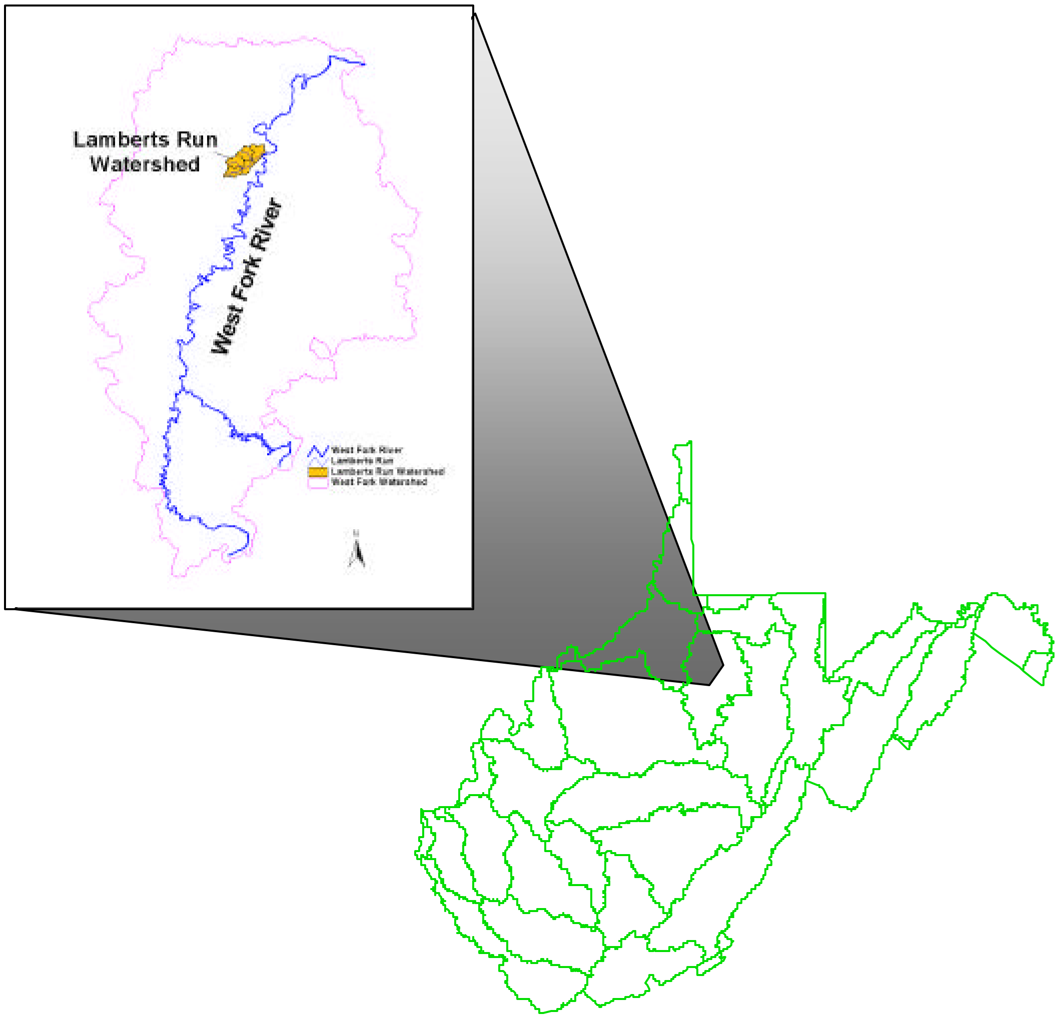
Watershed Based Plan for Lamberts Run to Implement the West Fork River TMDL



Prepared by

GUARDIANS OF THE WEST FORK WATERSHED ASSOCIATION

and the

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

September 25, 2003

WATERSHED BASED PLAN
FOR THE IMPLEMENTATION OF THE LAMBERT RUN TMDL

Prepared by
Guardians of the West Fork Watershed
and the
West Virginia Department of Environmental Protection

Contributors

Bruce Edinger, Co-chair, Guardians of the West Fork Watershed
John Eleyette, Co-Chair, Guardians of the West Fork Watershed
Mandy Seitz, OSM AMD Intern (2003)
Lou Schmidt, WVDEP Non-Point Source Program
Alvan Gale, WVDEP Non-Point Source Program
Jennifer Simmons, National Mine Lands Reclamation Center

Introduction

The Lambert Run sub-watershed is within 4 miles of the City of Clarksburg, county seat for Harrison County, in north central West Virginia. Like many areas of the region, it was deep mined and surface mined during the late 19th and most of the 20th century. While there is no longer any mining the drainage from that mining still impacts the streams. Today land uses in the watershed includes small farms, woodlots, and residential.

Mine drainage is a common problem in the coal-bearing regions with high pyrite content in associated geological strata. Coal seams in north central West Virginia are particularly prone to acid and alkaline mine drainage associated with abandoned underground and surface mines without appropriate water quality treatment for the percolating and accumulated runoff. Lambert Run has multiple sources of mine drainage with high metal concentrations, and in a few cases, high acidity. Most sections of the main stem and tributaries have significant deposits of iron and aluminum salts, which has greatly reduced populations of fish and benthic macroinvertebrates. Lambert Run has been listed as impaired in WV 303(d) lists in 1996 and 1998. In 2002, the West Fork River Total Maximum Daily Load (TMDL) was finalized, and all five sections of Lambert Run sub-watershed were earmarked for reductions in metals.

This watershed TMDL implementation plan proposes the actions necessary to reduce the concentration of heavy metals reaching Lambert Run and restore the streams to water quality standards.

a. (i) Geographical Extent.

Lambert Run is a 8 square mile subwatershed of the West Fork River watershed in Harrison County, West Virginia. The West Fork watershed comprises 880 square miles located in north central portion of West Virginia. Its boundaries include all of Harrison County, most of Lewis County, and parts of Marion, Taylor, Barbour and Upshur Counties. The West Fork River flows

103 miles north through Weston and Clarksburg, to its confluence with the Tygart River near Fairmont, where the two form the Monongahela River.

Clarksburg is the nearest, large city, about four miles to the southeast. The smaller communities of Hepzibah, Meadowbrook and Spelter lie just outside the southeastern border of the Lambert Run watershed. US Route 19 also lies just outside the southeastern boundary of the watershed.

The northern half of the West Fork Watershed, including Lambert Run, has been heavily mined for coal for the past more than 100 years. Many inactive and active surface and underground mines are present, and scores of portals are present where acid mine drainage leaks into nearby streams. Lambert Run (coded MW-16) consists of subwatersheds 1901, 1902, 1903, 1904, 1905 within Region 5, in the West Fork River 2002 TMDL (EPA, 2002, Appendix A-5, Figure 1). Region 5 of the West Fork Watershed consists of 83,127 modeled acres (129.89 sq. miles,). While Region 5 consists of 86 subwatersheds (43% of which are listed as having abandoned mines [seep, deep mine, and/or leachate]), all five of Lambert Run subwatersheds (100%) have abandoned mines (Ibid, A-5, Table 2).

The watershed has a low population density. Land uses consist largely of hardwood and oak dominant forest and pasture (comprising 87% of the total). More details can be found in Table 1. Recent logging activity in the bottomlands and slopes was observed in 2003. Impacts are negligible now but future observations will be conducted to gauge any impacts.

Table 1. GAP2000 Landuse Distribution in the West Fork Watershed (From EPA, 2002)

GAP2000 Landuse Category Area	(Acres) Area	(Percent) Area
Diverse / Mesophytic hardwood Forest	179,341	32.19%
Oak dominant forest	154,393	27.71%
Pasture / Grassland	151,311	27.16%
Shrubland	16,341	2.93%
Low intensity Urban	14,345	2.57%
Surface Water	8,029	1.44%
Barren land - Mining / Construction	7,020	1.26%
Woodland	5,768	1.04%
Populated Area - mixed land Cover	5,094	0.91%
Cove Hardwood Forest	4,153	0.75%
Floodplain Forest	2,604	0.47%
Intensive Urban	2,392	0.43%
Major Powerlines	1,683	0.30%
Mountain Hardwood Forest	1,644	0.30%
Surface Water	982	0.18%
Moderate intensity Urban	937	0.17%
Major Highways	673	0.12%
Herbaceious Wetland	363	0.07%
Forested Wetland	64	0.01%
Shrub Wetland	54	0.01%

a. (ii). Measurable water quality goals

Applicable West Virginia water quality criteria are enumerated in the West Fork Watershed TMDL (EPA, 2002). One-hour (acute) aluminum concentrations cannot exceed 750 micrograms/L

(0.75 ppm) for warm water fishery streams, trout waters, and wetlands. Four-day (chronic) iron concentrations cannot exceed 1.5 mg/L (1.5 ppm) for warm water fishery streams and wetlands, and not exceed 0.5 mg/L (0.5 ppm) for trout streams. Also, waters used as public water supply or water contact recreation cannot exceed 1.5 mg/L (1.5 ppm). While no aquatic life water criteria are in effect for manganese, waters used as public water supply or water contact recreation cannot exceed 1.0 mg/L (1.0 ppm).

The West Fork Watershed underwent an EPA Total Maximum Daily Load report in 2002 (EPA, 2002). Ninety eight stream segments and the West Fork mainstem are listed on West Virginia's 1996 and 1998 Section 303(d) lists as impaired because of heavy metals, acid or both. All five subwatersheds are slated by this TMDL for substantial required reductions of both aluminum and iron (ibid, Appendix A-5, Tables 5a. and 5b.). Subwatersheds 1903 and 1904 are also slated for required reductions of manganese (ibid, Appendix A-5, Table 5c.)

Figure 1 summarizes the required reductions of heavy metals from the five subregions of Lambert Run delineated by the TMDL (EPA, 2002).

Figure 1. Heavy metal baseline conditions and allocations for Lambert Run subregions (EPA, 2002).

Table 5a. Aluminum baseline conditions and allocations (LAs) for nonpoint sources

SWS	AML		Revoked Mines		Nonpoint Source		Requires Reduction
	Baseline Load (lb/yr)	Allocated Load (lb/yr)	Baseline Load (lb/yr)	Allocated Load (lb/yr)	Baseline Load (lb/yr)	Allocated Load (lb/yr)	
1901	2,853	713	0	0	352	352	x
1902	546	273	0	0	341	341	x
1903	2,227	290	0	0	203	203	x
1904	740	111	3,815	572	211	211	x
1905	845	186	0	0	287	287	x

Table 5b. (cont.) Iron baseline conditions and allocations (LAs) for nonpoint sources

SWS	AML		Revoked Mines		Nonpoint Source		Requires Reduction
	Load (lb/yr)	Load (lb/yr)	Load (lb/yr)	Load (lb/yr)	Load (lb/yr)	Load (lb/yr)	
1901	9,865	987	0	0	706	706	x
1902	1,888	472	0	0	678	678	x
1903	7,700	385	0	0	413	413	x
1904	2,558	512	2,634	527	388	388	x
1905	2,923	438	0	0	576	576	x

Table 5c. Manganese baseline conditions and allocations (LAs) for nonpoint sources

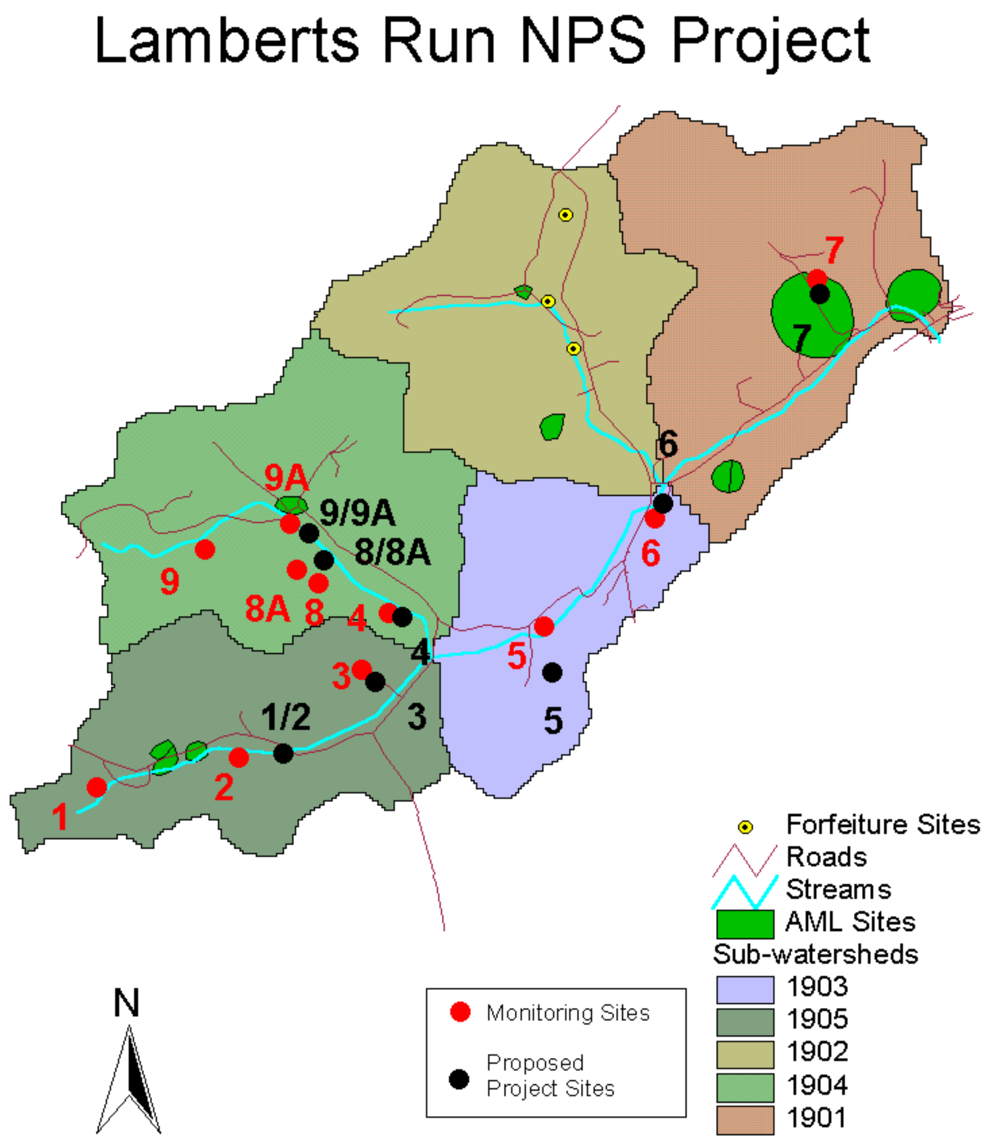
SWS	AML		Revoked Mines		Nonpoint Source		Requires Reduction
	Baseline Load (lb/yr)	Allocated Load (lb/yr)	Baseline Load (lb/yr)	Allocated Load (lb/yr)	Baseline Load (lb/yr)	Allocated Load (lb/yr)	
1901	1,711	1,711	0	0	285	285	
1902	327	327	0	0	279	279	
1903	1,336	601	0	0	163	163	x
1904	444	222	1,690	845	182	182	x
1905	507	507	0	0	233	233	

Figure 2 shows individual metals reductions needed in each sub-watershed and split between the reductions from projects covered in this plan and those called for from permitted special mine reclamation forfeiture sites.

Figure 2: Total metals load reductions needed to achieve TMDL

SWS	Aluminum lbs/yr	Iron lbs/yr	Manganese lbs/yr
1901	2140	8878	0
1902	273	1416	0
1903	1937	7315	735
1904	3872	4153	1067
1905	659	2485	0
Totals	**8881**	**24247**	**2302**
319 Projects	5638	22140	957
Special Reclamation	3243	2107	845

Figure 3: Map of Lamberts Run



a. (iii). Causes and sources of impairment

The sampling that lead to the West Fork River 2002 TMDL and its finding that load reductions were required for Lambert Run, determined that levels of aluminium, iron, and manganese exceeded existing water quality standards.

During site visits in 2003, representatives of Guardians of the West Fork Watershed and WVDEP Water Resources discovered new sources of impaired water, measured flows and sampled heavy metal concentration and acidity (and several other parameters). A list of all of the major tributaries to Lambert Run, including its mainstem components, was compiled, and is shown in Table 2, Table 3 summarizes loads from the perspective of the proposed projects.

Table 2 summarizes the water chemistry samples taken in the spring and summer of 2003 on Lambert Run to identify the location and severity of water impairment. These samples were required for the design of wetlands and other mitigation projects. They provide a more detailed dataset than the two sampling points employed with the Lambert Run watershed for the 2002 West Fork Watershed TMDL (EPA, 2002).

Table 2. Summary of Lambert Run sources 2003 sampling chemistry and loads.

Site #	Date	Flow (gpm)	pH	Temp (ºC)	Field Cond	Lab Cond	DO (mg/L)	Acid Load (T/yr)	Acid Load (mg/l)	Fe (T/yr)	Mn (T/yr)	Al (T/yr)	Fe (ppm)	Mn (ppm)	Al (ppm)	Landowner/Comments
LR-1	6/12/03	187.3	6.8	13.7	400	1480	7.96	<0.41	<1	4.2	1.19	0.02	10.2	2.9	0.05	Scarf; pipe in front yard
LR-2	6/18/03	157.7	8	13.8	1459	1780	5.1	<0.35	<1	4.27	1.27	0.03	12.3	3.65	0.09	Greathouse; ditch running on side of property
LR-3*	5/9/03	150.5	5.5	14	410	2020	9.8	24.17	73	0.7	1.9	1.77	2.12	5.73	5.35	Allen, Gun Club; downstream, near gate
LR-3A*	5/9/03	62.2	3.3			2230		13.7	100	1.81	0.92	0.87	13.2	6.73	6.37	Allen, Gun Club; portal
LR-3pond	6/23/03		7.2						<1							General Chem:pH, Acid, Alk
LR-4	6/10/03	161.5	7.3	13.5	590	1810	9.95	<0.36	<1	1.45	0.37	<0.02	4.07	1.03	<.05	Moore; coming off hill
LR-4A	6/10/03	519.5	6.9	15.8	390	1710	9.38	<1.14	<1	14.51	2.23	2.62	12.7	1.95	2.29	Moore; at bridge
LR-4seep	6/23/03		6.5	12.5	1558	2170	0.72		<1				18.6	2.71	<.05	top of hill, amd suite-no flow
LR-5	6/12/03	934.1	6.7	13.1	520	1900	10.11	<2.06	<1	8.84	4.13	0.45	4.3	2.01	0.22	Allen; in meadow just beyond treeline
LR-6*	5/9/03	286	4.8	13.5	2150		6.71	13.2	23	11.51	2.15	1	18.3	3.41	1.52	Guinn; sister open mout portals
LR-7*	5/8/03	2886	6.6		1770	1770		<6.35	<1	151.7	19.6	0.7	23.9	3.08	0.11	impoundment AML site
LR-8	6/12/03	42.78	6.9	13.5	340	1440	9.98	<0.09	<1	0.22	0.16	0.17	2.39	1.65	1.8	Olddaker; out in field
LR-8A	6/12/03	511.3	6.8	14.1	390	1580	9.96	<1.12	<1	11.81	2.34	0.1	10.5	2.08	0.09	Olddaker; near house
LR-9	6/18/03		5			2430			152				38.4	4.58	10.8	Cox; upstream
LR-9A	6/23/03	556.9	4.2			2150		88.21	72	34.67	5.26	10.22	28.3	4.29	8.34	Cox; downstream-passe under rd, railroad underpass

b. Nonpoint source management measures needed

Heavy metals from mine drainage can be removed from running waters by upward adjustment of pH if acid conditions are present and by oxidizing natural wetlands. Since few of our sites were significant sources of acid loads, oxidizing wetlands to precipitate the heavy metals are recommended. Where needed open limestone channels and leach beds will be used to raise the pH and alkalinity.

An aerobic wetland consists of a large surface area pond with a water depth of 6 to 18 inches with horizontal surface flow. The pond may be planted with cattails and other wetland species. Aerobic wetlands can only effectively treat water that is entirely alkaline. In aerobic wetland systems, metals are precipitated through oxidation reactions to form oxides and hydroxides. Aeration prior to the wetland, via riffles and falls, increases the efficiency of the oxidation process and therefore the precipitation process. Iron concentrations are efficiently reduced in this system but the pH is further lowered by the oxidation reactions. (PADEP)

An open limestone channel is a drainage ditch constructed of limestone so that the ditch collects AMD-contaminated water. A leach bed is a pond-like structure filled with limestone or other alkaline material such as steel slag. Dissolution of the alkaline material adds alkalinity to the water and raises the pH.

Conceptual designs for project sites LR 1\2, LR 3 and LR 8\8A have been developed and the technologies to be used are listed below.

1. Site LR 1\2, Raines Property Project – aerobic wetland
2. Site LR 3, Muzzleloader Club Project – aerobic wetland with a steel slag leach bed to raise the alkalinity of an unimpaired source
3. Site 8\8A, Oldaker Property Site – two (2) aerobic wetlands

Additionally, Site 4 would need drainage diverted through a culvert under the existing access road into an aerobic wetland. Sites 5 and 9 need upgrades to existing wetlands below the mine discharge, since the current size of the present wetlands are insufficient to allow metal precipitation and retention. Site 6 needs a small wetland installed at the base of the existing portal, discharge from the wetland into a limestone channel that will divert water from the upper bench to the lower bench. Site 7 would benefit from an aerating apparatus, and enlargement of the existing impoundment to allow sufficient retention for the nearly 3,000 gpm of water discharging this site during high flow events.

All projects for heavy metal abatement construction sites are pending acquiring funding and landowner’s final approval.

c. An estimate of the load reductions expected

The critical areas on the Lambert Run subwatershed were identified by 12 sampling and monitoring visits to Lambert Run from May through July, 2003, by personnel of the WV DEP Water Resources, Guardians of the West Fork Watershed, OSM Acid Mine Drainage 2003 Intern, and National Mine Lands Reclamation Center. Both field and lab chemistry analyses were conducted (field measurements, Guardians of the West Fork Watershed; lab measurements – Sturm Environmental Services, the results of which are summarized in Tables 2 and 3.

Jennifer Simmons, Program Coordinator, National Mine Lands Reclamation Center, has prepared conceptual designs for three construction projects, LR 1\2, LR 3 and LR 8\8A (see map page 4) using the critical water flow and chemistry data collected this year. Project conceptuals were designed for complete reduction of the heavy metals aluminum, iron, and managanese from their upstream sources.

Table 3. Water chemistry flows, metal concentrations, and loads for impaired waters proposed for projects in Lambert Run, from field and lab data collected by Guardians of the West Fork Watershed and Sturm Environmental Services, May-June, 2003, as used by West Virginia Water Research Institute.

Source/Project	Flow (gpm)	Flow (gpy)	Alum. (ppm)	Iron (ppm)	Mang. (ppm)	Fe Ld. lb/yr	Al Ld. lb/yr	Mn Ld. lb/yr	Cost
Raines Property	338.3	1.78E8	0.1	11.1	3.2	16,500	100	4920	$201,167
Muzzleloader Club	62.2	3.27E7	6.4	13.2	6.7	3,600	1740	1840	$146,316
Oldaker Property	554.03	2.71E8	1.89	12.89	3.73	23,950	540	5000	$219,885

The Raines and Muzzleloader projects in sub-watershed 1905 would reduce iron loading by 20,100 lbs/yr. These two projects, if completely effective, would reduce the loading of iron for the entire Lamberts Run watershed to within 10% of the goal set by the TMDL.

Table 4: Anticipated Load Reductions for remaining project sites based on monitoring completed during the summer of 2003

Project	Fe Ld lb/yr	Al Ld. lb/yr.	Mn Ld. lb/yr	
LR 4	2900	NA	740	
LR 5	17,680	900	8260	
LR 6	23,020	2000	4300	
LR 7	303,400	1400	39,200	
LR 9\9A	69,340	20,440	10,520	
Total WBP Reductions	460,390	27,120	74,780	(Includes all sites)

Anticipated load reductions may change significantly when proposals are drafted for them. Pollution loads were based on this year's monitoring which occurred during the wettest summer on record. During an average summer flows and loads should be reduced. Monitoring during low flow conditions to develop an average has not taken place because low flow conditions have not existed in 2003.

d. An estimate of the assistance (financial and technical) and authorities the state anticipates having to rely on to implement the plan.

Cost estimates:

Site 1\2, Raines Property Project, Aerobic wetland

Aerobic wetland	$163,428
Mobilization and demobilization	$5,000
Diversion channel	$4,500
Misc. construction costs (pipes, hay bales, etc.)	$2,000
Engineering @ 15%	$26,239
Project subtotal	$201,167

Site 3, Muzzleloader Club Project, Aerobic wetland and steel slag leach bed

Aerobic wetland	$111,166
Mobilization and demobilization	$5,000
Freshwater steel slag leach bed	$10,000
Erosion control & miscellaneous	$2,000
Engineering @ 15%	$18,150
Project subtotal	$146,316

Site 8\8A, Oldaker Property Project, 2 Aerobic wetlands

Aerobic wetland #1 (Site 8)	$10,718
Aerobic wetland #2 (Site 8A)	$166,818
Mobilization and demobilization	$5,000
Diversion channel	$1,800
Access road	$5,868
Erosion control & miscellaneous	$1,000
Engineering @ 15%	$26,681
Project Subtotal	$219,885

Implementation Total	$567,368
Administrative costs @ 10%	$56,737
Total for first three projects	**$624,105**

Sites LR 4, LR 5, LR 6, LR 7 and LR 9\9A are anticipated to average approximately $200,000 each = $1,000,000

Pre- and post-construction monitoring

Flow rates, analytical chemistry of heavy metals	$16,000

Out Reach and Education

Full color pamphlet on Lambert Run project	$2,000
Posters	$1,000
GIS and modeling support	$1,000

Total estimated watershed plan costs:	**$1,700,000**
319 share not to exceed:	**$1,020,000**
Anticipated 319 share:	**$867,000**
Anticipated OSM, AML funds:	**$833,000**

<u>Funding Sources</u>

Section 319 EPA, 51%

US Office of Surface Mining (OSM) Clean Streams Initiative, 49%

Technical assistance needed:

Dr. Paul Ziemkiewicz, Ph.D., Director and Program Coordinator
National Mine Lands Reclamation Center
West Virginia University Water Research Institute
West Virginia University
P.O. Box 6064
Room 2002D NRCCE
Morgantown, WV 26506-6064
304-293-2867, ext. 5441; pziemkie@wvu.edu

Dr. Ziemkiewicz has toured the Lambert Run watershed on June 19, 2003 and deemed it a very good candidate for remediation projects because of the presence of some existing wetlands, current land use practices compatible with possible project construction, and landowner cooperation. Jennifer Simmons has prepared initial models to propose location and type of treatment systems. They have been provided with flow data (Guardians of the West Fork) and heavy metal concentrations (sampled by Guardians of the West Fork, analyzed by Sturm Environmental Services) to allow for his conceptual plan.

Ryan Gaujot
Cartographer and Circuit Rider
GIS Mapping Division
Canann Valley Institute
Davis, West Virginia 26260

Canaan Valley Institute is eager to work with Guardians of the West Fork Watershed by providing us with a GIS map of the Lambert Run watershed that will include several data layers. This map will be interactive, posted to the Web with Javascript so that it can be viewed and printed remotely, for research and educational purposes.

Bruce Edinger, Ph.D.
Salem International University, Department of Biology.
Dr. Edinger's expertise is in the areas of biology and environmental science. He has been involved in water quality sampling, particularly regarding the use of benthic macroinvertebrate sampling to determine stream quality, for the last five years. His training in using computational science in science education will allow a STELLA simulation model of the Lambert Run heavy metals loads to be made using actual data to allow visualization of load reductions using various treatment methods. This model will be demonstrated at watershed conferences and posted to the web as a Javascript applet.

Lou Schmidt, Water Resources, Nonpoint Source Specialist
WV DEP Water Resources
Has already provided crucial assistance to administer aluminum, iron, and manganese concentration sampling for approximately 20 samples (and AMD chemistry suites – pH, hot acid, alkalinity, conductivity) at major sources and tributaries to Lambert Run. These samples, with field-provided flow rates, are crucial for planning the location and type of treatment structures.

e. Information/education component, enhancing public understanding and involvement in nonpoint source management measures.

History. Members of Guardians of the West Fork Watershed have been providing education about AMD and other nonpoint source issues since the group's inception in late 2001. They have received about $13,000 in small grants from U.S. Dept. of Interior – OSM, West Virginia Stream Partners Program, Harrison County Solid Waste Board, West Fork Soil Conservation District, and DuPont for monitoring and education projects. Guardians members have given 5 public lectures, conducted two stream monitoring workshops, visited three classrooms and guest-taught. Our activities were recognized in Fall 2002 by being honored by the WV Stream Partners as the best West Virginia watershed group in the 'Water Monitoring' category.

Posters. The state of West Virginia, in conjunction with Guardians of the West Fork, will make two copies of a free-standing, illustrated poster display of the Lambert Run project which can be used by both the State on a state-wide basis and by Guardians on a more local basis. Photographs of pre-conditions have already been taken. Both organizations have experience in making such multi-panel poster displays.

GIS Map. The Canaan Valley Institute has been consulted about making a GIS map of the project area with watershed boundaries, water bodies, coal seam and mine information, surface elevations, water quality data at about 12 sites, treatment project locations, and other data layers. This map will be posted on the web and allow interactive viewing, and the project, and background history, will be included in associated web pages. CVI has already completed similar projects and their interactive GIS maps of various watershed projects can be seen at http://canaanvi.org/gis/mapFrame.asp. We have received a verbal commitment from CVI to assist in the making of this map

Load Reductions Modeled with Stella. It is very difficult to quickly explain to the general public the concepts of Total Maximum Daily Load and load reduction. However, these are crucial to water quality improvement, and the Clean Water Act has many provisions for enhancing public participation in and understanding of its initiatives. Therefore, a member of Guardians of the West Fork watershed will create a Stella (mathematical simulation software) model that will visualize the acid and metal loads found in Lambert Run with and without actual and proposed mitigation wetlands and other projects. Actual data will be used to initialize the model, and the converting action of the proposed treatment projects will also be accurately simulated. Such a model can be labeled appropriately for general audiences, demonstrated at watershed meetings, and distributed as a self-standing, self-running interactive application on the web as a Java applet or to interested parties.

Watershed Open Houses. Before, during, and after wetland construction, the state will host watershed open houses where the media and general public can see first-hand the beneficial construction activities. Guardians of the West Fork members would help man different activitites, such as tours of the sites, demonstration of using benthic macroinvertebrates as bioindicators, demonstrations of water sampling equipment, etc.

f. Schedule for implementing the nonpoint source management measures

Fall 2003	Secure low-flow stream samples measuring stream flow and metals concentrations to allow a third dataset for most accurate designing of mitigation wetlands by National Mine Lands Reclamation Center personnel.
Fall 2003	Complete round of standardized benthic macroinvertebrate samples downstream of constructed wetland to provide pre-constructed benthic habitat conditions.
Winter 2003/04	Submission of Section 319 Project Proposal for Muzzleloader Club project and apply for the 50% match from OSM
Spring 2004	Secure signed right-of-entry agreement from landowners
Spring 2004	Upon positive notification, advertise bids for the project
Summer 2004	Begin projects construction, Submission of Section 319 Project Proposal for Oldaker and Raines projects and apply for the 50% match from OSM
Fall 2004	Post construction monitoring
Winter 2004/05	Advertise requests for project proposals for remaining projects
Spring 2005	Select next project(s) and produce 319 project proposal(s)
Summer 2005	Submit 319 Proposals to EPA
Spring 2006	Begin process for the construction of the next set of projects
Summer 2006	Submit 319 Proposals to EPA
Fall 2006	Complete construction of FY 05 319 projects, monitor results
Summer 2007	Submit 319 Proposals to EPA for final projects
Fall 2007	Finish construction of FY 06 projects, continue monitoring for results
Fall 2008	Finish all projects, monitor for results and submit final status report

g. A schedule of interim, measurable milestones that can be used to determine whether nonpoint source management measures or other control actions are being implemented.

The criteria that will be used to see if water quality standards are being improved are concentrations of heavy metals and heavy metal loads and health of benthic macroinvertebrate communities in the affected water bodies. Water quality criteria follow those listed in the West Fork River 2002 Final TMDL (EPA, 2002).

Sampling for benthic macroinvertebrates will occur in the Fall of 2003 for sub-watershed 1905 to serve as a comparison with post-construction sampling to be taken after construction and then again one year later. The comparison should tell if the first two projects have improved biological conditions in the sub-watershed. This bio-assessment compared to the post-construction sampling for metals should show if the projects are removing enough metals and sediment to bring the stream back to life. These projects' results within one sub-watershed will allow us to determine if the technologies being used will be effective throughout the watershed.

h. A set of criteria that can be used to determine whether substantial progress is being made toward the water quality standards and, if not, criteria that will help to determine whether the nonpoint source TMDL should be revised.

Post construction sampling will be conducted with each project site to compare to sampling taken in preparation of this plan. Each project should remove the anticipated load reductions calculated from average flow conditions. If reductions fall short then an examination of the technologies being used will be examined before new projects are submitted. If load reductions fall short of TMDL goals but benthic macroinvertebrate sampling shows life is returning to acceptable conditions then it may indicate the TMDL levels need to be revised downward. If the load reductions exceed the TMDL levels, as now anticipated, then it is possible the TMDL needs to be revised upward.

i. A monitoring component to evaluate how effective the implementation efforts are as measured against the set of criteria developed as described previously.

Sampling will be done before, during and after the wetland projects have been completed and then annually to monitor continued progress. Benthic macroinvertebrate samples will consist of a minimum of 200 individuals per sample, standardized sample areas, identification to morpho-family, and calculation of six different metrics, using the updated WV Save Our Streams Protocol Three. Chemical sampling will monitor for iron, aluminum and manganese.

The Guardians of the West Fork or the intern working for them through the OSM's intern program will conduct sampling. Supplemental monitoring will be conducted by the Non-Point Source Program in WVDEP's Division of Water and Waste Management (DWWM) but the final determination of success will be judged by monitoring by the TMDL Program in DWWM.

References

U.S. Environmental Protection Agency. 2002. Metals and pH TMDLs for the West Fork River Watershed, West Virginia. Region 3, 1650 Arch Street, Philadelphia, PA. September.