan Creek	Active	2014	B, S
	Muddy Creek	Active	2009	B, S
	Second Creek	Active	2008	B
Gauley	Upper Meadow River	Active	2014	B, M
Upper Guyandotte	Upper Guyandotte	Active	2006	B, M
James	Potts Creek	Active	2012	B
Upper Kanawha	Cane Fork	Not-active	2011	M, P
	Morris Creek	Active	2013	M, P, S
Monongahela	Deckers Creek	Active	2015	B, M, P
	West Run	Active	2008	M, P
Lower New	Piney Creek	Active	2012	B, M, P
	Wolf Creek (R)	Active	2009	M, P, B
Potomac Direct Drains	Back Creek (Protection)	Active	2014	NA
	Elks Run	Active	2013	B, S
	Mill Creek (Opequon)	Active	2008	B, S
	Sleepy Creek	Active	2008	B
	Tuscarora Creek	Active	2011	B, S
South Branch Potomac	Mill Creek (South Branch)	Active	2007	B, S
Tug Fork	North Fork Elkhorn	Active	2007	B, M
Tygart Valley	Roaring Creek	Active	2012	M, P
	Sandy Creek	Not active	2012	M, P
	Three Forks Creek	Not-active	2005	M, P
	Upper Buckhannon	Active	2006	M, P, B
West Fork	Little Tenmile/Jones Creek	New	2015	M, B, S
	Lamberts Run	Active	2004	M, P
NPS Pollutants: (B) Bacteria, (M) Metals, (P) pH, (S) Sediment, (NA) None, (R) revisions occurring				

Knapp Creek Watershed Plan

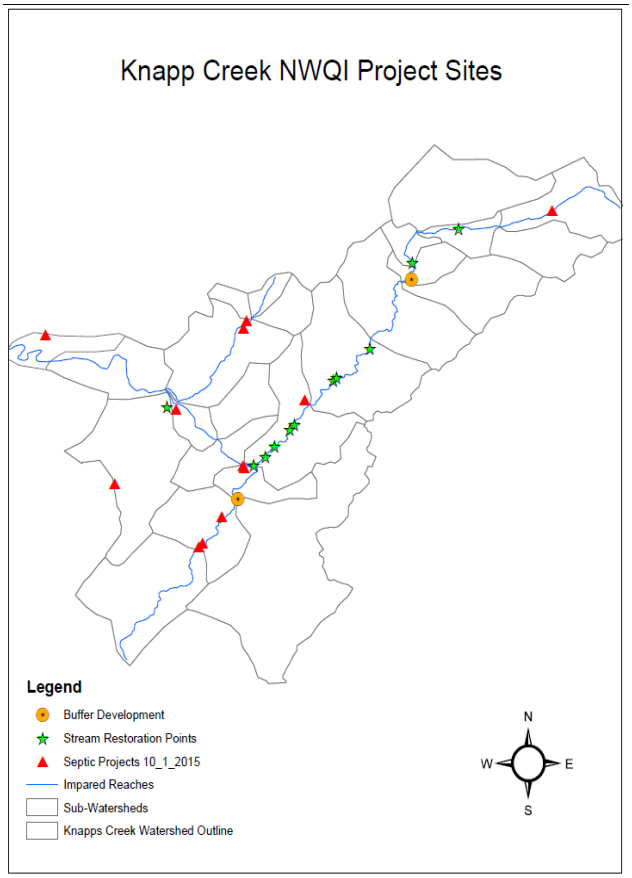
Introduction

Knapp Creek is a 26.3 mile stream located entirely within Pocahontas County, West Virginia. The watershed encompasses approximately 176 square miles. Its headwaters originate in the mountains that form the West Virginia/Virginia boundary north of the town of Frost. The other towns within the watershed are Minnehaha Springs, Huntersville and Marlinton at the confluence of Knapp Creek and the Greenbrier River. The focus of this 2013 watershed plan is the reduction of fecal coliform and sediment using a variety of agricultural BMPs, septic programs and natural stream restoration.

The Knapp Creek watershed plan calls for a reduction of 4.12E+13 cfu/year assuming the City of Marlinton is able to upgrade the sewage treatment plant and eliminate combined sewage overflow (CSO) discharge. The plan recommends upgrades and/or repairs to faulty septic systems and the elimination of cattle access to the stream. Additionally sediment will be reduced using natural stream restoration techniques and grass/forest buffers.

Project highlights

Figure 18. Knapp Creek project sites



One § 319 watershed project was completed in 2012. A second 2013 project is on schedule. Additional BMP implementation was provided by NRCS through NWQI funding in 2012 and 2013. The following BMPs were installed in 2015.

FY	BMP	Quantity	unit
2012	Exclusion fence	3,030.0	ft
2012	Stream restoration	957.0	ft
2013	Alternate water source	1.0	unit
2013	Heavy use protection	1.0	unit
2013	Septic - new	2.0	unit
2013	Streambank protection	365.0	ft
2013	Streambank protection	275.0	ft

NWQI funded BMPs include 5,200 feet of streambank repair, two stream crossings, 900 feet of fencing and three acres of tree planting.

Results

Since the BMPs are relatively new, except for a few of the earlier stream restoration projects, pollutant reductions are not significant. We anticipate that as the BMPs mature, hydrology will be restored and bacteria concentrations will respond due to decreased cattle access. WVCA estimates that fecal coliform has been reduced by 3.79E+12 cfu/year.

Funding

Figure 19. NRCS stream restoration project

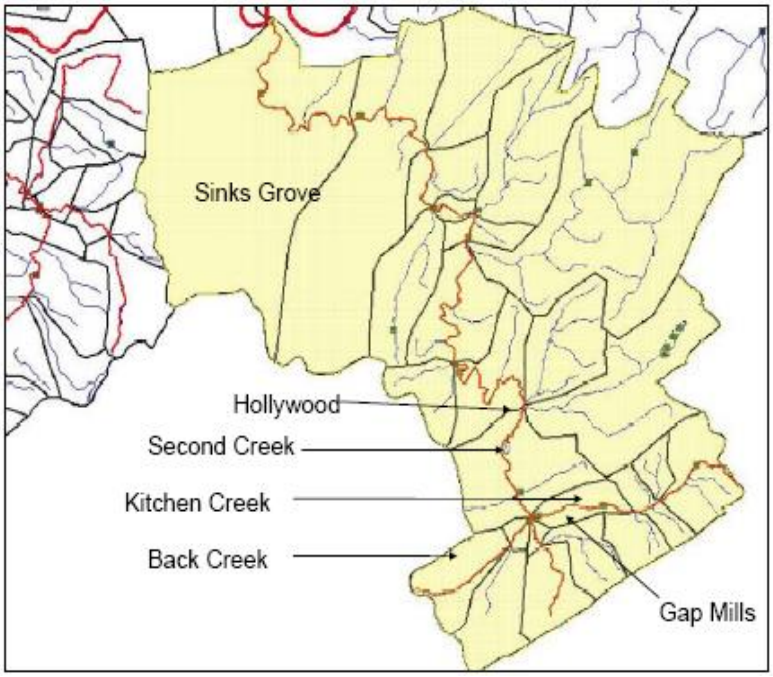
The § 319 watershed project completed in 2012 cost $171,812 including match. The 2013 project is on schedule with $162,622 § 319 and $107,334 match funding in place. NWQI funding of $447,792 provided additional BMP implementation.

This photo shows a completed project. Existing trees on the left were kept intact. Cross vanes and other structures enables sediment transport and on the right fencing keeps livestock out and the visible tree guards protects tree plantings from deer.

Second Creek Watershed Plan

Introduction

Figure 20. Location of impaired streams - Second Creek watershed



Second Creek is a sub-watershed of the Greenbrier River watershed. It is located in the southern portion of the Greenbrier River watershed in the counties of Monroe (89%) and Greenbrier (11%). The drainage area is approximately 124 square miles, 79,346 acres. According to the Greenbrier River Watershed TMDL, impaired streams in the Second Creek sub-watershed demonstrate the highest levels of fecal coliform than any other within the Greenbrier watershed.

The focus of the 2008 Second Creek watershed plan is the remediation of fecal coliform focusing primarily on agricultural BMPs that limit cattle access, filter run-off and provide alternate water/locations for the cattle. The Second Creek watershed plan calls for fecal coliform reduction of 3.00E+14 from agricultural lands and 8.17E+12 from failing septic systems.

Project highlights

A total of four projects have been completed and a fifth is currently underway. A sixth proposal is approved and expected to start in the summer of 2016. The WVCA CS specialist in the Greenbrier District has been the lead project manager for all projects. Thus far the focus is on agricultural BMPs in Kitchen Creek (3 projects complete), Back Creek (one project complete), and two (still active) are focused in the lower portions of Second Creek, specifically in the karst areas.

The BMPs implemented in Kitchen Creek include approximately 100 acres of nutrient management and grazing plans, 104 acres of riparian buffers, 16 stream crossings, 14 alternate water sources and 12,489 feet of exclusion and divisional fencing. In other portions of the watershed BMPs include six alternate water sources, 379 acres of grazing plans, one stream crossing, one heavy use protection area and 6,893 feet of fencing.

Results

Table 10. Load reductions from the Second Creek watershed plan

Project	Year	Load Reductions		
		Fecal (cfu/year)	Nutrients (lbs/year)	Sediment (tons/year)
Kitchen Creek	2009	2.10E+12	2,152	15.4
Kitchen Creek II	2011	6.01E+13	-	-
Kitchen Creek III	2012	1.98E+12	-	-
Back Creek	2010	4.78E+13	-	-
Second Creek Karst	2013	5.32E+12	39,154	-
Totals for watershed		**1.17E+14**	**41,306**	**15.4**

Landowners in Kitchen Creek have responded to the assistance provided by WVCA, and have embraced the recommended BMPs (Figure 21). In this small watershed 104 acres of riparian area (> 6 miles of stream) have been developed into buffers. These buffers and grazing management plans have reduced the overall time livestock are exposed to the stream from 5% to 0.12%.

Figure 21. Kitchen Creek farms with BMP implementation

Fecal coliform has been reduced but the more surprising improvements are occurring to the physical conditions and habitat adjacent to the stream. Brook trout fingerlings were introduced and after two years they have survived and show greater than average growth rates. Fish surveys have indicated a change in the overall non-game population from primarily dace to sculpin, an indicator of high quality water. Other terrestrial species including river otters, bald eagles, golden eagles, golden winged warblers, and bobwhite quail have been

observed in the area, which shows the benefit to improvement of the water quality. Other landowners in Back Creek and portions of Second Creek have been slower to sign-up. However, optimism remains high as many are talking about the success of Kitchen Creek.

Funding

Thus far $425,426 in § 319 funds, and $363,639 in state contributions have been spent since Second Creek watershed plan approval.

Table 11. Second Creek watershed plan spending

§ 319 Requested	§ 319 Spent	State Funds
$108,523	$108,523	$72,350
$49,520	$49,520	$33,014
$70,517	$24,795	$16,390
$120,500	$93,959	$34,062
$100,000	$46,269	$23,601
$130,000	$130,000	$115,626
$182,000	$102,360	$68,596
$115,428	-	-
$876,488	**$425,426**	**$363,639**

Implementing a Bacteria Watershed Plan

Introduction

Instead of focusing on a specific watershed plan, this section provides a summary of several plans, all located within the Potomac Direct Drains HUC8 basin. All of these plans focus on fecal coliform reductions and thus far have had varying levels of success. We explore the possible reasons in this section. Table 11 provides a list of the watershed plans and Figure 23 shows their boundaries. Canaan Valley Institute (CVI) is the local project manager for Tuscarora and Mill Creek, WVCA is the local project manager for Sleepy Creek and Elk Run.

Table 12. Bacteria watershed plans in the Potomac Direct Drains

Watershed plan	Year approved
Sleepy Creek	2008
Mill Creek Opequon	2008
Tuscarora Creek	2011
Elk Run	2013

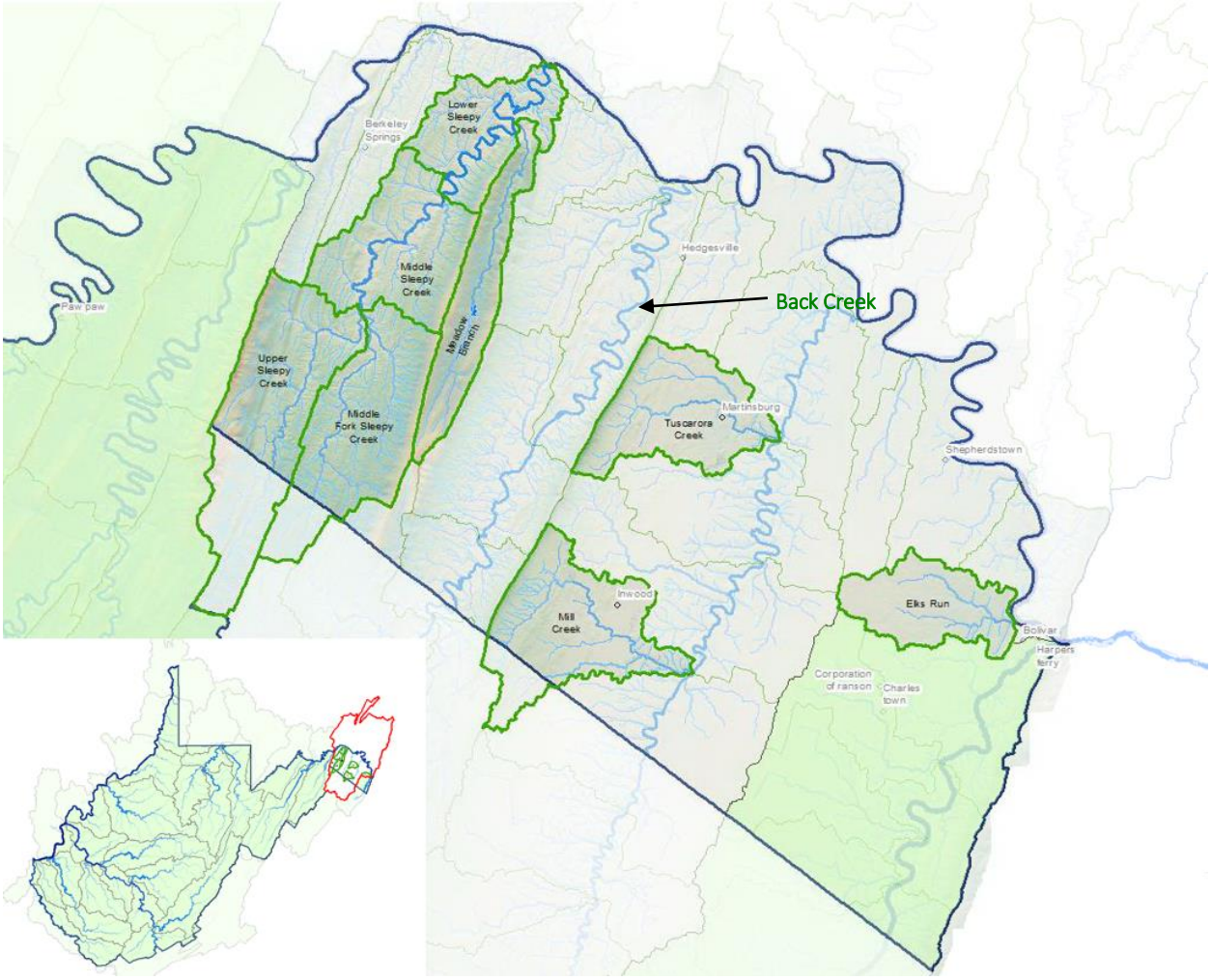
Not listed in the table above, or shown on the map is the Back Creek watershed protection plan (WPP), which was approved in 2014. Back Creek is a large watershed (its headwaters are in VA) west of Sleepy Creek.

Project highlights

A successful bacteria project is one that meets the project's goals and objectives, and in the end results in a reduction of fecal coliform in the target stream. Sounds easy enough, but project managers in the Potomac have found mixed results. Most of the impetus has been placed on septic system repair, replacement or pumping since the TMDLs show failing septic systems as the most significant source. Some of the tools used to target residents are brochures/flyers, newspaper articles, radio and TV interviews, workshops, booths fairs and festivals and more (Figure 24). These tools are not randomly distributed. A concerted effort by local project teams (PTs), made-up mostly of volunteers and agency representatives, decide what outreach tools may work best, and where and how they should be distributed. There are active PTs in Sleepy Creek, Tuscarora Creek and Elk Run.

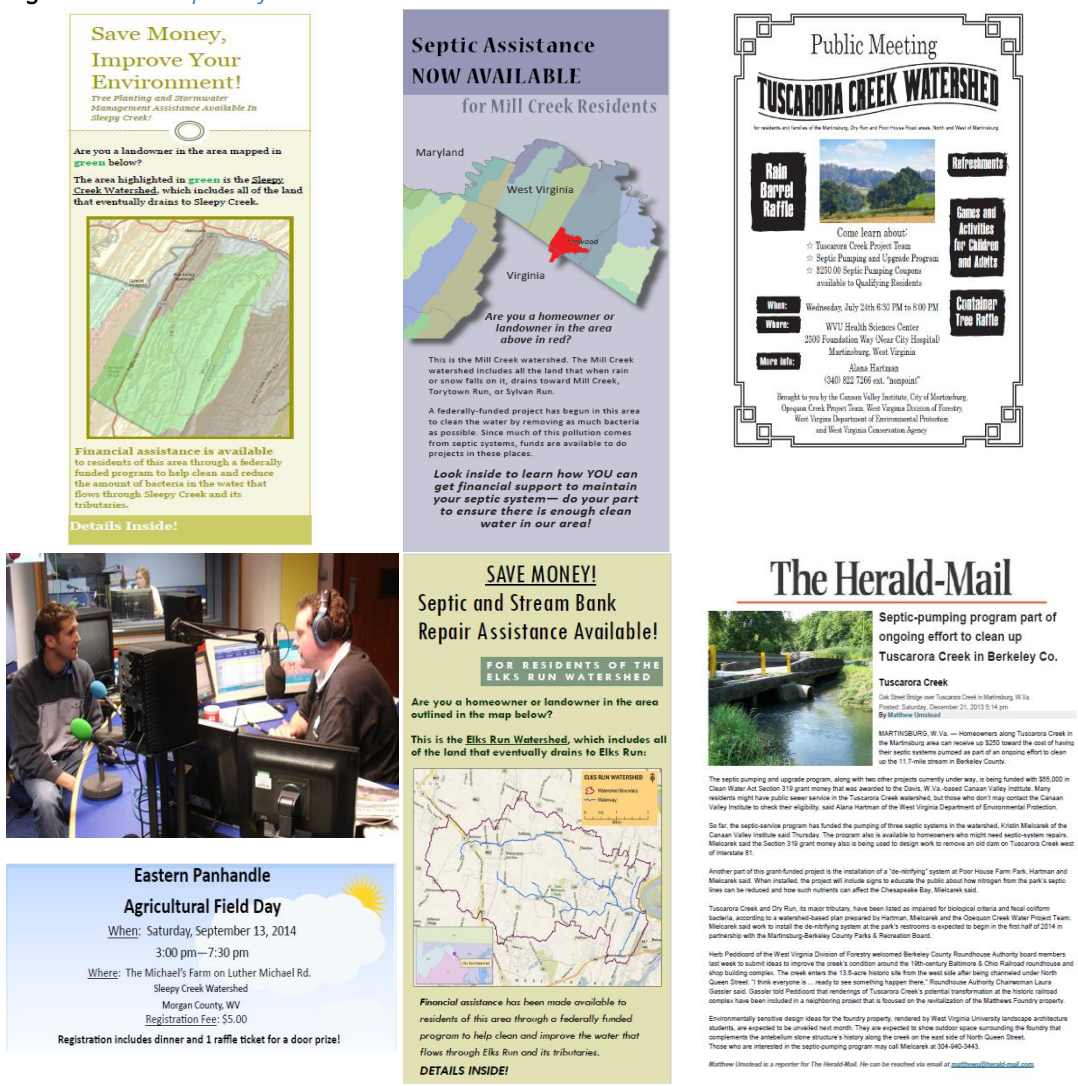
Door-to-door solicitation

Figure 22. Watershed plan boundaries within the Potomac Direct Drains



Brochures/flyers were distributed to schools, local churches, doctor/dentist offices, public buildings etc. Community events such as workshops, and booths at fairs/festivals were typically weekend events. At least twice each year local newspaper articles highlighted the efforts, and radio interviews were given. A door-to-door effort and direct mailing was also undertaken. And finally presentations were given at City Council and Chamber of Commerce meetings, and other local government meetings/events. Many of these efforts were promoted with help from the Local Health Department (County Sanitarian).

Figure 23. Examples of outreach tools used in the Potomac basis



Results

How successful are outreach campaigns?

Tuscarora/Mill Creek: Flyers/brochure were somewhat successful generating interest but more importantly they were a communication tool. Newspaper articles and radio spots generated some interest, but it came from outside the watershed. Presentations at city/county meetings generated little interest, it was our hope to find more partners and match. Workshops and other community outreach events were not successful standing alone, but were more successful at existing fairs/festivals.

Table 13. Potomac septic project summary

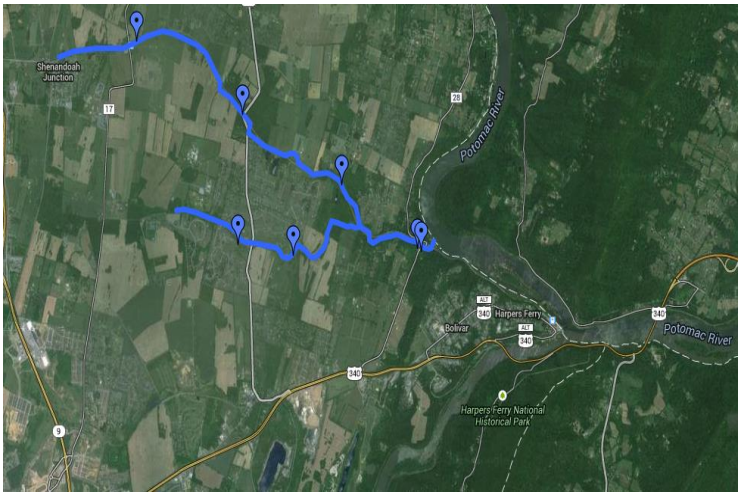
Project	Year	Org	Goal	Actual	Septic LR	%
Mill Creek Opequon	2009	CVI	25	13	7.67E+13	0.52
Sleepy Creek	2008	WVCA	25	43	2.94E+13	1.72
Elks Run	2011	WVCA	11	2	3.29E+12	0.18
Tuscarora Creek	2011	CVU	11	5	3.29E+12	0.45
		Totals	**72**	**63**	**1.13E+14**	0.88
Sleepy Creek 2	2013	WVCA	0	**On-going projects**		
Sleepy Creek 3	2014	WVCA	12			
Mill Creek Opequon 2	2015	CVI	10			
Elks Run	2015	WVCA	10			
Tuscarora Creek 2	2015	CVI	5			
		Totals	**37**			

Sleepy Creek: The grant has been very successful. There has been a steady influx of inquiries about the program and the application process. The great success of the 2008 project had a profound influence on future efforts. The community was very familiar with the program and the local watershed group, Sleepy Creek Watershed Association (SCWA). There was great respect for what SCWA is trying to do. In general, the local communities are more environmentally aware and they want to keep the conditions as clean and healthy as possible.

Elk Run: Thus far, the efforts have not been very successful. The project goals for septic system repairs were not met. Similar outreach tools were used and there was also an effort to target septic installers with a workshop about the programs. Perhaps if they are aware they would also promote the effort. The Elk Run watershed plan left a bad taste among home owners (especially sub-division) because it pointed to that group as a large source in the watershed. Thus far there has been better cooperation and participation in the FY 2014 project.

It is important to note that all of these projects promoted and implemented several BMP types known to reduce bacteria. These seemed to encounter less resistance than the septic programs. Thus far the projects have installed four raingardens, 12 acres of buffers, 4.5 acers of urban/sub-urban tree planting, 5,000 square feet of porous pavement, 57 feet of streambank stabilization and 830 feet of stream channel restoration.

Figure 24. Elk Run monitoring locations



Monitoring

Several monitoring efforts were explored throughout the life of these projects. Initially volunteer monitoring lead by SCWA, OPT and Elk Run Watershed Association (ERWA) were effective but seemed to lack momentum as time passed. ERWA is the newest effort and still moving forward. Getting an approvable QAPP, funding and training for a watershed wide volunteer monitoring effort is challenging. The most effective approach is a partnership

and contract with organizations such as Cacapon Institute (CI), Freshwater Institute (FI) and Shenandoah University (SU). These organizations have professionally trained staff and in-house labs. The lab at SU has agreed to analyze volunteer samples at a reduced rate. Additionally the students get time in the field working with ERWA and others.

Where are we now? Table 14 provides a snap-shot of the progress. There is still more work to do, but results thus far are promising.

Table 14. Project costs and bacteria reduction in the Potomac Direct Drains

Year	Watershed plan	LR needed	Total cost
2008	Mill Creek Opequon	2.79E+15	$5,325,986
2008	Sleepy Creek	5.75E+15	$4,799,010
2011	Tuscarora Creek	4.52E+15	$17,415,822
2011	Elks Run	2.75E+15	$27,326,788
			$54,867,606
319 projects completed		LR achieved	Project cost
2008	Sleepy Creek	7.87E+13	$292,230
2009	Mill Creek Opequon	7.71E+13	$243,992
2011	Tuscarora Creek	1.76E+13	$43,911
2011	Elks Run	3.32E+12	$32,326
			$612,459
319 on-going			
2013	Sleepy Creek	1.74E+13	$70,200
2014	Sleepy Creek	1.97E+13	$74,600
2015	Mill Creek Opequon	5.90E+13	$161,801
2015	Elks Run	1.66E+13	$68,200
2015	Tuscarora Creek	3.14E+13	$56,523
			$431,324
		Total	**$1,043,783**

The total cost and load reductions are estimates from the watershed plans. The cost and load reductions in red are from projects not yet completed. These numbers are not included in the load reductions achieved.

We estimate that 51% of the total bacteria load has been reduced. Note: Indian Run has been delisted (2013 319 Success Story).

Lambert Run Watershed Plan

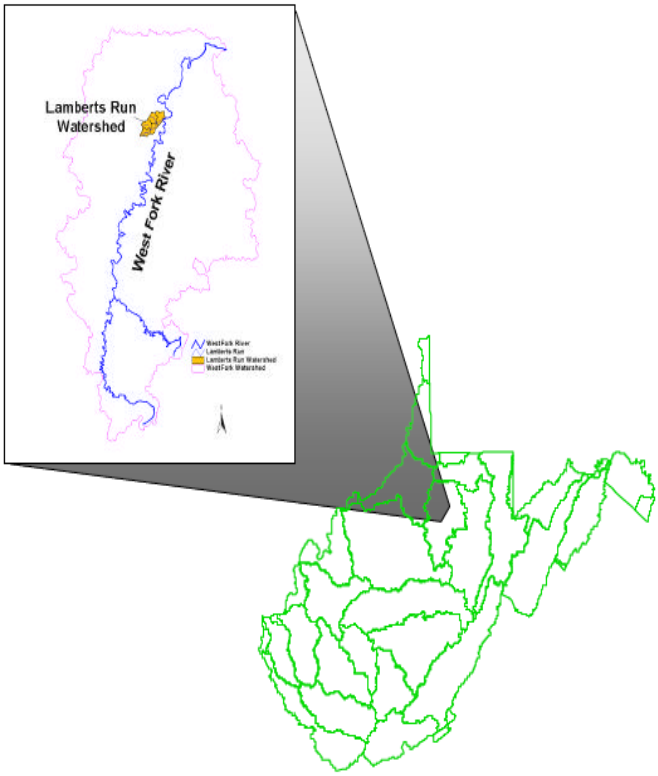
Introduction

Lambert Run is an eight square mile watershed located near the town of Spelter in Harrison County, WV. Deep mining has taken place in the watershed since the 1950s. Most of the mining performed in the watershed was to extract the Pittsburgh coal seam. Water chemistries vary from slightly acidic mine drainage to alkaline mine drainage (AMD).

In 2003 WVDEP, GWF and other partners submitted West Virginia's first watershed plan. It was approved by the US EPA in 2004. The plan allowed the partners to pursue funding for passive treatment remediation of the mine discharges in the watershed. The goal of the watershed plan is to reduce AMD metals (Aluminum (Al), Iron (Fe) and Manganese (Mn)) by > 500,000 lbs/year.

In 2004, a partnership between the WVDEP, Office of Surface Mining (OSM), West Virginia University (WVU) – NMLRC, and the GWF started work toward restoration, installing multiple passive treatment systems. Since 2004, six AMD treatment systems have been installed in the watershed.

Project highlights



Site 3 (Muzzleloader Club)
Completion: 2006 (FY 2004 funds)
Cost: $142,000 for construction (§ 319 and WCAP)

Site 3 was constructed in 2006, and was the first of the projects to be completed. Before treatment, Site 3 was an acidic, metal laden mine discharge. After treatment, the Site 3 discharge is now alkaline with very low metal concentrations. This project has significantly improved the mainstem of Lambert Run by removing a source of metals and acidity.

Site 8 (Oldaker property)
Completion: 2007 (FY 2004 funds)
Cost: $147,000 for construction (§ 319 and WCAP)

After treatment of Site 8, all metal concentrations have decreased. In conjunction with the treatment system at Site 9, Site 8 has remediated an entire tributary of Lambert Run. Recent developments at this site have resulted in an attempt to revive the system due to the ponds filling and vegetation dying. We suspect the damage was caused by the construction of an oil and gas pipeline near the system.

Site 5 (Alan Meadows property)
Completion: 2008 (FY 2004 funds)
Cost: $168,000 for construction (§ 319 and WCAP)

Site 5 was a slightly alkaline source before treatment, which means the main focus of the treatment was to precipitate out the metals from the mine drainage through oxidation. Metal concentrations have been reduced at the site. However, a few minor maintenance issues now need addressed for optimal system performance. This includes repair of the wetland baffles and some minor berm restoration.

Site 9 (Blake Cox property)
Completion: 2009 (FY 2004 funds)
Cost: Appx. $500,000 (§ 319 and Compensatory Mitigation from White Oaks Dev. Project)

The treatment system at Site 9 continues to perform well. Before construction, Site 9 contributed roughly 60 mg/L of acidity to Lambert Run. It is now alkaline water that contributes approximately 100 mg/L of alkalinity. Metal concentrations have also been lowered significantly.

Site 7 (Barnhart Property)
Completed: September 2015 (FY 2011 funds)
Cost: Appx. $400,000 for Engineering and Construction (§ 319, SRF, WCAP)

This site was described in the Project Highlights section of this report.

Figure 25. Before and after at Lambert Site 9

Conclusions and future projects

To date, six AMD remediation projects have been constructed throughout the watershed. Combined, these projects have removed hundreds of tons of metals and acidity from the watershed. Optimistically, Lambert Run will become only the second stream that was listed for mine drainage impairment to be removed from the WV 303(d) list. The NMLRC and GWF plan to revise the watershed plan over the next few years. This will enable partners to verify successful passive projects, perform operation and maintenance, and address areas where AMD issues persist.

Table 15. Lambert Run watershed plan summary

Project	Load reductions	FY	§ 319	State
Lambert treatment projects	Al – 400 lbs/yr Fe - 19,200 lbs/yr	2004	$301,400	$227,600
Lambert Site 3	Al – 34, 800 lbs/yr Fe – 34,600 lbs/yr	2004	$63,998	$42,665
Lambert Site 5	Al – 1,000 lbs/yr Fe – 17,600 lbs/yr Mn – 8,200 lbs/yr	2006	$146,334	$97,614
Lambert Site 6	Acidity – 23,800 lbs/yr Al – 1,800 lbs/yr Fe – 22,820 lbs/yr	2009	$150,000	$100,000
Lambert Site 7	Acidity – 97,808 lbs/yr Fe – 30,000 lbs/yr	2011	$384,375	$169,895
Totals	Acidity – **121,628** lbs/yr Al – **38,000** lbs/yr Fe – **124,220** lbs/yr Mn – **8,200** lbs/yr		**$1,046,107**	**$637,774**