SR 81
ABANDONED MINE RESTORATION AREA
Final Report
June 2004

Washington Township
Butler County, Pennsylvania

Slippery Rock Watershed Coalition

Stream Restoration Incorporated

A PA Non-Profit Organization 501(c)(3)
3016 Unionville Rd., Cranberry Twp., PA 16066
PH: 724-776-0161; FX: 724-776-0166; sri@streamrestorationinc.org

Date: June 30, 2004

To: Timothy Van Dyke, Project Officer
Sherry Carlin, Watershed Manager
PA Department of Environmental Protection
Bureau of District Mining Operations
P.O. Box 669, Knox, PA 16232-0669

Re: Final Report
ME# 350410; Project # NW01771
SR81 Abandoned Mine Restoration
Washington Township, Butler County, PA
540102/FR-trans

Enclosed is the final report for the above noted project.

SR 81 restoration had a much greater impact than originally described in the Growing Greener Grant application. As flows increased from the pre-construction average of ~40 gpm to the post-construction average of ~200 gpm, instead of the projected 3 tons/yr of acidity neutralized, the system is currently neutralizing ~33 tons/yr, and, instead of the 1ton/yr of iron removed, the system is removing 12 tons/yr. Even though site conditions and other considerations did not allow for increasing the size of the Anoxic Limestone Drain, the size of the retention components (Settling Pond and Aerobic Wetlands) were increased by a total of ~13,000 SF. Nonetheless, as this was a public-private partnership effort, no additional funds were requested. Water quality has been monitored at the site for 18 months and little to no maintenance has been required to date.

In addition, the planting of the 2/3-acre wetlands by volunteers provided wonderful opportunities for education and outreach. Volunteer groups included students from Washington Elementary School, Butler County Juvenile Court System, and college student interns. This would not have been possible without assistance from Bob Beran, formerly with Aquascape, Dale Hockenberry, PA Game Commission, and the Butler Co. Conservation District, which generously provided 1000 wetland plant seedlings.

The patience, assistance, and contributions by the Knox District Mining Office have been very much appreciated. If there are any questions or comments about the final report, please do not hesitate to contact us. The submission of a good quality work product is important to all of us.

From: Stream Restoration Incorporated

By: Margaret H. Dunn, PG, President

Sent: First Class Mail

SLIPPERY ROCK WATERSHED COALITION

SR81 ABANDONED MINE RESTORATION FINAL REPORT

Slippery Rock Creek Headwaters
Washington Township, Butler County, PA

"Making It Happen" through a Public-Private Partnership Effort

A Pennsylvania Growing Greener Watershed Restoration Project

Brief Description of Project Work through Grant and Partnership Contributions

- Completed applications and received permits and approvals. Installed approved Erosion and Sediment Controls.
- Designed passive system complex for the SR81 and SR81A abandoned mine discharges impacting Slippery Rock Creek. Design basis (from raw water monitoring conducted by PA DEP and other project partners): 60 gpm flow, 4.0 pH, no alkalinity, 125 mg/l acidity, 50 mg/l iron, 10 mg/l manganese, and <1 mg/l aluminum.
- Installed a passive treatment system (components in series) consisting of: Collection System; Anoxic Limestone Drain containing 1350 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate; Settling Pond 1 (11,600 SF); Aerobic Wetland (28,700 SF).
- Neutralizing 33 tons of acidity/year and removing 12 tons of iron/year, which is more than 10 times that projected. (Post-construction flow rate averages ~200 gpm).
- Neutralized ~4000 CY (twice the projected amount) of existing abandoned coal refuse for use in restoring an ~1½-acre abandoned mine spoil area.
- Improved success of vegetation in existing natural wetland used to "polish" treated flow
- Continued monitoring of Slippery Rock Creek by project partners.
- Developed O&M field sheet and expanded use of Datashed (**www.datashed.org**).
- Conducted before, during, and after site tours for news media, community groups, watershed education programs (including several wetland plantings with Washington Elementary School students, Butler County Youth Services, college students, etc.)
- Kept photographic log.
- Submitted electronic updates, quarterly status reports, and final report; administered contract.

DEP Grant Program: Environmental Stewardship and Watershed Protection Grant
Growing Greener Initiative - $120,000

In-Kind/Matching: Butler County Commissioners; Western Pennsylvania Watershed Program; PA Game Commission; Amerikohl Mining, Inc.; Aquascape; Beran Environmental Inc.; Washington Elementary School; Butler County Youth Services; Grove City College; Urban Wetland Institute; Quality Aggregates Inc.; BioMost, Inc.; Slippery Rock Watershed Coalition; Stream Restoration Inc.

PUBLIC-PRIVATE PARTNERSHIP: CONSTRUCTION AND MONITORING

Water Quality Monitoring, Construction Inspection
PA Dept. of Environmental Protection, Bureau of District Mining Operations,
PO Box 669, Knox, PA 16232
GILLEN, Timothy, PG; BOWMAN, Roger, Engineer; PLESAKOV, James, MCI; ELICKER, Theresa, MCI; Van DYKE, Timothy, Insp. Supervisor; ODENTHAL, Lorraine, Permit Chief; CARLIN, Sherry, Watershed Manager; MIRZA, Javed, Dist. Mining Mgr. (814) 797-1191

Landowner, Wildlife Management
PA Game Commission, PA Gamelands #95
2026 West Sunbury Rd., West Sunbury, PA 16061
HOCKENBERRY, Dale, Land Mgr.; BRUNST, Chip, WCO (724) 637-3120

Environmental Assessment, Wetland Plantings, Education/Outreach
Aquascape, 147 South Broad Street, Grove City, PA 16127
BERAN, Robert, President; REIDENBAUGH, Jeff, Env. Eng.; SPENCER, Laura, Biologist; SALMON, Cody, Wildlife & Fisheries Sci.; McANNICH, Anna, Biologist (724) 458-6610

Beran Environmental Inc., 2322 West Sunbury Rd., Boyers, PA 16020
BERAN, Robert, President; REIDENBAUGH, Jeff, Env. Eng.; SALMON, Cody, Wildlife & Fisheries Sci.; McANNICH, Anna, Biologist (724) 735-2766

Conceptual and Engineering Design of Passive Treatment Systems, Water Quality Monitoring, Operation & Maintenance
BioMost, Inc., 3016 Unionville Rd., Cranberry Twp., PA 16066
DANEHY, Timothy, QEP; DUNN, Margaret, PG; BUSLER, Shaun, Biologist; DENHOLM, Clifford, Environmental Scientist; DANEHY, Sylvia, Office Manager; CANDIELLO-BUZZELLI, Candice, Intern (724) 776-0161

Passive Treatment System Construction
Amerikohl Mining, Inc., 202 Sunset Drive, Butler, PA 16001
STILLEY, John, President; JOHNSON, Fred, Reclamation Manager (724) 282-2339

Limestone Aggregate
Quality Aggregates Inc., 200 Neville Rd., Neville Island, PA 15225
ALOE, Joseph, President; ANKROM, Jeff, Vice President (412) 777-6717

Water Quality Monitoring
Grove City College, 100 Campus Dr., Grove City, PA 16127
BRENNER, Frederick, PhD, Biologist, Biology Dept. (724) 458-2113

Urban Wetland Institute, [non-profit], 789 North Liberty Rd., Grove City, PA 16127
BRENNER, Frederick, President (724) 748-4310

Grant Administration, Education and Public Outreach, Volunteer Effort
Stream Restoration Inc., [non-profit], 3016 Unionville Rd., Cranberry Twp., 16066
DANEHY, Timothy, QEP; DUNN, Margaret, PG; BUSLER, Shaun, Biologist; DENHOLM, Clifford, Environmental Scientist; DANEHY, Sylvia, Office Manager; CANDIELLO-BUZZELLI, Candice, Intern (724) 776-0161

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WASHINGTON TOWNSHIP, BUTLER COUNTY, PA

A SLIPPERY ROCK CREEK MINE DRAINAGE ABATEMENT PROJECT
Slippery Rock Creek Headwaters

submitted to

Pennsylvania Department of Environmental Protection

EXECUTIVE SUMMARY

Participants in the Slippery Rock Watershed Coalition received a grant from the PA Department of Environmental Protection through the Commonwealth's Growing Greener initiative. The purpose of the grant was to fund in combination with matching/in-kind contributions the installation of a passive system to treat two acidic, metal-bearing, discharges and related education and public outreach activities.

Within 18 months of grant approval, not only were the necessary permits/approvals received but also the passive system was designed and placed online without additional costs to the Commonwealth. This economic, efficient, and effective method of project implementation is attributed to the public-private partnership effort that included federal, state, and local agencies, private industry, nonprofits, a local college, and volunteers.

The passive treatment system includes: Collection System; Anoxic Limestone Drain (1350 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate); Settling Pond (11,600 SF); Wetland (28,700 SF). Even with the substantial increase in flow from a pre-construction 60 gpm maximum (design flow) to a post-construction 280 gpm maximum, the passive treatment system is performing phenomenally well. After nearly two years of operation, the improvement in discharge quality is characterized as follows:

Sample Point	Description	pH (field/lab)	Alk (field/lab)	Acd	Fe	Mn	Al
SR81	raw; pre-construction	5.0/3.6	NM/0	109	50	9	<1
SR81A	raw; pre-construction	5.3/3.5	NM/0	125	58	11	<1
Natural WL (improved)	treated site drainage	6.8/6.5	34/25	-9	6	4	<1

Alkalinity, acidity, and dissolved metals in mg/l; average values from sample sets of 5 or 6; SR81 & SR81A sampled at upwellings; DEP SR81 sampling (See monitoring sheets.) collected downgradient of upwellings; natural wetland (improved) sampling conducted prior to confluence with Slippery Rock Creek

In addition, the system is neutralizing on average 182 lbs/day or 66,400 lbs/year (33 tons/year) of acidity, which is 11 times the projected 3 tons/year, based on pre-construction monitoring. The system is also removing 68 lbs/day or 24,800 lbs/year (12 tons/year) of dissolved iron, which is 12 times the 1 ton/year of iron that was expected based on pre-construction monitoring. With improved water quality, the vegetation in the impacted natural wetland has also been notably more successful.

Successful site revegetation was made possible by the efforts of about 100 volunteers, including 55 students from Washington Elementary School. This education/outreach effort is key to the successful implementation and sustainability of all SRWC watershed restoration projects.

COMPREHENSIVE TIMELINE

DEP Inspection; Tour; News Item

Date	Description
05/03/00	Site investigation; water monitoring
06/26/00	Site investigation; water monitoring
07/11/00	Site investigation
08/11/00	SR81 Growing Greener Grant submitted
01/04/01	Official letter of grant award received
02/08/01	Growing Greener Training
02/22/01	Cover Letter (to be dated 2/26/01), Simplified Budget, Detailed Budget, and Scope of Work faxed to PA DEP
02/26/01	Contract, Simplified Budget, Detailed Budget, and Scope of Work Submitted
04/10/01	Water Sampling by Bob Beran
04/16/01	Environmental Assessment & Restoration Waiver Submitted to PA DEP
05/24/01	PA DEP completes processing of fully executed grant
06/07/01	Restoration Waiver approved by PA DEP; site inspection; water sampling
09/20/01	Earthtech Inc. completed topographic survey
09/25/01	On-site meeting about materials & scheduling with Hockenberry & Bowman
09/26/01	On-site meeting with survey crew
10/11/01	Quarterly Report submitted
11/06/01	Quarterly Report, Application for Reimbursement, and Environmental Assessment and Restoration Waiver submitted
11/29/01	Revised Application for Reimbursement submitted
01/15/02	Quarterly Report submitted
03/14/02	Site investigation and water sampling
04/12/02	SR81 included in SRWC Symposium field tour
04/18/02	Quarterly Report submitted
05/03/02	Water sampling
05/08/02	Passive Treatment Design Plan (Preliminary Draft) submitted
05/17/02	Erosion and Sedimentation Control Plan, Passive Treatment System Design Plan, Preparedness, Prevention & Contingency Plan submitted to PA DEP
05/28/02	Site investigation
05/29/02	Equipment on-site, no work started; DEP insp. (J. Plesakov, MCI)
06/04/02	Area for treatment system and gob disposal area cleared, bale barrier in place, track hoe has begun excavation on ALD cell east end, dozer pushing soil uphill and stockpiling near access road, road constructed to access gob pile for removal; DEP insp. (J. Plesakov, MCI) Construction site inspection and water sampling
06/13/02	Tour with Watershed Academy
06/14/02	Tour with Dr. Robert Nairn and his students from the University of Oklahoma
06/18/02	Additional excavation has been completed on treatment system; DEP insp. (J. Plesakov, MCI)
06/21/02	Site inspection and water sampling

06/25/02	Limestone being placed in ALD, additional piping to be installed, compost stockpiled on site, additional gob removed and placed at new location, ~4' remains to be regraded and topsoiled, 497 tons alkaline material incorporated with removed gob (slip said that weigh slips might be needed to verify this); DEP insp. (J. Plesakov,MCI); site inspection
06/28/02	Site inspection and Tribune Review photo shoot
06/30/02	Pittsburgh Tribune Review Article "Growing Greener may lose funding, impact"
07/—/02	SRWC "The Catalyst" article "Dr. Robert Nairn Visits from Oklahoma with Some of His students"
07/02/02	Anoxic Limestone Drain began discharging
07/12/02	Site inspection
07/17/02	Wetland Planting; Quarterly Report submitted
07/24/02	Fish Survey of Slippery Rock Creek
08/—/02	SRWC "The Catalyst" article "SR81 Wetland Planting"
08/01/02	Site inspection
08/06/02	Butler County Contract Executed (sent in - dated July 9)
08/07/02	Disturbed lands seeded and mulched, wetland planting in last three wetland cells, samples taken of ALD and final wetland cell discharge, construction of ALD and wetland cells completed, spreading of compost in wetland cells completed, planting of last three wetland cells completed, removal of part of gob to placement area completed, diversion of surface water completed, seeding and mulching of cell disturbed areas completed, the following can not be confirmed as completed: amount of alkaline addition to gob, covering of gob with fabricated soils, construction of 500' anoxic collection system, planting of 1st two wetland cells; DEP insp. (J. Plesakov, MCI); site inspection and water sampling
08/22/02	Scope of Work revision request and Budget revision request submitted to PA DEP
09/—/02	SRWC "The Catalyst" article "Fish Found in Slippery Rock and Seaton Creek"
10/08/02	Butler County Reimbursement Request submitted; Grant extension requested
10/14/02	Site inspection; water monitoring
10/15/02	Grant extension approved
10/21/02	Quarterly Report submitted
11/06/02	Installed 6" elbow onto ALD effluent pipe; site inspection
12/06/02	Field meeting with survey crew
12/12/02	Site inspection; water monitoring
01/15/03	Quarterly Report submitted; Application for Reimbursement request submitted to PA DEP Knox DMO
03/10/03	Site inspection; water monitoring
04/17/03	Quarterly Report submitted
04/23/03	Site inspection for possible upgrades
04/24/03	Site inspection; water monitoring
04/29/04	Seedlings planted by Washington Elementary 2nd grade classes, PA Game Commission, and Aquascape Wetland and Environmental Services
05/08/03	Grant extension request sent to PA DEP Knox DMO
05/09/03	Grant extension request approved by PA DEP Knox DMO
06/---/03	"Washington Elementary Students Help Plant SR-81" article in SRWC monthly newsletter *"The Catalyst"*

06/30/03	Site inspection; Water monitoring
07/10/03	Quarterly Report submitted
08/28/03	Site inspection; Water monitoring
10/15/03	Quarterly Report submitted
10/30/03	Site inspection; Water monitoring
01/14/04	Quarterly Report submitted
03/24/04	Site inspection; Water monitoring
04/01/04	Quarterly Report submitted

PROJECT DESCRIPTION

Introduction

In northern Butler County, western Pennsylvania, coal mining has been conducted in a 27-square mile area of the Slippery Rock Creek headwaters for over 100 years. Mining communities which were once bustling communities are now either abandoned or in decline, leaving only polluted streams, coal refuse, spoil, and highwalls. The residents that stayed called Slippery Rock Creek, "Sulfur Creek", due to the affects of mine drainage. In 1970 during the Commonwealth's Operation Scarlift, the quality of the headwaters was documented to be "the most severe condition of coal mine drainage…Indeed, very little drainage from this region is produced exclusive of contact with, or issuance from mine workings." (About 4,000 acres are underlain by mine workings and 8,000 acres were included in surface mine permits.) Within the 410 square miles of the Slippery Rock Watershed, streambed sediments in the headwaters have the highest heavy metal concentrations.

Since December 1994, participants in the Slippery Rock Watershed Coalition have been working to restore the headwaters and have successfully completed fifteen abandoned mine restoration projects. As reported in the Pennsylvania Department of Environmental Protection, Knox District Mining Office (PA DEP Knox DMO) (10/01) Slippery Rock Creek Progress Report: 2001, these systems have been about 100% effective in neutralizing acidity and 60 to 100% effective in reducing metal loadings. Also reported is the significant improvement of 11 miles of stream.

According to the 1998 Comprehensive Mine Reclamation Strategy Report (CMRS) by the PA DEP Knox DMO, Priority Area 5: Ferris, was heavily impacted by pollutive drainage from abandoned coal mines in the headwaters. Seven discharges were identified with an average combined flow of 183.5 gpm that did contribute a pollutional load to this priority area of: 209 lbs/day of acid; 24.5 lbs/day of iron; and 9.5 lbs/day of aluminum to the main branch of Slippery Rock Creek. In addition, about 240 acres of unreclaimed pre-act surface coal mining existed in the area including an estimated 4,000 cubic yards of coal refuse.

Five of the seven discharges were addressed by the successful installation of the SR85/SR86, SR87/SR88 and SR84 passive treatment systems by the PA DEP Knox DMO and others. This final report addresses the restoration activities at the SR81 Abandoned Mine Restoration Area site. Funding was received through the PA DEP "Growing Greener" initiative, Butler County Commissioners, Western Pennsylvania Watershed Program, and other participant matching funds and in-kind services. The SR81 passive system was designed to treat two discharges (SR81 and SR81A) that appear to be hydrologically related to both surface and underground mining on the Brookville coalbed (Clarion Fm.; Allegheny Gp.).

Site Location

The SR81 site is located along Kohlmeyer Road (T-504) in Washington Township, Butler County near the old mining "ghost town" of Ferris. The system is constructed on PA Gamelands No. 95 property. The site is located on the 7½' USGS Hilliards topographic map (PR1977) at latitude 41° 05' 24" and longitude 79° 51' 34".

Site History

The town of Ferris was named after a post office established on January 15, 1894, with John A. Turner as postmaster. According to the History of Butler County Pennsylvania, 1895, the Turner Coal, Coke and Mining Company had transformed this locality into a busy mining village, and produced about 800 tons of coal a day. The Brookville coalbed has been extensively mined in the area over the years. (See Figure 2, Table I, and Table II). Two abandoned mine discharges (SR81 and SR81A) were identified at the SR81 site by the PA DEP. Based on the Operation Scarlift "Extent of Mining Butler County" map (03014 283 20X 304190) obtained from the US Office of Surface Mining Mine Map Repository, several known abandoned deep mine complexes located along the southern bank of Slippery Rock Creek could be contributing to the discharges. (See Figure 2. and Table II.) Even though any one or all of the mines could be contributing to the site drainage, the Ferris #2 mine, which was in operation from 1947 to 1948, is in proximity to the discharges. An estimated 2000-cubic yard coal refuse pile, located on site, was also attributed to this underground mine.

Table I. Underground Mines Potentially Hydrologically-Related to SR81 & SR81A

Map Key (Figure 2)	Name of Mine	Dates of Operation
173	Penn Brook	1923 to 1930
174	Spring Valley	1902 to 1937
175	Ferris #2	1947 to 1948
176	Keystone #1	1888 to 1923

Table II. Other Known Underground Mines in General Vicinity

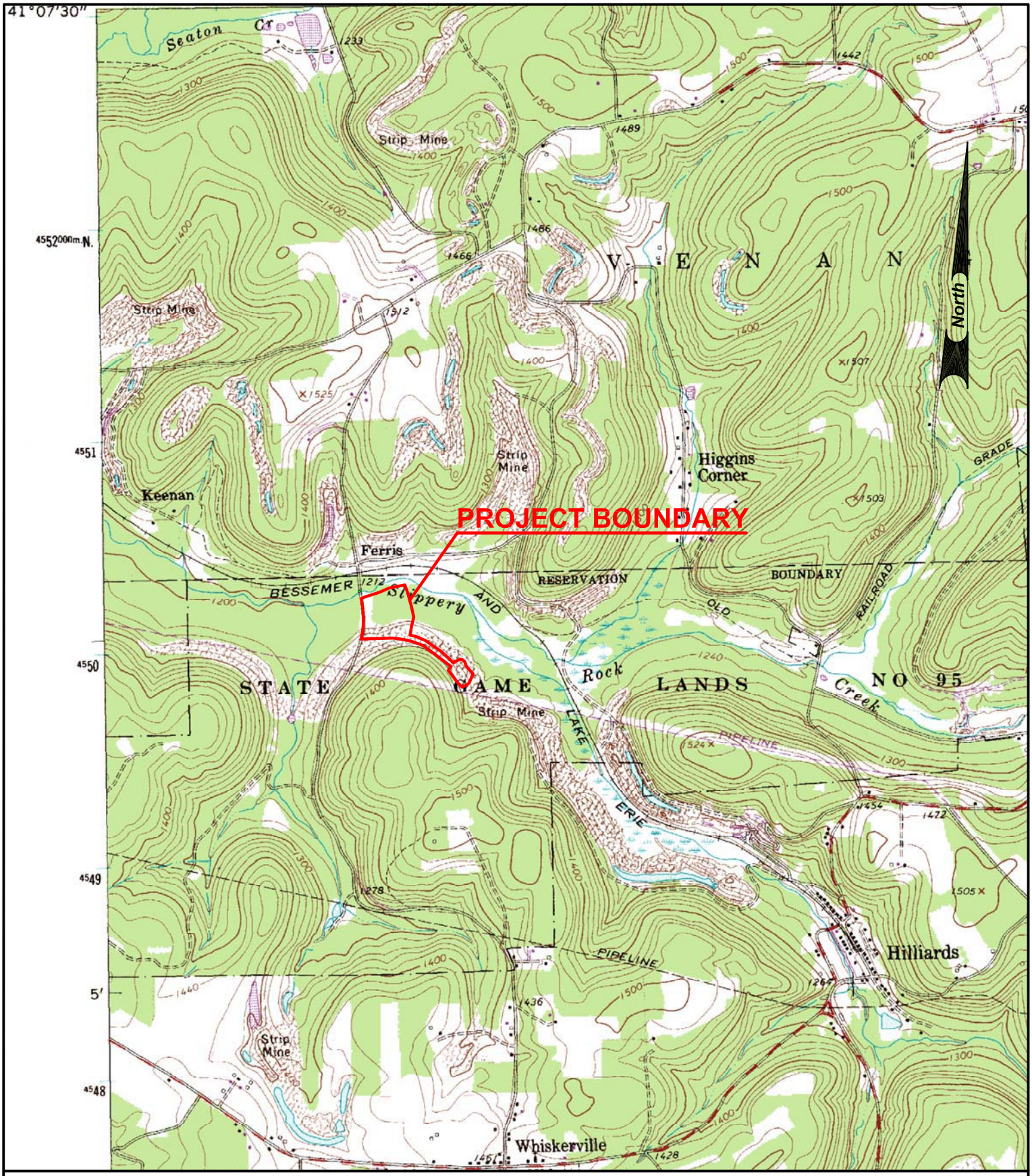
Map Key (Figure 2)	Name of Mine	Dates of Operation
160	Keystone No. 5	1909 to 1931
161	Nellie	1900 to 1919
162	Allegheny No. 2	1888 to 1893
163	Standard	1894 to 1919
164	Royle	1894 to 1928
165	Lake Trade #1	1919 to 1931
167	Boston	1917 to 1920
168	Cooper	1913 to 1917
169	Mckain	1912 to 1913
170	Lake Erie #1	1899 to 1899
171	Mizner	1895 to 1903
172	Hamilton	1923 to 1930
177	Keystone #2	1895 to 1921
178	Keystone #3	1919 to 1930
179	Wild Wood	1902 to 1913
180	Erie #1	1888 to 1930

According to the Slippery Rock Creek Watershed CMRS, the two discharges were responsible for approximately 3% of the iron and acid load from Priority Area 5. Based, however, on an increase in flow during construction and the extent of the underground mining on both sides of the creek (Figure 2), a greater loading has most likely been entering Slippery Rock Creek as base flow. Comparing DEP SR81 monitoring with that at the upwellings, the two discharges appear to encounter less polluted water in the degraded wetland prior to entering Slippery Rock Creek. This can be demonstrated by the discrepancy in water quality (especially upon comparing sulfate concentrations) and flow data obtained by project partners PA DEP and BioMost, Inc. below for pre-construction discharge characteristics. (See Table III.)

Table III. Pre-Construction Discharge Water Quality

Sampling Point	Flow	pH (lab)	Alkalinity (lab)	Acidity	Fe	Mn	Al	Sulfates
DEP SR81	42	4.1	3	36	8	3	<1	146
SR81	5	3.6	0	109	50	8	<1	352
SR81A	5	3.5	0	125	68	10	<1	443

SR81 and SR81A are BioMost, Inc. sampling points taken at the source of each discharge; DEP SR81 is PA DEP Knox DMO sampling point taken below the confluence of the discharges; Average Values; Flow in gallons per minute; pH measured in standard units (s.u.) and not averaged from H-ion concentrations; Alkalinity and acidity in mg/L of $CaCO_3$; Iron, manganese and aluminum are total metal concentrations in mg/L; Sulfates in mg/L;



PROJECT LOCATION - USGS 7.5' HILLIARDS, PA (PI1977)
SR81 ABANDONED MINE RESTORATION AREA

State Game Lands No. 95
Washington Township, Butler County, PA
Stream Restoration Incorporated
June 2004, Scale 1" = 2000'

Approximate Center of Project (deg-min-sec)
41-05-24 latitude 79-51-34 longitude

1000 0 1000 2000

540102AB/Project Location

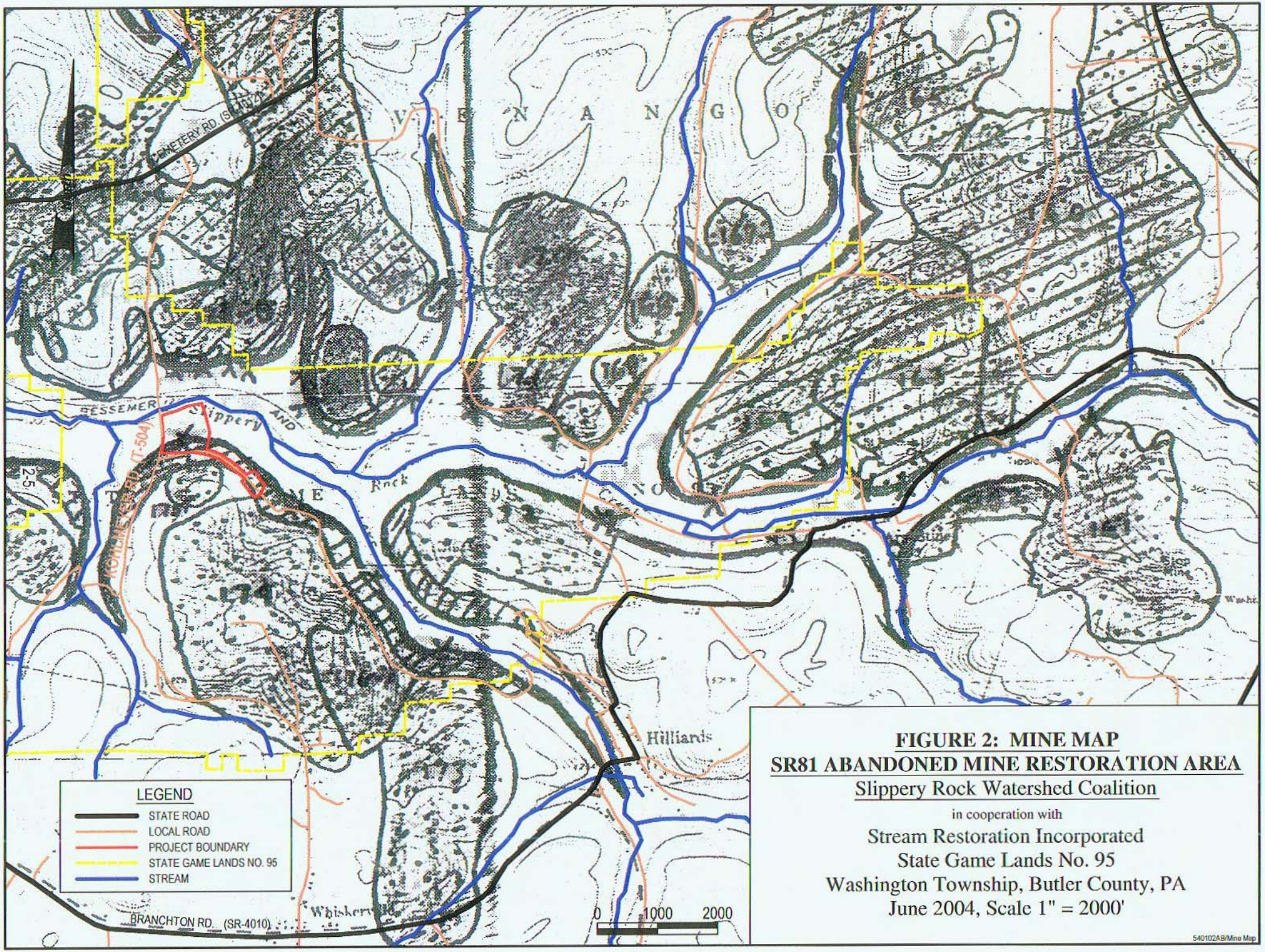


FIGURE 2: MINE MAP
SR81 ABANDONED MINE RESTORATION AREA
Slippery Rock Watershed Coalition
in cooperation with
Stream Restoration Incorporated
State Game Lands No. 95
Washington Township, Butler County, PA
June 2004, Scale 1" = 2000'

540102AB/Mine Map

Site Preparation

Erosion and Sediment Pollution Controls were installed upon completion of a written plan. Controls included a diversion ditch upgradient and staked hay bales downgradient of the earth disturbance activities. Hay bales were used at the request of the PA Game Commission. An Environmental Assessment was conducted and submitted and a waiver of permit requirements was received under Pennsylvania Code Title 25, Chapter 105.12(a)(16). Amerikohl Mining, Inc. addressed the road bond and highway occupancy permit requirements. Passive system design plans were completed by BioMost, Inc. and submitted to the PA DEP, Knox District Mining Office. PA One Call relating to underground utilities was contacted. The site of the passive treatment system was cleared and grubbed.

Passive Treatment System

The passive treatment system at the SR81 Abandoned Mine Restoration Area consists of the following components in series **(See plans and photo section.)**:

1. Collection System
2. Anoxic Limestone Drain
3. Settling Pond
4. Aerobic Wetland
5. Natural Wetland (improved)

Spent mushroom compost was placed in the Aerobic Wetland. River gravel was placed in the Collection System within the Anoxic Limestone Drain. Limestone aggregate was used in the spillways and as the treatment medium in the Anoxic Limestone Drain. Alkaline pond fines (~70% CCE) were used to neutralize the acidic coal refuse material. The source of the limestone aggregate and alkaline pond fines is the nearby Quality Aggregates Inc., Boyers Quarry, Boyers, PA. The Vanport limestone (Clarion Fm.; Allegheny Gp.) is a high calcium (90% $CaCO_3$) marine limestone.

Collection System: In the original design plan, a 500-foot long anoxic Collection System was to be installed. During construction of the Anoxic Limestone Drain, however, abandoned mine drainage began issuing from the southeast corner of the ALD as a result of the excavation. The flow rate was significantly greater, resulting in the essential elimination of the SR81 and SR81A discharges that had emanated at a higher elevation. The proposed collection system, therefore, was not installed. Instead a 6-inch, perforated, Schedule 40, PVC pipe bedded in PennDOT 2B, non-calcareous, river gravel, was installed along the southern end of the ALD in order to provide for "collection" and distribution of the discharge within the component.

Anoxic Limestone Drain (ALD): The primary purpose of the ALD is to neutralize proton acidity while generating excess alkalinity to neutralize the acidity associated with the formation of metal solids upon aeration within the Settling Pond and Aerobic Wetland. Geotextile was used to line the bottom and sides of the ALD to the approximate elevation of the top of the limestone. Limestone aggregate (1350 tons, AASHTO #1, high calcium, 90% $CaCO_3$, Vanport limestone) was then placed to a thickness of 4 feet

in an excavation that was approximately 55 feet in length and 35 feet in width. At the outlet end (northwest corner) of the ALD, a 6-inch, perforated, Schedule 40, PVC pipe was bedded in PennDOT 2B, non-calcareous, river gravel and connected to a 6-inch, Schedule 40, Solid-Core, PVC pipe with pressure-rated tee. The solid PVC pipe, with an Anti-Seep Collar, was extended from the treatment medium through the breastwork. Approximately midway through the breastwork a 90° elbow was inserted to create a riser as the outlet for the passive treatment component. A 90°, 6-inch, elbow was installed after completion of the system in order to measure flow.

Settling Pond (SP): The ALD discharges into an 11,600-SF Settling Pond. The pond provides for formation, settling, and storage of metal solids. A spillway (7'W x 30'L x 2'D) lined with R-3 limestone riprap was installed to convey the flow from the Settling Pond to the Aerobic Wetland while providing additional aeration.

Aerobic Wetland (WL): The 28,700-SF constructed Aerobic Wetland receives the flow from the Settling Pond. Four earthen berms, which function as directional baffles to discourage preferential flow paths, were constructed within the wetland. The wetland was planted with a variety of native, hydrophytic, plant species to create a diverse, naturally-functioning, wetland. The constructed wetland discharges through a spillway lined with R-4 limestone riprap into the pre-existing, degraded, natural wetland.

Natural Wetland (improved): Prior to removing the abandoned coal refuse and constructing the passive system at this site, the abandoned mine drainage created, or significantly fed, a degraded wetland. Upon improving the site drainage quality by passive treatment, the vegetation in the degraded wetland has become more successful while providing additional treatment to the drainage prior to entering Slippery Rock Creek.

Gob Pile Removal and Land Reclamation

In the original proposal, an estimated 2,000-cubic yard gob pile was to be removed, placed in a 1-acre area, neutralized, and covered with a fabricated soil. A topographic EDM survey conducted by Earthtech, Inc. provided a more accurate determination of the volume of abandoned coal refuse present. The calculated volume was about 4,400 cubic yards. Approximately 3,600 cubic yards were removed and placed in a 1.5-acre, essentially barren area, neutralized with about 495 tons of alkaline pond fines (~70% CCE) and covered with approximately 3,000 cubic yards of soil material encountered during installation of the passive treatment system. Total land reclamation associated with this site is approximately 5 acres.

PASSIVE TREATMENT SYSTEM PERFORMANCE

Drainage Treatment

The passive treatment system at SR81 has been online and functional since July 2002. In addition to monitoring by BioMost Inc. and the PA DEP, sampling has been conducted by Grove City College.

Even though sampling has been conducted for over 18 months, the results must be considered preliminary when considering the design life of the system to be 25 years. Table IV identifies the water quality characteristics through each component from the influent to the effluent.

Table IV. Water Quality Through the SR81 Passive Treatment System

Component	Flow	PH (field/lab)	Alkalinity (field/lab)	Net Acd (meas.)	Net Acd (calc.)	Fe	Mn	Al	DO
SR81	5	5.0/3.6	NM/0	109	125	50	9	<1	0
SR81A	5	5.3/3.5	NM/0	125	148	58	11	<1	0
ALD	200	6.8/6.4	112/66	9	-27	40	7	<1	0
SP	200	6.8/6.2	77/34	-2	-15	27	7	<1	6
SEEP	4	5.4/5.0	16/6	94	84	47	7	<1	0
WL	205	6.7/6.3	38/29	1	-3	12	7	<1	8
Natural WL	NM	6.8/6.5	34/24	-9	-16	5	4	<1	NM

Average values; flow in gpm; flow measured at ALD outlet pipe and seep; other flows assumed; lab and field pH not averaged from H-ion concentrations; alkalinity, acidity, dissolved metals, and dissolved oxygen expressed in mg/L; net acidity calculated from measured values for free acidity, dissolved metals, and field alkalinity; NM-not measured; SR81 and SR81A pre-construction values --- post-construction raw water values for dissolved metals assumed equal to ALD effluent values (See attached sample analyses.)

Overall, the passive system appears to be working phenomenally well especially when considering that the system was designed based on a maximum flow of 60 gpm (average 42 gpm) and the system has been treating, on average, 200 gpm. The raw mine drainage based on pre-construction water quality data can be characterized as being net acidic with high concentrations of dissolved ferrous iron, elevated concentrations of manganese, and very low concentrations of aluminum. Based on average values, the final effluent from the pre-existing Natural Wetland (improved) to Slippery Rock Creek at sampling point (Natural WL) is net-alkaline (34 mg/L alkalinity and –9 mg/L acidity) with 5 mg/L and 4 mg/L dissolved iron and manganese concentrations, respectively.

A more impressive evaluation of the system can be made through a loading analysis in pounds per day. As can be seen from the loadings table (Table V), on average the system is neutralizing 182 lbs/day of acidity and is decreasing the dissolved iron loading by 68 lbs/day. This equates to neutralizing 66,400 lbs/year (33 tons/year) of acidity and removing 24,800 lbs/year (12 tons/year) of dissolved iron. In the original proposal, based upon the Comprehensive Mine Reclamation Strategy (CMRS) for Slippery Rock Creek prepared by the PA DEP Knox DMO, the system was expected to neutralize 3 tons/year of acidity and retain 1 ton per year of iron. In comparison the passive system is neutralizing 11 times that amount of acidity and retaining 12 times the amount of iron per year.

Table V. Loading Analysis for the SR81 Passive Treatment System

Component	Alkalinity (field)	Alkalinity (lab)	Acidity (net)	Fe	Mn
DEP SR81	NA	1.0	14.3	2.2	1.4
SR81	NA	0	6.4	2.8	0.5
SR81A	NA	0	7.4	3.4	0.6
Raw (post-const.)	NA	NA	calc. 186.0	assumed 103.9	assumed 17.5
ALD	260.4	149.4	14.0	103.9	17.5
SP	186.1	79.6	-9.1	95.3	18.1
SEEP	0.5	0.3	4.6	2.4	0.4
WL	78.8	61.3	1.1	38.3	17.0

*Average loading values in pounds per day; iron and manganese loadings calculated from dissolved concentrations; NA **---** no data available; loadings from Natural Wetland not calculated as flow rate not measured; DEP SR81, SR81, and SR81A pre-construction data; Raw $_{(post\text{-}const.)}$ assumes dissolved iron and manganese concentrations as well as the flow rate are conservative through the ALD with acidity calculated from dissolved metal concentrations.*

Function of Individual Components

Anoxic Limestone Drain: Despite the 300% increase in flow, the 1350-ton Anoxic Limestone Drain (ALD) has been successfully functioning since the component began discharging in July of 2002. Assuming metal hydrolysis and the neutralization of free acidity are not significant within the component, the ALD is producing 112 mg/L or 260 lbs/day of alkalinity. This is sufficient alkalinity to neutralize the acidity associated with the oxidation/hydrolysis process for precipitation of iron. If the substantial increase in flow rate remains relatively constant, the treatment media may need to be replaced at a date earlier than the 25-year original design life.

Settling Pond: About 9 lbs/day of iron solids are formed in the Settling Pond (SP), consuming about 74 lbs/day of alkalinity. This accounts for approximately 8% of the total dissolved metal loading. Interestingly, on average there is a 33% reduction in dissolved iron concentration. The iron removal rate for the Settling Pond is 4 g/m^2/day.

Aerobic Wetland: The constructed wetland (WL) is on average removing about 59 lbs/day of dissolved iron that consumes about 107 lbs/day of alkalinity. This accounts for about 57% of the total dissolved iron loading. Between SP1 and the effluent of WL, there is a 74% decrease in dissolved iron concentration. Despite the design being based on significantly lower loadings, the iron removal rate is 10 g/m^2/day, which conforms to the typical rate of 10-20 g/m^2/day that Hedin et al (1994) described. A dramatic decrease in both total and dissolved iron was observed upon establishing vegetation in the wetland.

Natural Wetland (improved): As the vegetation becomes more successful and encourages increased accumulation of metal solids, the Natural Wetland is expected to further “polish” the abandoned mine drainage prior to discharging into Slippery Rock Creek. Similar to the constructed wetland, as the vegetation became more successful in the Natural Wetland, improvement in water quality was observed.

Comparison of pH, Alkalinity, and Acidity Throughout the SR81 Passive Treatment System (Average Values)

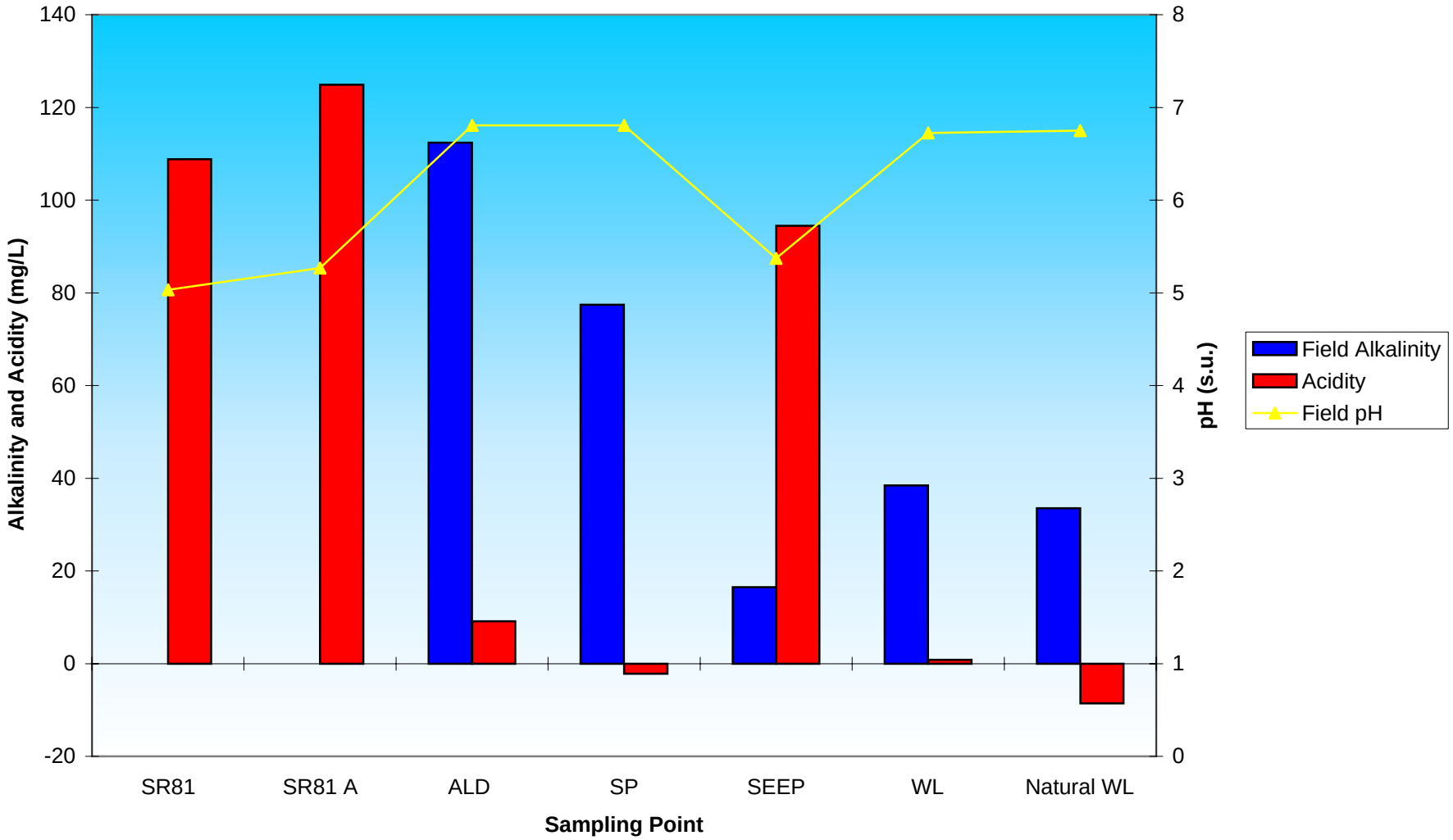


Figure 3.

Comparison of Dissolved Metals Concentrations Throughout the SR81 Passive Treatment System (Average Values)

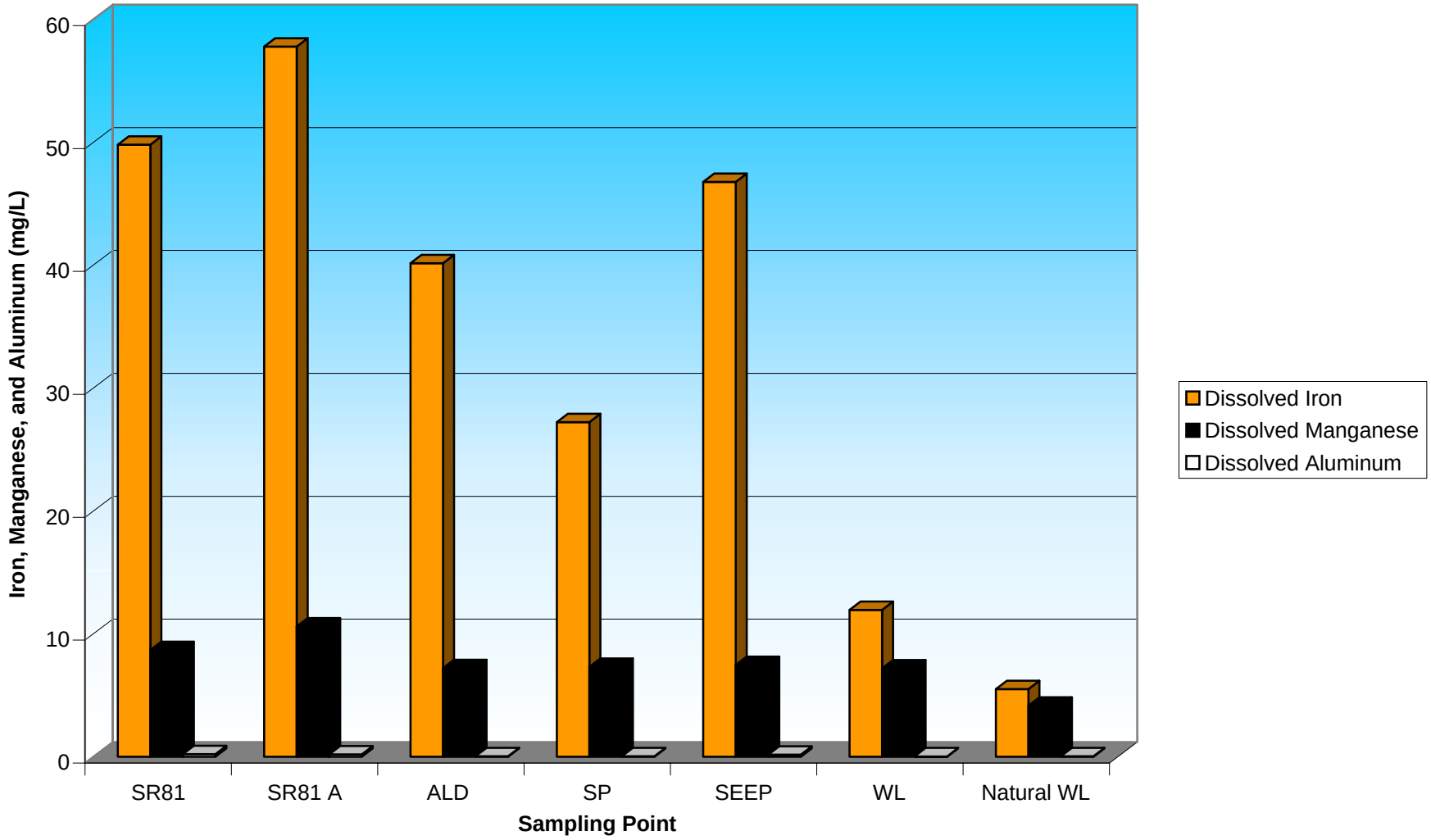


Figure 4.

MEASURABLE ENVIRONMENTAL RESULTS

Site Drainage Improvement

Based on the water quality data collected by various project partners, the SR81 passive system is successfully treating the abandoned mine drainage encountered at the site. Effluent from the constructed Aerobic Wetland was observed in July of 2002. Water samples were first taken of the Aerobic Wetland effluent in August of 2002 and sampling of the final effluent from the Natural Wetland (improved) began in December of 2002. The average water quality for the pre-construction untreated mine discharges and the final effluent of the passive system and Natural Wetland are listed in Table VI.

Table VI. Site Discharge Quality Before and After Passive System Construction

Sample	pH	Alk	Acidity	Iron	Manganese	Aluminum
SR81	5.0	NA	109	50	9	<1
SR81A	5.3	NA	125	58	11	<1
Wetland	6.7	38	1	12	7	<1
Natural Wetland (improved)	6.8	34	-9	6	4	<1

Average values; alkalinity, acidity, and dissolved metal concentrations in mg/L; pH not calculated from average H-ion concentrations; NA --- no data available; SR81 and SR81A pre-construction values; passive treatment performance section describes assumed post-construction raw water quality; (See attached analyses.);

The final effluent can be characterized as an alkaline-iron-manganese discharge with very low concentrations of aluminum. As previously noted, on average, the system is neutralizing about 182 lbs/day of acidity and preventing about 68 lbs/day of iron from entering Slippery Rock Creek.

Based upon current water quality data and assuming continued effective treatment, the passive system will result in the prevention of the following pollutants from entering Slippery Rock Creek every year:

- 66,400 lbs/year of acidity
- 24,800 lbs/year of total iron

Impact to Receiving Stream

PA DEP Acidity Measurements: The PA DEP, Knox District Mining Office has conducted long-term monitoring upstream (DEP 63) and downstream (DEP 64) of the SR81 restoration area. DEP 63 is also upstream of the Ferris Passive Treatment Complex and downstream of other passive systems and untreated abandoned mine drainage. Pre-construction monitoring at both the upstream and downstream points indicates that the stream quality fluctuates significantly with regard to all parameters measured (pH, conductivity, alkalinity, acidity, total iron, total manganese, total aluminum, sulfates). There is an apparent discrepancy unrelated to varying water quality, however, in the acidity measurements (both upstream and downstream). This discrepancy was first observed in the analyses reported for the 10/31/01 sampling and continues through the most recent analyses of 3/31/04. In this regard, the reported acidity measurements are much higher than the calculated acidity that is determined

from the free acidity (proton acidity reflected by pH) and the mineral/metal acidity (associated with dissolved iron, manganese, and aluminum species). Note that this time period includes acidity measurements both before and after installation of the SR 81 passive treatment system. The impact of the SR81 passive treatment system to Slippery Rock Creek is, therefore, difficult to discern. (See water monitoring data sheets.)

BMI and DEP Stream Monitoring:

Tables VII and VIII below show the average values of parameters measured from samples collected by DEP and BMI, respectively. The pH in Slippery Rock Creek appears to have improved after installation of the Ferris system and again after installation of the SR 81 system. Even though substantial iron and acidity loading is being removed by the SR 81 system, this is not reflected in a cursory review of the total metals and lab alkalinity measurements. Continued monitoring may reflect improvement specifically associated to the installation of the SR 81 system as the wetland vegetation becomes more established. Note that the BMI monitoring indicates that in 2003/2004, the average water quality for Slippery Rock Creek downstream of the Ferris, SR 81, and other systems meets the in-stream criteria of $\geq$ 6 pH with total iron and manganese of 1.5 mg/L and 1.0 mg/L, respectively. Continued monitoring will be necessary to determine long-term improvement in Slippery Rock Creek.

Table VII. DEP Stream Monitoring Before and After Passive System Construction

Sample Point	Construction Status	pH (lab)	Alk (lab)	Fe	Mn
DEP 63 (above SR81/Ferris)	pre- & post-Ferris & SR 81	5.69	12	1.9	0.9
DEP 64 (below SR81/Ferris)	pre-Ferris & SR 81	5.49	10	1.0	0.7
	post-Ferris; pre-SR 81	5.58	12	1.4	1.0
	post-Ferris & SR 81	5.93	12	2.2	0.9

Average values; alkalinity, acidity, and total metals concentrations in mg/L; average pH not calculated from H-ion concentrations; (See attached analyses.)

Table VIII. BMI Stream Monitoring Before and After Passive System Construction

Sample Point	Construction Status	pH (field)	Alk (lab)	Fe	Mn
SR81 UP (above SR81/below Ferris)	post-Ferris; pre- & post-SR 81	6.03	8	2.0	1.0
SR81 DN (below Ferris & SR81)	post-Ferris; pre-SR 81	6.13	10	1.7	0.8
	post-Ferris & SR 81 (2002)	6.22	9	2.1	1.2
	post-Ferris & SR 81 (2003/2004)	6.25	9	1.1	0.9

Average values; alkalinity, acidity, and total metals concentrations in mg/L; average pH not calculated from H-ion concentrations; (See attached analyses.)

Comparison of pH, Alkalinity, and Acidity at Sampling Point 63 Upstream of the Ferris and SR81 Passive Treatment Systems

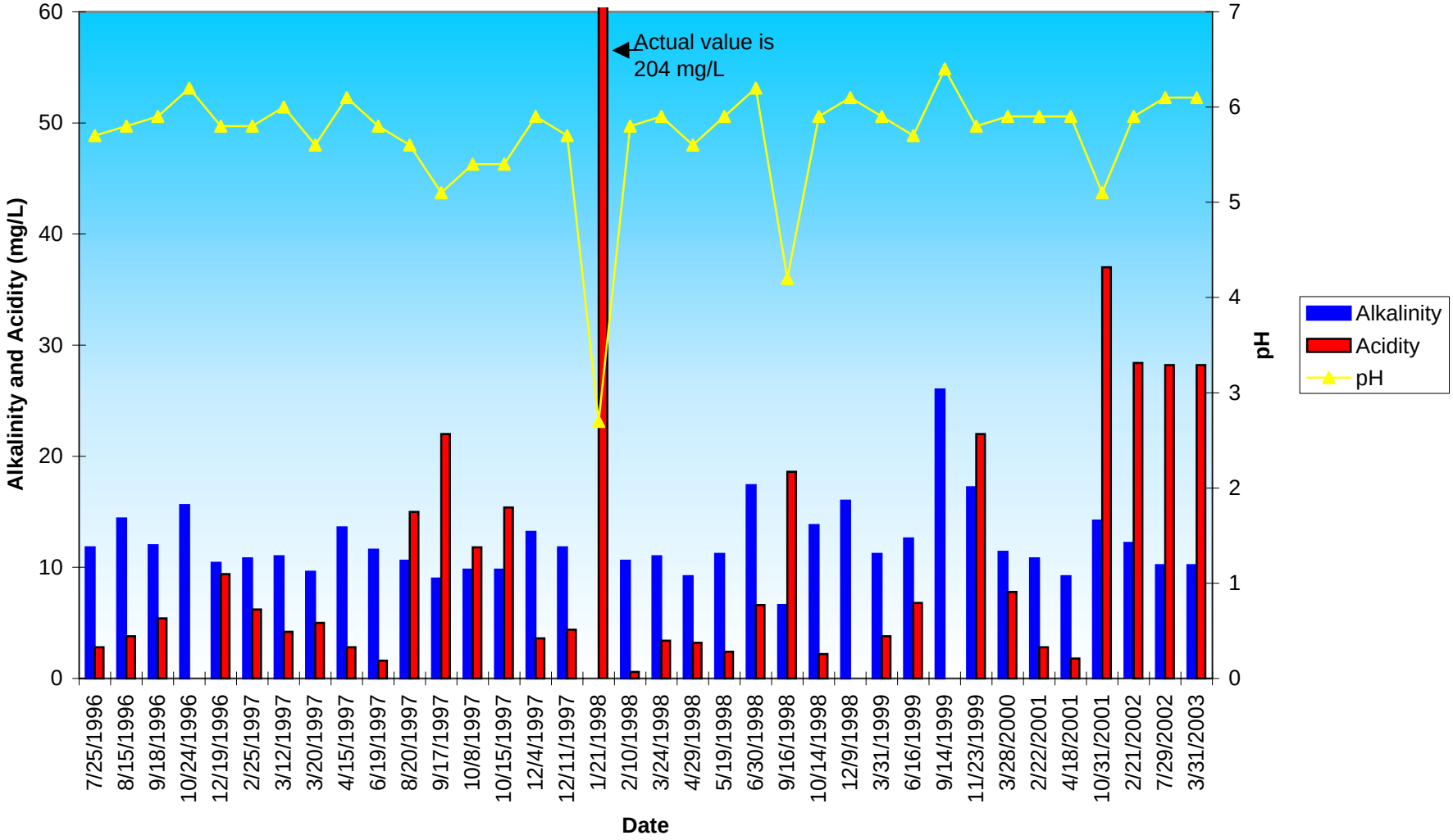


Figure 5.

Comparison of pH, Alkalinity, and Acidity at DEP Sampling Point 64
Downstream of Ferris and SR81 Passive Treatment Systems

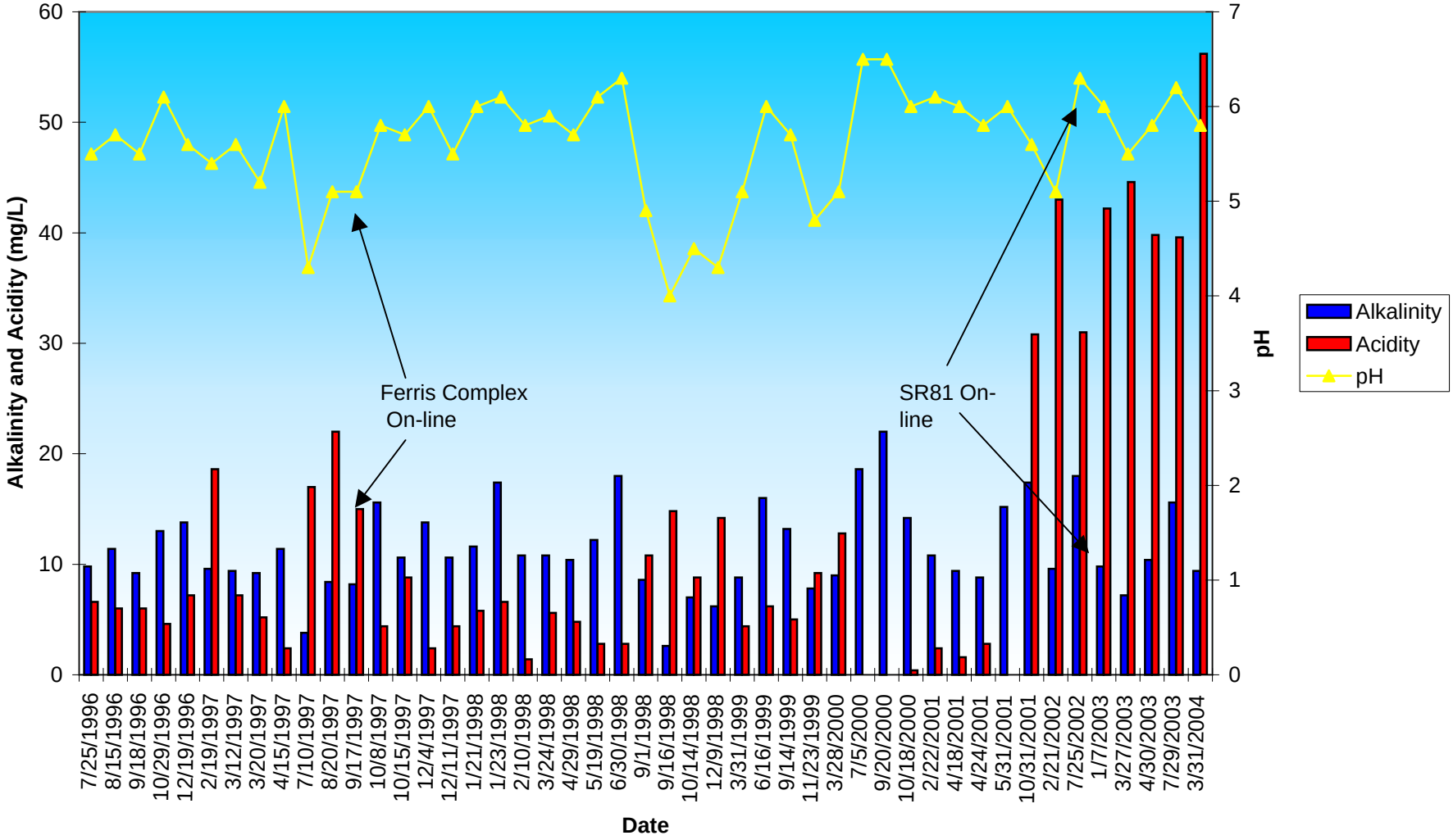


Figure 6.

Comparison of Iron and Manganese Concentration of DEP Sampling Point 63
Upstream of the Ferris and SR81 Passive Treatment Systems

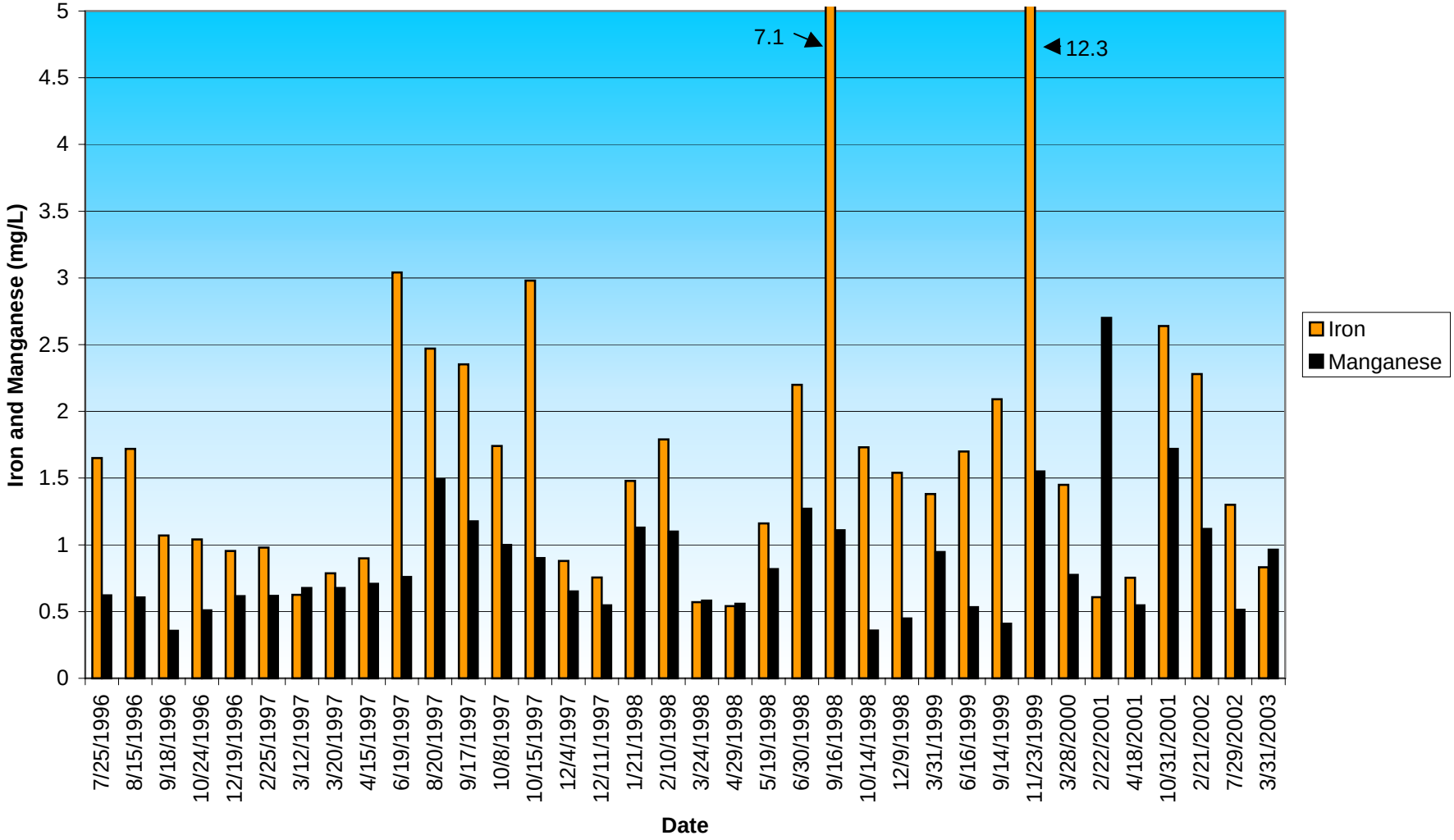


Figure 7.

Comparison of Iron and Manganese Concentrations at DEP Sampling Point 64 Downstream of Ferris and SR81 Passive Treatment Systems

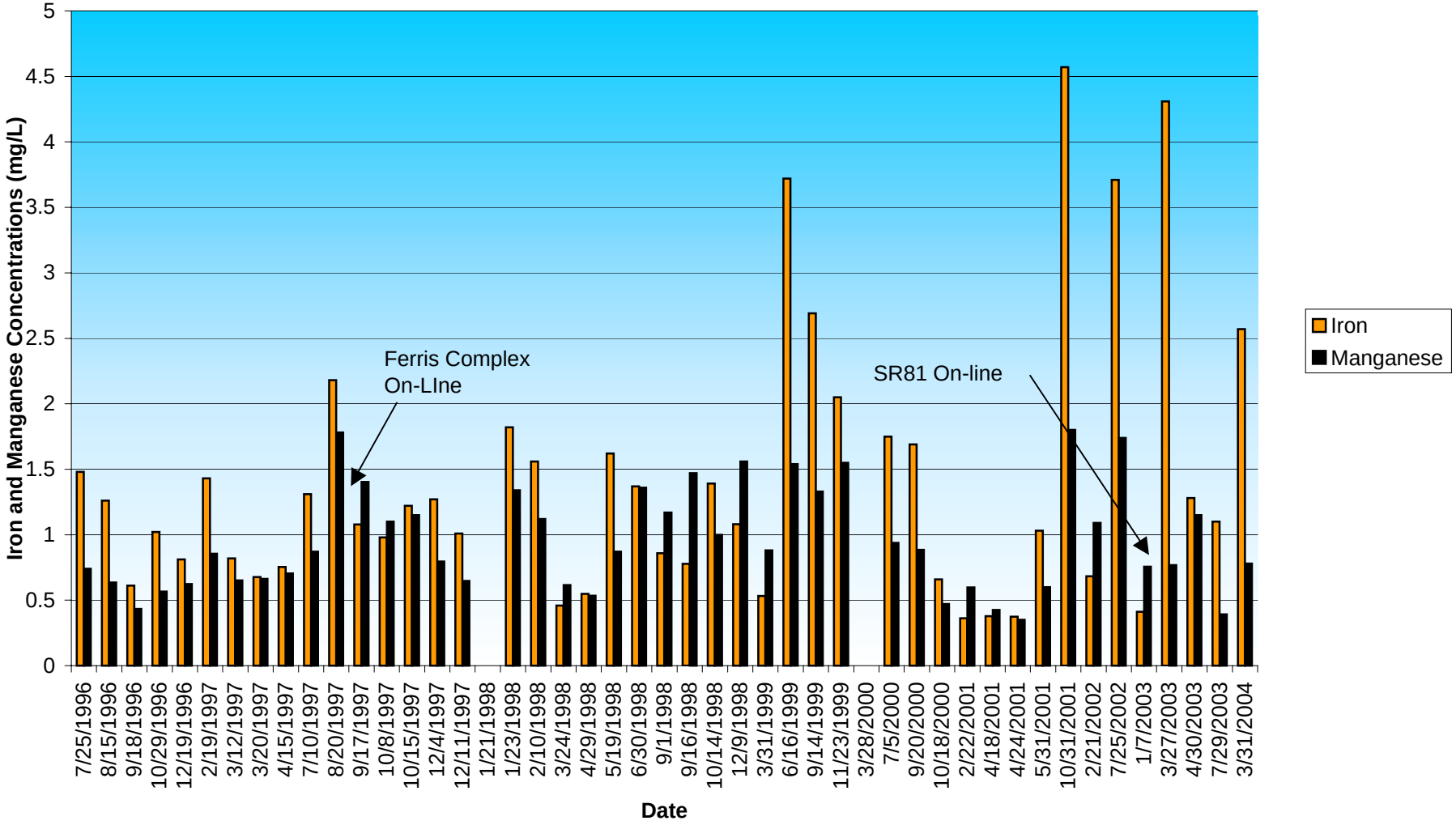


Figure 8.

The SR81 **(Above)** and SR81A **(Below)** discharges emanated from a deep mine on the Brookville coalbed (Clarion Formation, Allegheny Group).

View of a portion of the “kill zone” of the SR81 and SR81A discharges.

Views of the 4,400 cubic yard gob pile that was located at the site.

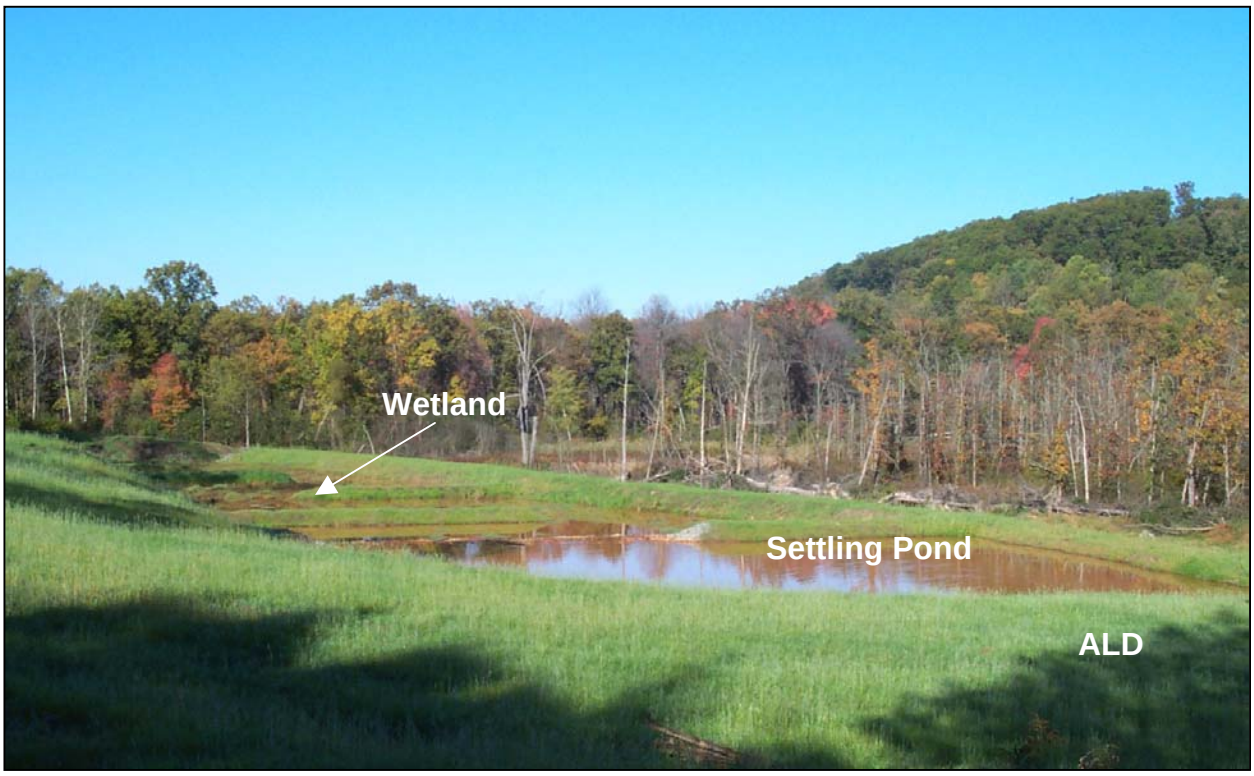
A barren spoil area associated with an abandoned surface mine **(above)** with erosion gullies **(right)** was located near the site. As part of the project, approximately 3,600 cubic yards of gob was mixed with alkaline limestone quarry pond fines. This material was then hauled about 1/2 mile, spread on the barren area, and then seeded and mulched.

Construction of the SR81 passive treatment system was completed by Amerikohl Mining, Inc. **(Above)** Geotextile and bedding stone are being placed in the Anoxic Limestone Drain (ALD). **(Below)** Construction of the Settling Pond/Wetland Basin is underway.

Once the limestone had been placed geotextile was placed on top of the stone and then backfilled with dirt.

View of the soil profile during excavation of the passive treatment system. The top 1-2 feet was a thick “bed” of iron precipitates that had accumulated over the years from the abandoned mine discharge.

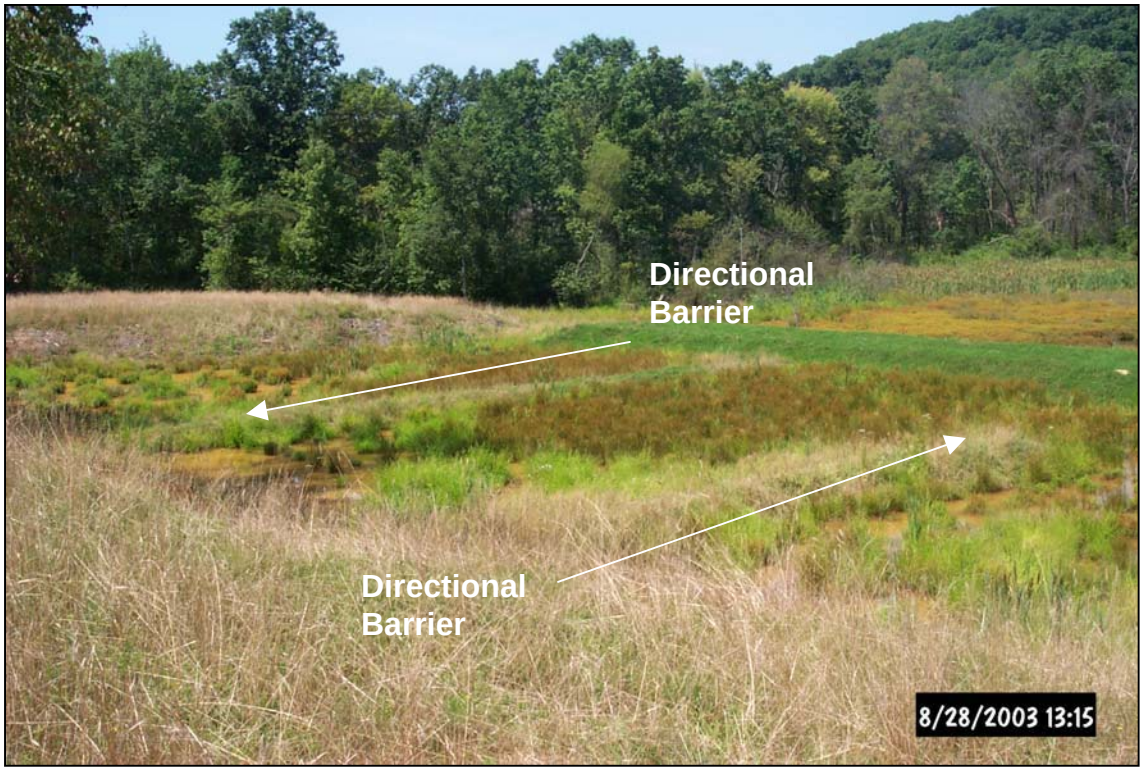
The coal refuse and limestone quarry pond fines were mixed together, placed in the barren area, covered with native soil material **(Above)** and then graded **(Below)**.



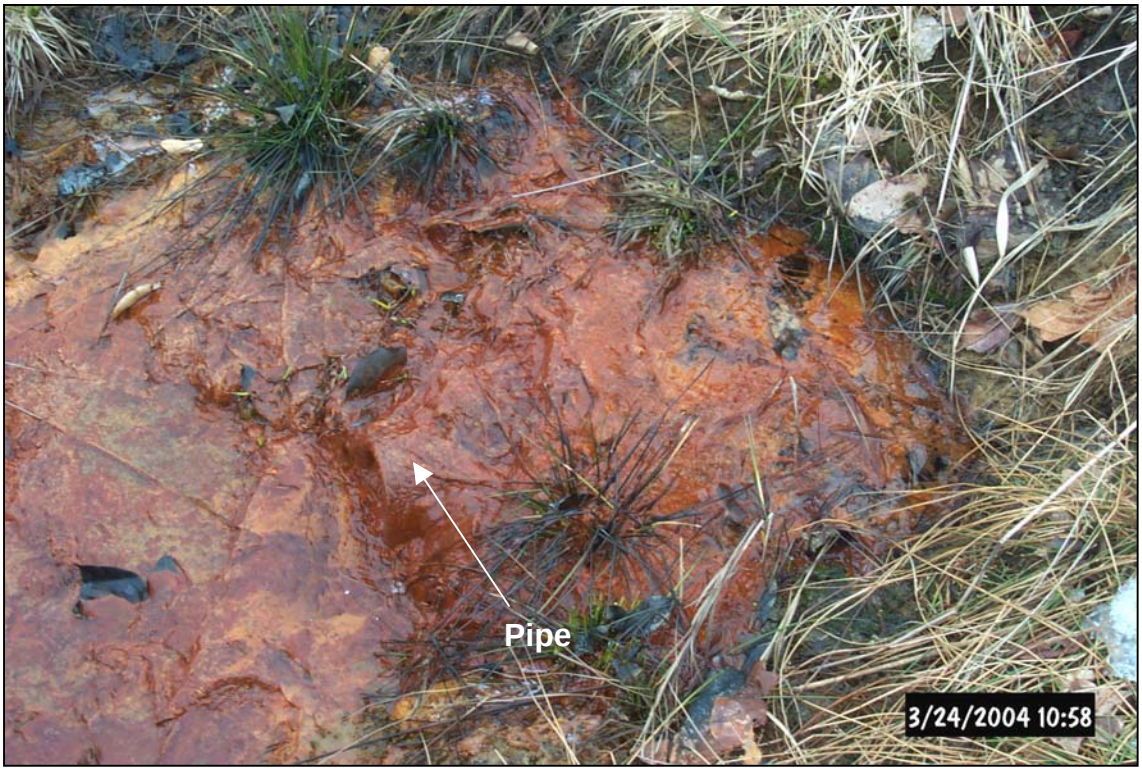
(Above) View of the SR81 passive treatment system, which consists of an Anoxic Limestone Drain (ALD), Settling Pond (SP), and Wetland (WL). **(Below)** View of the location of the Anoxic Limestone Drain, which is buried.

The ALD discharges on average about 200 gallons per minute (gpm) through a 6” pipe **(Above)** into the Settling Pond **(Below)** for oxidation, precipitation, and accumulation of metals.

From the Settling Pond the water discharges to the first “cell” of the constructed Wetland **(Below)** over a rock-lined spillway **(Above)** to aerate the water for additional oxidation, precipitation and accumulation of metals.



The constructed Wetland **(Above)** is essentially split into "cells" that are divided by earthen flow directional barriers to discourage preferential flow through the wetland. A small seep **(Below)** developed post-construction along the southern bank of the "final cell" of the Wetland averaging about 4 gpm. A small pipe was installed to measure flow that periodically needs to be cleaned out.



The final effluent from the passive system discharges into a previously existing wetland that provides additional treatment before flowing directly into Slippery Rock Creek.

SR81 was included as part of the 2002 SRWC Symposium field tour **(Above)**. The site was also included as part of a tour given to students of Dr. Bob Nairn formerly with the US Bureau of Mines and currently a professor at the University of Oklahoma.

On April 29, 2003, second graders from Washington Elementary School assisted Dale Hockenberry from the PA Game Commission and Aquascape Wetland and Environmental Services in planting over 1000 seedlings of 13 different species at the site. Students were given a brief ecological lesson and basic planting instructions.

Datashed

Datashed, www.datashed.org, is a fully-featured, GIS enabled, internet database designed to assist watershed groups, academic institutions, private industry, and government agencies. Powered by open source software, this database provides a cost-effective and reliable solution to the management of data associated with environmental efforts. GIS capabilities allow users to easily view geographic data and directs users to additional content. Anyone with internet access can view the site and download information. This allows the website to function not only as a data management tool, but also as part of the education/outreach effort associated with the project. Datashed was developed by Stream Restoration Incorporated and 241 Computers using the PHP programming language and open source software such as APACHE HTTP Server, MySQL database, and Map Server.

As part of the SR 81 project a site-specific operation and monitoring plan was developed. This plan is available online at Datashed for viewing and printing. The plan will be used to perform routine inspections and site evaluations of the passive treatment system. Monitoring events will include inspecting the system, taking photographs, and completing inspection forms. Water quality monitoring may also be conducted including measuring flows, conducting field tests for iron, manganese, alkalinity, and pH. Water samples may also be collected for lab analysis.

In addition to the monitoring plan, an aerial photo, location map, directions to the site, passive system schematic, site photos, water quality data, and dynamically-generated statistics and graphs are available for download. In the future, the site will be updated to allow approved users with a password to directly upload data online.

The following pages represent a portion of the highlights of the SR 81 section of Datashed:

- SR 81 Project Page
- SR 81 Downloads Page
- SR 81 Project Aerial Location Map
- SR 81 Passive Treatment System O&M Inspection Form
- SR 81 Site Schematic
- Example Report for SR 81 ALD
- Example Graph for SR 81 Sampling Point ALD

Powered by APACHE

MySQL

Powered by Map Server

php

SR 81 - Abandoned Mine Restoration Area

Site Type: Passive Treatment System
Latitude: 41 05 24
Longitude: -79 51 34
Determined by GPS: No
Elevation: 1300
Quad: Hilliards, PA (PR 1977)
Stream: Slippery Rock Creek
Watershed: Slippery Rock Watershed
Municipality: Washington
County: Butler
Year Constructed: 2002
Primary Funding Partners: DEP Growing Greener
Other
Treatment Technologies: ALD
Aerobic Wetland
Settling Ponds
Contact: Stream Restoration, Inc.
Responsible Organization: Stream Restoration, Inc.
Source of AMD:
Links: **http://www.srwc.org**
http://www.streamrestorationinc.org

	Flow (GPM)	Field pH	Lab pH	Spec. Cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)	DO (mg/L)	Calc Acid (mg/L)	TDS (mg/L)
ALD	194.9	6.81	6.36	746.33	8.88	112.38	65.9	10.12	44.23	40.16	7.49	7.2	0.1	0.08	404.39	10.4	--	86.5	--
SR81 SEEP	3.89	5.37	5.02	699.33	9.5	16.5	7.6	94.46	48.63	46.77	7.56	7.47	0.21	0.17	434.96	6.33	--	99.9	--
WL	196.4	6.73	6.3	716	10.88	38.43	28.97	0.89	17.68	11.96	7.44	7.19	0.06	0.06	410.21	15.3	8.2	33.76	--
Natural WL	--	6.75	6.52	619	11.8	33.5	24.55	-8.58	7.73	5.5	4.54	4.17	0.2	0.08	351.12	8.67	--	17.66	--

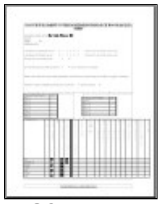
* Records with no value are not included in statistical calculations.
** Dissolved metals used for calculated acidity values when available. Acidities calculated from total metals may be exaggerated.

Datashed

Home | Database | i-Map | Login | Projects | About | Help

Home > **Projects** > **Slippery Rock Watershed** > SR 81 - Abandoned Mine Restoration Area

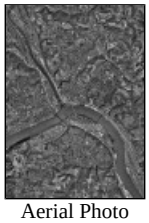
SR 81 - Abandoned Mine Restoration Area


O&M Form


Schematic


Map


Directions


Aerial Photo


Database

Back to Watershed
Project Details
Downloads
View Data
View i-Map
View Pictures
Partners

* To view certain files you will need **Adobe Reader**.

PROJECT LOCATION - USGS DIGITAL ORTHOPHOTO (HILLIARDS, PA)

SR81 ABANDONED MINE RESTORATION AREA

State Game Lands No. 95

Washington Township, Butler County, PA

Stream Restoration Incorporated

June 2004, Scale 1" = 2000'

Approximate Center of Project (deg-min-sec)
41-05-24 latitude 79-51-34 longitude

1000 0 1000 2000

540102AB/Aerial Photo

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

Rev 06/2004

Inspection Date:		Project Name:	SR 81 – Abandoned Mine Restoration Area
Inspected by:		Municipality:	Washington Township
Organization:		County:	Butler State: PA
Time Start:	End:	Project Coordinates:	41°05'24" Lat 79°51'34" Long
Receiving Stream:	Slippery Rock Creek	Sub-watershed:	Slippery Rock Watershed: Slippery Rock

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny Temp (°F): ≤32 33-40 41-50 51-60 60+

Is maintenance required? Yes/No If yes, provide explanation:

_____
_____
_____
_____

INSPECTION SUMMARY

A. Re-vegetated Areas

Overall condition of vegetation on site: 0 1 2 3 4 5 (0=poor, 5=excellent, circle one) (See instructions.)

Is any reseeding required? Yes/No If yes, describe area size and identify location on Site Schematic:

_____
_____
_____
_____

B. Ditches, Channels, Spillways

Channel Identification	Erosion Rills (Y/N)	Debris Present (Y/N)	Maintenance Performed (Y/N)	Maintenance Performed and Remaining (Indicate spillway by number i.e. 1c = Wetland)
1. Rock-Lined Spillways				
a. ALD				
b. Settling Pond				
c. Wetland				

C. Passive Treatment System Components

Component	Erosion Rills (Y/N)	Berms Stable (Y/N)	Vegetation Successful (Y/N)	Maintenance Performed and Remaining (Indicate which component i.e. ALD)
ALD				
SP				
Wetland				

D. Access Roads

Are the access roads passable for operation and monitoring? Yes/No?

Do the access roads need maintenance? Yes/No?

Describe maintenance performed and remaining (Identify location on Site Schematic.):

_____
_____
_____
_____

E. Wildlife Utilization

Animal sighted or tracks observed _____

Invasive plants observed _____

Describe any damage caused to treatment system by wildlife (especially muskrats) and required maintenance:

_____
_____
_____
_____

F. **Field Water Monitoring and Sample Collection -** Raw water sample locations as marked on plan. For passive components sample effluent.
☐ - Not monitored

Sampling Point	Flow		pH	Temp (°C)	Alkalinity (mg/L)	DO (mg/L)	Iron (mg/L)	Comments	Bottle #	Bottle # (total metals)	Bottle # (diss. metals)
	gals	sec.									
ALD											
Settling Pond											
SR 81 - Seep											
Wetland											
Natural Wetland											
SR 81 - Upstream											
SR 81 - Downstream											

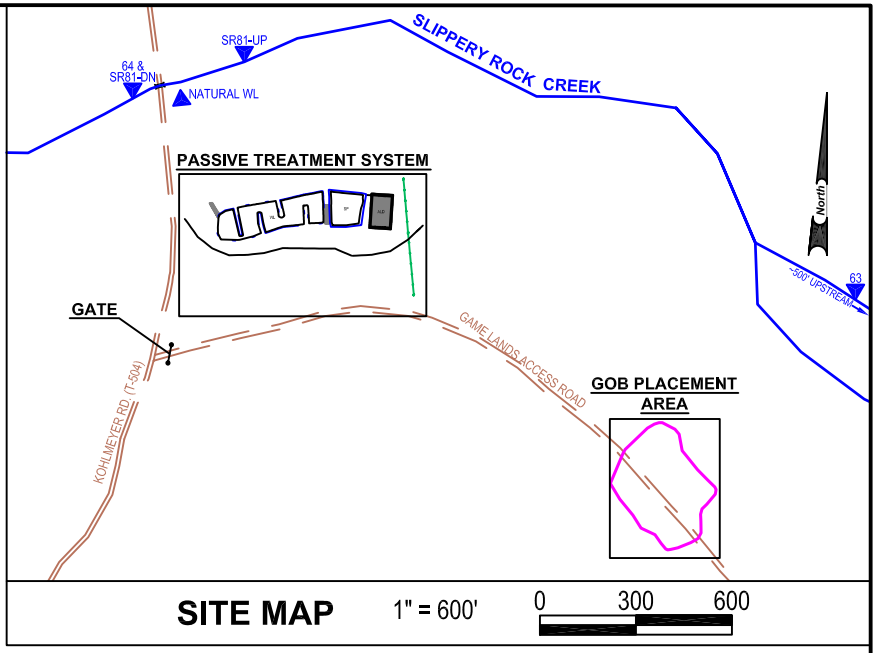
SR81 ABANDONED MINE RESTORATION AREA
SITE SCHEMATIC

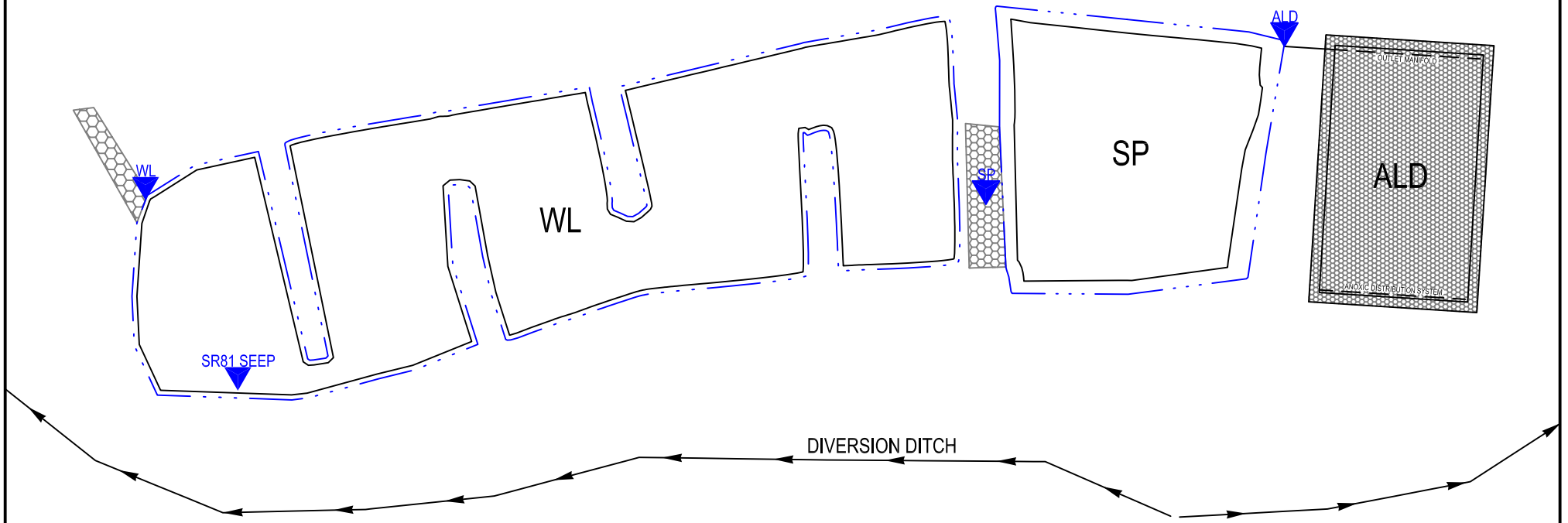
Slippery Rock Watershed Coalition

in cooperation with

Stream Restoration Incorporated
State Game Lands No. 95
Washington Township, Butler County, PA
June 2004, Scale 1" = 60'

0 30 60



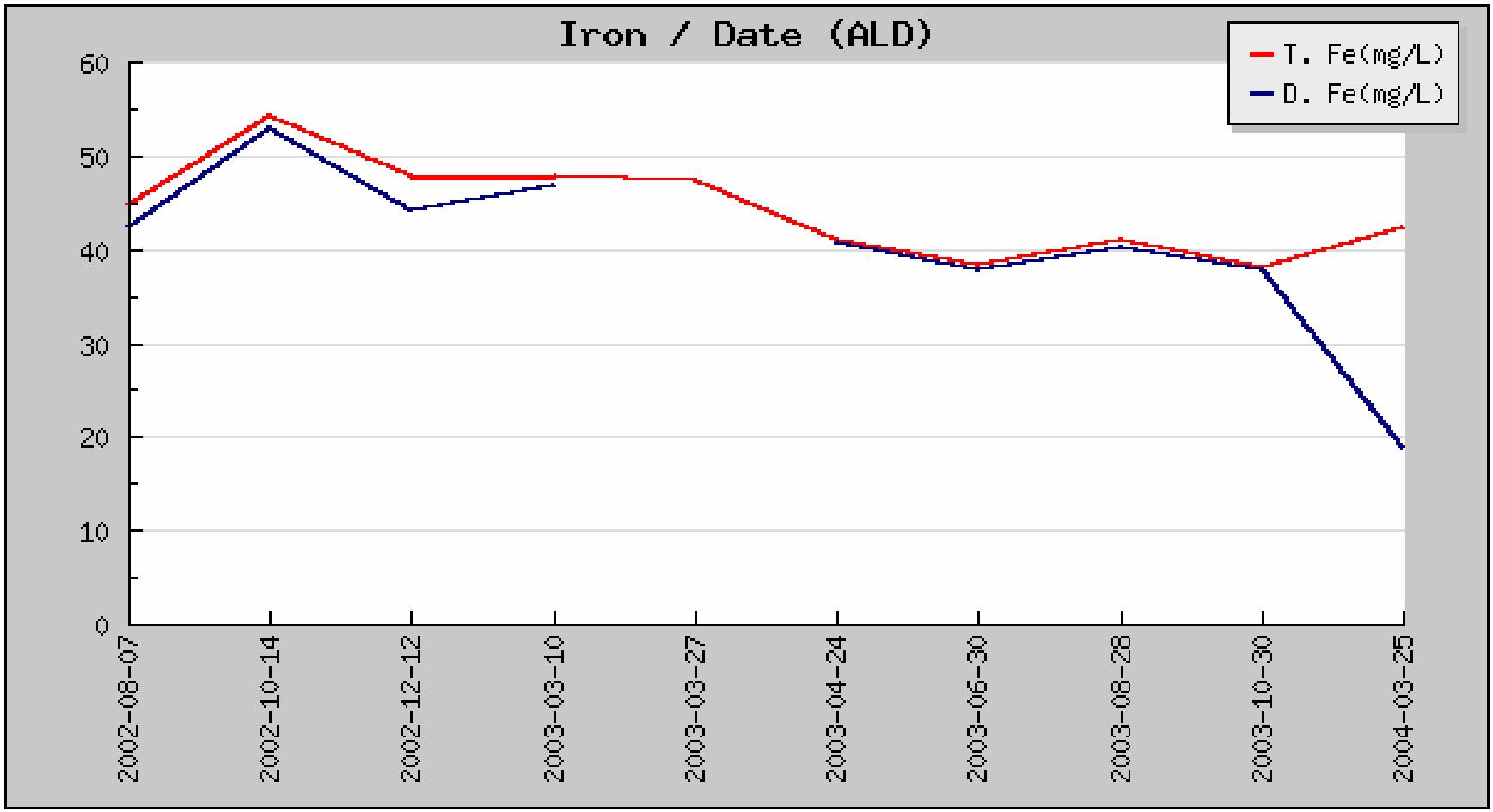


540102AB/Schematic

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
WL	8/7/02	Assumed	280	6.5	6.2	707	15		30	0	14.9	12.8	7.8	7.4	0.1	0.0	331	8
WL	10/14/02	Assumed	275	6.8	5.9	782	8	30	9	4	20.1	14.6	9.1	8.7	0.1	0.1	479	25
WL	12/12/02	Assumed	129	6.9	6.3	836	3	55	32	33	26.2	24.1	8.5	8.3	0.1	0.1	465	7
WL	3/10/03	Assumed	155	7.0	6.5	896	1		44	7	26.8	22.2	8.4	8.3	0.1	0.0	551	37
WL	3/27/03	Estimated	135		6.2				36	51	26.4		7.1		0.0		360	34
WL	4/24/03	Assumed	150	6.8	6.5	664	19	28	23	-15	20.0	8.1	6.8	6.3	0.0	0.0	551	15
WL	6/30/03	Assumed	180	6.5	6.4	618	15	39	29	-19	8.2	4.6	6.0	5.9	0.0	0.0	355	4
WL	8/28/03	Assumed	170	6.5	6.5	677	18	30	25	-18	5.2	1.4	6.7	6.2	0.1	0.1	371	4
WL	10/30/03	Assumed	220	6.7	6.2	650	8	35	30	-18	11.4	7.9	6.6	6.5	0.1	0.1	387	9
WL	3/25/04	Assumed	270	6.8	6.3	614		52	33	-18							253	10
Min			129	6.5	5.9	614	1	28	9	-19	5.2	1.4	6.0	5.9	0.0	0.0	253	4
Max			280	7.0	6.5	896	19	55	44	51	26.8	24.1	9.1	8.7	0.1	0.1	551	37
Avg			196	6.7	6.3	716	11	38	29	1	17.7	12.0	7.4	7.2	0.0	0.0	410	15
Range			151	0.5	0.6	282	18	27	35	70	21.7	22.7	3.0	2.8	0.1	0.1	299	33

Description: Wetland sampled at effluent of constructed wetland



A graph from Datashed showing total and dissolved iron concentrations over time for sample point ALD.

EVALUATION OF THE EFFICIENCY OF PASSIVE TREATMENT SYSTEMS ON WATER QUALITY IN THE HEADWATERS OF SLIPPERY ROCK CREEK[1]

James Dunne, Emily Coughlin, Candace McClure, Shawn Rummel,
Fred J. Brenner and Shaun Busler[2]

Abstract: To treat acid mine drainage, both active and passive methods are utilized for the removal of acid and metals. Individual passive technologies target specific aspects of acid mine drainage, and consequently overall efficiency of passive systems can be significantly enhanced with the linking of multiple components. Within the Slippery Rock Creek Watershed, a wide variety of passive systems are being employed to treat acidic mine discharges. Two anoxic limestone drains (ALDs) used in conjunction with aerobic wetlands consistently maintain pHs between 6.4 and 7.2 pH units. Iron concentrations are reduced significantly within these ALD/wetland systems, with an average removal of 32 mg/L at an average flow of 89 gpm, but these systems are generally not effective in removing manganese from acid mine discharges. But, when Vertical flow ponds (VFPs) are used in combination with aerobic wetlands and horizontal flow limestone beds (HFLBs), the discharges to receiving streams are have alkalinity in excess of acidity, alone with a reduction in metal concentrations. For the two VFP/aerobic wetland and HFLB systems, 27 mg/L of alkalinity (as $CaCO_3$) was added to the average flow of 61 gpm to receiving streams and iron, manganese, and aluminum concentrations were reduced by 40 mg/L, 16 mg/L and 27 mg/L, respectively. In addition, pH units were increased from between 2.87 and 3.80 in the inflows to an average of between 6.8 and 7.2. These studies are continuing to analyze the efficiencies of the individual system components.

Additional Key Words: Passive Treatment, Water Quality, Watershed

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[1]Paper was presented at the 2004 National Meeting of the American Society of Mining and Reclamation and the 25th West Virginia Mine Drainage Task Force, April 18-24, 2004. Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

[2] James Dunne and Emily Coughlin are Chemistry and Biology Majors at Grove City College, Grove City, PA 16127. Candace McClure and Shawn Rummel are 2003 Grove City College Biology Graduates. Fred J. Brenner is Professor of Biology, Grove City College, Grove City, PA 16127, Shaun Rummel, Biologist, Stream Restoration, Inc. Cranberry Township, PA 16066

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Growing Greener may lose funding, impact

By Lawrence Sanata
TRIBUNE-REVIEW
Sunday, June 30, 2002

Environmentalist Tim Danehy is trying to remain optimistic, but he can't help being a little concerned about threatened cuts to the state's Growing Greener program.

Backed by hundreds of thousands of dollars in Growing Greener funding, groups such as the Slippery Rock Watershed Coalition and Stream Restoration Inc. have helped restore several miles of waterways and land poisoned by abandoned coal mines in Butler County, Danehy said.

Growing Greener funding cuts could force both nonprofit environmental groups to scale back new cleanup efforts, he said.

Projects currently under way would not be affected, added Danehy, who is involved with both groups.

"When the state doesn't have the money," he said, "you can't do everything you want to do, but you can still get things done and make improvements."

There also could be more far reaching consequences, he and others said.

Passive treatment techniques to filter contaminants from waterways developed by environmental groups in the county are used in other parts of the world, according to local environmentalists. If funding is cut, research into those techniques could be curtailed with no one in line to continue the work, said Cliff Denholm an environmental scientist with the Slippery Rock Watershed Coalition.

A Peru-based mine conglomeration, Compania Minera Antamina, is preparing to use a passive water treatment technique developed by the coalition. The technique involves the use of limestone aggregate, mushroom compost or organic compounds to filter toxic material from water, Denholm said.

"It seems like a lot of the innovations in passive treatment are coming from Pennsylvania, which has been somewhat spurred by Growing Greener," he said.

Gov. Tom Ridge signed Growing Greener into law in 1999 to provide nearly $650 million over a five-year period for state environmental improvements.

The project was aimed at abandoned mine cleanup and improvements to watersheds.

Because of an anticipated state budget shortfall of $1.2 billion, Gov. Mark Schweiker has recommended cutting $100 million from Growing Greener over two years.

Photo Gallery

click to enlarge

Tim Danehy
Keith Hodan/Tribune-Review

Tools

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Some Pennsylvania legislators are hoping to increase tipping fees paid by trash haulers at landfills to help restore the money.

Kristen Wolf, a state Department of Environmental Protection spokeswoman in Harrisburg, said that while Schweiker has talked about extending Growing Greener to a sixth year and providing additional money, there also is a possibility of further cuts.

Glenn Hurowitz, director of PennEnvironment in Pittsburgh, said he is worried about the proposed cut and the governor's promise to extend the program another year.

"He's not even running for re-election, and he's telling us what's going to be in the budget in (coming years)," Hurowitz said.

PennEnvironment is a branch of the Pennsylvania Public Interest Research Group.

Even more troubling, Hurowitz said, is the possibility of delays in future environmental projects.

"A lot of this money really needs to be spent now," he said.

Waiting a year or two for funding could mean the loss of more land and waterways to pollution, he said.

Danehy said he hopes the DEP will target a steady stream of Growing Greener funding for watershed groups in the state, including the Slippery Rock Watershed Coalition.

Growing Greener has been especially important in Butler County, according to Dave Johnston, director of the county planning department.

He commended the Slippery Rock Watershed Coalition, Stream Restoration Inc. and similar groups for helping reclaim land seriously damaged by old coal mines in the county.

Johnston said he also worries about the impact of Growing Greener cuts on environmental work in the county.

"We've done a lot of work to kind of foster that program … by using some of our local funds as a match for Growing Greener funds. So we think it's a very good program," he said. "The proof is in the pudding whenever you see streams where there were no fish before, and all of a sudden there are fish coming back."

In April, the Slippery Rock Watershed Coalition made headlines when Schweiker recognized it for cleaning abandoned mines in Butler County.

With the help of more than $800,000 in Growing Greener funds, Stream Restoration is working with modern-day mining companies to reclaim a portion of Seaton Creek in Venango Township, near the Erico Bridge. Until recently, Seaton Creek was known for its dark and murky water and floating red and yellow scum — the result of acid run-off from nearby abandoned mines.

The Cranberry Township group was awarded $100,000 to remove gob piles — leftover material from mining, including shale, low-grade coal, iron and manganese — and build wetlands where Seaton Creek meets the bridge.

The group was awarded another $716,000 to restore the area so it can be environmentally productive again.

"Growing Greener has done some amazing things up to this point," Danehy said.

Lawrence Sanata can be reached at lsanata@tribweb.com or (724) 779-7109.

The Watershed Academy Visits Our Watershed

On Thursday June 13th, the Watershed Academy visited our treatment systems at Goff Station and Erico Bridge. What is the Watershed Academy? Well, it is a program organized by the PA DEP and offers information about what watersheds are and some of the problems and issues impacting them. This year the program was held at **Jennings Environmental Education Center** in Slippery Rock. While at the sites, participants were given a tour and the different elements of the system were explained.

We have been asked to participate in the past and are pleased to once more be a part of such an informative day. Some of those providing the tour were: **Margaret Dunn** from **Stream Restoration Incorporated** as well as **Bob Beran** and **Maggie Allio** from **Aquascape.** In the picture to the left, Bob Beran is explaining restoration techniques to the group at Goff Station. Thanks to all those who attended! And a special thanks to those who helped make this such an informative trip!!!

Thank You Waste Management!

If you have ever witnessed or participated in a wetland planting, you may have noticed the way the plants are transported. Wetland plants are harvested and transported in recycling buckets donated by **Waste Management**. The buckets are sturdy enough to handle the rigors of containing heavy plant material while people carry them to and from the wetland. They provide convenience for wetland plantings as the plants can be grouped according to species and subsequently placed at appropriate water levels for the volunteers to plant. Without these buckets, harvesting and planting would be more difficult and definitely more costly (and probably less fun!!). We would like to give a very special thanks to **Jim David** and **Keith Bowser** of **Waste Management- Northwest Sanitary Landfill** for their very generous donation of buckets!

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. July Distribution: 906 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday July 11th at 7pm Jennings Environmental Education Center, pizza and pop will be provided.

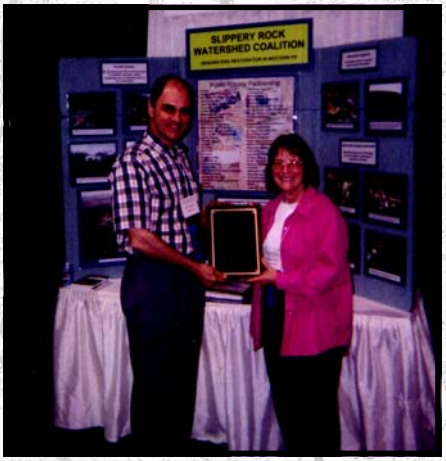
Dr. Robert Nairn Visits from Oklahoma with Some of His Students!!!

On Friday June 14, **Dr. Robert Nairn** and students from the University of Oklahoma toured the Slippery Rock Creek headwaters specifically to see the passive treatment systems. The graduate students included: **Denae Athay**, **Jennifer Coffey**, **Russell Garrett**, **Jessica Brumley,** and **Aisling O'Sullivan**. They were escorted on their tour by **Tim Danehy**, **Margaret Dunn**, **Cliff Denholm,** and **Shaun Busler** from Stream Restoration Inc., **Bob Beran** from Aquascape, **Dr. Fred Brenner** from Grove City College, and **Jeff Ankrom** from Quality Aggregates later joined the group and provided a wonderful outdoor picnic.

They toured the Sunbeam Tipple Site, SR 96 (where construction activities were described by **Jerry Jesteadt** of Jesteadt Excavating), SR 81, Erico Bridge, and Goff Station. The different components at each site were explained as well as the water quality data and construction issues. Thank you for making the long trip out here and taking an interest in our watershed reclamation efforts, your enthusiasm and interest were inspiring!!! Bob Nairn is an extra-special visitor, as he provided guidance on passive systems installed at Jennings.

SRWC Participant Receives Reclamationist of the Year Award

During the national meeting of **The American Society of Mining and Reclamation**, **Margaret Dunn** was presented with the 2002 Reclamationist of the Year Award. In the June 21st, DEP Update an article titled, "PA's Margaret Dunn Receives National Award," DEP Secretary **David Hess** is quoted as saying, "This national recognition for Margaret's work to build partnerships to clean up her watershed is well deserved." The article highlights both Margaret and the SRWC. Margaret feels this award further recognizes Pennsylvania's leadership nationally in abandoned mine restoration. **Joe Galetovic** from the Office of Surface Mining (OSM), was on the selection committee for the award. Pictured to the right are **Joe Galetovic** and **Margaret Dunn** with the award in front of the SRWC display at the conference. The conference was held in Lexington, KY from June 9th through the 12th. Good Job Margaret, We Are All Proud of You!!!!



Construction Begins at SR96

Construction of the 700 ton limestone drain recently began at the SR 96 site. On May 30th and 31st, OSM intern **Steve Short** (a biology student at Grove City College) staked 100 hay bales at the site for E&S Control. June 10th brought the actual construction of the drain. **Jerry and Jason Jesteadt** of **Jesteadt Excavating**, **Steve Short**, and SRI intern **Chris Treter** placed liners, spread limestone, and assembled the piping system. Thanks to Jerry and Jason Jesteadt for helping to build this system!!!!

On Friday June 21st, Steve and Chris placed 300 more hay bales as part of the wetland reconfiguration and during the week of June 24th they will be seeding, mulching, fertilizing, and more. Thank you Steve and Chris for all the back breaking work you both are doing!!!

PHOTO OF THE MONTH

The Butler County Juvenile Court System helps out with a wetland planting! Thanks!!!

PHOTO OF THE MONTH

The Butler County Juvenile Court System Plans to Help All Summer

This summer, the Butler County Juvenile Court System, will continue to provide extra help for wetland planting. Each Tuesday, from June 11 to August 27 they will work with Stream Restoration Inc., AquaScape, and Quality Aggregates, planting wetlands and helping with local Growing Greener projects. The Keystone Interventional Program (KIP), Community Intensive Supervised Probation (CISP) Program, and two local judges also plan to help with the planting activities. This is a unique opportunity for the participants to learn and enhance their own lives while assisting with environmental restoration.

Karns City Earth Day

On April 29th, **Bob Beran** and **Laura Spencer** of **Aquascape** participated in the **Karns City Elementary School Earth Day Activities**. Bob and Laura spent the day speaking to Kindergarten through 6th graders on insect biodiversity. The program, put together by staff at Jennings Environmental Education Center, provided the students with many laughs, interesting facts and information to fulfill educational curriculum needs. **Many thanks to: Jennings Environmental Education Center** for providing the power point program, as well as other learning tools, **PA DEP**, especially **Ms. Sherry Carlin**, for providing posters, bookmarks, and magnets for the students, and to **Mrs. Marion Hall** of **Karns City Elementary School** for inviting us to participate in their earth day activities!!

4th Annual AMD/AMR Conference

On June 14th and 15th, the 4th Annual AMD/ AMR Statewide Conference took place at the Penn-Stater Convention Center in State College, PA. **Deanna Treter**, **Steve Short**, and **Chris Treter** represented the SRWC, introducing conference attendees to the reclamation work in our watershed and our recent publication, “Accepting the Challenge.” Seminars introduced conference goers to a variety of new treatment technologies and different forms of Operation and Maintenance for existing treatment systems. The highlight of the conference was a speech by PA DEP Secretary David Hess on Growing Greener and AMR Partnerships. Thanks to all those who attended and came over to learn more about the SRWC!!!!

Pennsylvania River Sweep

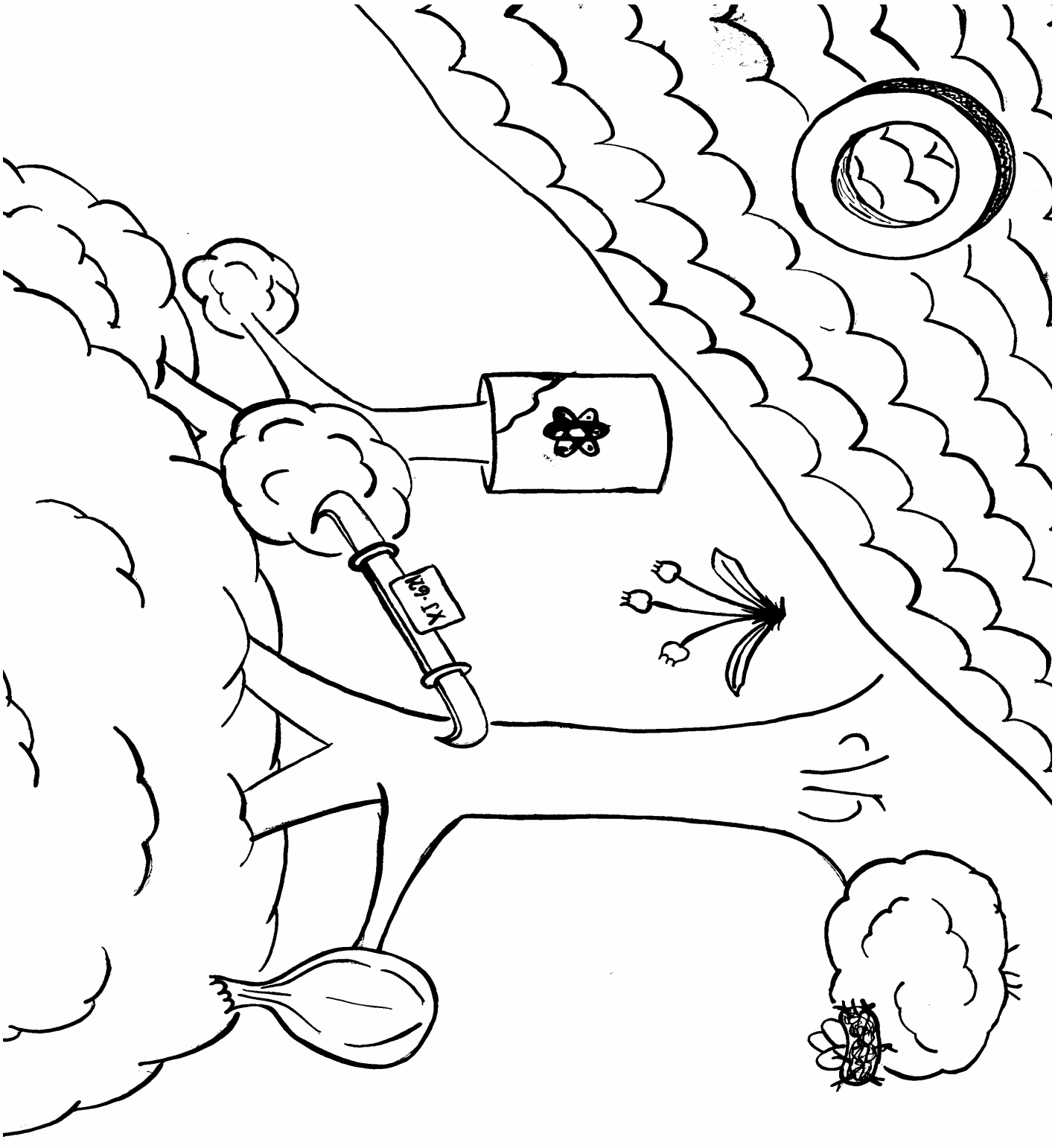
On Saturday June 15th, about 30 participants joined the statewide effort to clean our rivers. The participants, including **Shaun Busler, Melissa Busler,** and **Tim Danehy** of the SRWC, removed trash from the Blacks Creek Restoration Area located along Porters Rd., in Marion Twp. Those who were involved in this project include: **Marion Twp. Environmental Advisory Council, SRWC, PA Cleanways of Butler County, and Americorps.** A great time was had by all even though they got a little wet. Thanks to **Sheryl Kelly** and **Deb Bailey** for planning this extremely worthwhile project!!!

The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

River Seek and Find

Keeping our rivers clean is very important. When we do not properly dispose of our trash in a trash can it can harm some of the animals that call the river home. There are some things in this picture that don't belong. See if you can find them all, there are four of them. When you are done, color the picture and send it back to us for a free gift certificate. Good Luck, and remember to put your trash in the right place!



Name _____ Age _____ Address _____

SR81 Wetland Planting

On July 17th, there was a wetland planting at SR81. The SRI OSM intern **Steve Short** was there along with Laura Spencer from Aquascape and Alex Cashman an intern from Quality Aggregates. The planting went very well. Thanks to those who participated.

Remember we do numerous wetland plantings every year. Be sure to keep an eye out for opportunities to get involved. We will list sites and dates for plantings in future Catalysts. If you want to know more about how your group can get involved please call Shaun Busler at 724-776-0161. Thank you for helping us improve the animal habitat at our sites!!

Erico Bridge Drilling

On Thursday July 18th and Friday July 19th drilling and piezometer installation was conducted at the Erico Bridge site. SRWC participants in attendance included: **Margaret Dunn**, Stream Restoration Inc.(SRI); **Chris Treter**, Intern; and **Steve Short**, SRI's OSM Intern.

We would like to send out a special thank you to the drillers who worked through blazing sun and rain over the two days. Thank you Jon Ruscoe and Mike Hollabaugh of McKay & Gould. See the photo of Jon doing his thing! Thanks again!

I-79 Cleanup Scheduled for August 16th at Noon

As you all know, the SRWC has adopted a portion of I-79. On Friday August 16th we will be doing the first of four cleanups scheduled for this year. We will meet at the "park and ride" off of I-79 exit 99. When you get off go towards New Castle and it will be on your right. We will meet at noon and will carpool to the site from there. Our portion of I-79 is between mile markers 100 and 101 on both sides of the highway. We are very excited about keeping our highways beautiful and hope that many of you will volunteer to help. If you plan to attend please call Deanna Treter at 724-776-0161 by Friday August 9th. It is important to call in order for us to have the correct number of vest, gloves, etc. Last minute helpers are welcome! Remember to wear long pants and long sleeve shirts. We hope to see you there!!!!

Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., Allegheny Mineral Corporation and PA DEP for their support.
For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. August Distribution: 911 copies

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THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday August 8th at 7pm Jennings Environmental Education Center, pizza and pop will be provided. 07/11/02 Meeting Attendance: Tim Danehy, Cliff Denholm, Valentine Kefeli, Melissa Busler, Shaun Busler, Fred Brenner, Steve Short, Charles Cooper, Laura Spencer, Deanna Treter, Chris Treter, Steve Smith, Janice Belgraden, Margaret Dunn

Remember 2001!
A Year Full of Great Success!!

The year started out with some great changes in the Catalyst. In January the Catalyst went from a one page newsletter to a four page undertaking! We also began the Kids Catalyst, a section where kids could learn about issues in the watershed while getting the opportunity to win gift certificates. And now here is a list of all that the SRWC was able to accomplish and do during the past year!

Conferences

- **Growing Smarter: Land Use in PA Conference**: Hershey, PA 3/18-3/20
- **West Virginia Symposium**: Morgantown, WV 4/2-4/4
- **GIS Conference**: State College, PA 5/23-5/24
- **AMD/AML Conference**: State College, PA 6/1-6/2
- **ASSMR Conference**: Albuquerque, NM 6/3-6/7
- **Disturbed Lands Conference**: 6/12-6/13
- **Intro. to AVGWLF Conference**: State College, PA 9/13
- **PA Watershed Conference**: Poconos, PA 10/5
- **CMU Energy Conference**: 10/15

Recognition

- **2001 Governor's Award for Watershed Stewardship**
- **Watershed Weekly's Watershed Hero for the Month of November**: Margaret Dunn

Groups Who Did Projects To Help

- **Girl Scouts Bluebird Boxes**: Installed at Goff Station 3/3
- **Girl Scouts Wetland Planting**: Goff Station 5/19
- **Butler County Youth Wetland Planting**: Goff Station 6/26
- **Concordia Haven Workshop**: Built Bat Boxes for Goff Station in July
- **Butler County Youth Wetland Planting**: Goff Station 7/17

Construction

Goff Station: Second Half Completed 8/21

Outreach/Educational Activities

- **Army Corp of Engineers Tour**: 1/31
- **Jennings Environmental Education Center Teacher Workshop**: 3/24
- **6th Annual SRWC Symposium**: Slippery Rock, PA 4/5-4/6
- **Slippery Rock University's Earth Day Celebration**: 4/19
- **Spring Into Action**: Jennings Env. Ed. Center Slippery Rock, PA 4/21
- **Get Together**: Boyers, PA 5/9
- **Helicopter Tour**: DeSale Restoration Area 5/17
- **North Country Trail Day**: 6/2
- **USDOE Flushing of DeSale Phase II**: 6/20
- **Harrisville Community Day**: 7/4
- **DEP Watershed Academy**: 7/18-7/20
- **ARRIPA Tour**: 7/20
- **Shamokin Watershed Group Tour**: Through the Watershed in August
- **Mist Netting**: Conducted at Goff Station in August
- **Electro-Fishing Survey**: 8/6
- **Flushing of DeSale Phase I**: 8/10
- **Jack Dams Installation**: Unnamed Tributaries to Seaton Creek 8/17
- **Watershed Workshop**: University of Pitt. Greensburg 9/22
- **Sense of Place Workshop**: Slippery Rock, PA 9/25-9/28
- **Big Run Assessment**: 10/1-10/2
- **Erico Bridge Groundbreaking**: 10/3
- ***Accepting the Challenge***: First Copies Available in October
- **Western Pennsylvania Watershed Protection Program Reception**: Pitt. Hilton 11/14
- **Knox AMD Workshop**: 11/16
- **Senator Tim Murphy Tour**: 12/21

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Original artwork sent to us by Mikie Kay of Harrisville, PA.
Thank you Mikie for sharing your talents with us!!!!!!

More on the ASMR Conference in Lexington, KY

The American Society of Mining and Reclamation's (ASMR) 19th Annual National Conference was held in conjunction with the International Affiliation of Land Reclamation's (IALR) 6th International Conference at Lexington, Kentucky June 9-13. Seven representatives from the Slippery Rock Watershed Coalition participated in the conference including **Margaret Dunn, Tim Danehy, Shaun Busler,** and **Cliff Denholm** of Stream Restoration; **Bob Beran** of Aquascape; **Fred Brenner** of Grove City College; and **Melissa Busler** representing the Jennings Environmental Education Center.

The conference was wonderful as always with an opportunity to talk with old friends, make new ones, and listen to the latest research on passive treatment technology and reclamation activities that are happening throughout the world. The Coalition was busy as usual at the conference! Tim Danehy, Shaun Busler, and Fred Brenner each presented papers in addition to the four poster papers and three exhibits that members of the Coalition presented.

As if that was not enough, the SRWC crew presented a four-hour afternoon workshop attended by experts in the field of passive treatment entitled **Passive Treatment of Mine Drainage Part II: Practical Application & Lessons Learned**. The workshop focused on many of the issues relating to the actual implementation and construction of passive treatment systems such as: Public-Private Partnerships; Permitting; Construciton and Installation Considerations; Operation, Maintenance, and Replacement; Wildlife Habitat; and Education/Outreach. This was a follow up to the extremely informative morning workshop **Passive Treatment of Mine Drainage Part I** presented by **George Watzlaf, Karl Schroeder** and **Robert Kleinmann** of the US DOE National Energy Technology Laboratory Pittsburgh Office and **Dr. Robert Nairn** of the University of Oklahoma. Thank you to those of you who attended the workshop!!

SRWC In The News!!!

Some of you may have noticed the article on the front page of the Butler County section in the Tribune Review on Sunday, June 30th. The article titled, "Environmental Cuts Loom: Growing Greener May Lose Funding, Impact" was written by **Larry Sanata**. Thank you Larry for the wonderful article. The article can be found by searching the Tribune Review web site (triblive.com).

The KIDS Catalyst

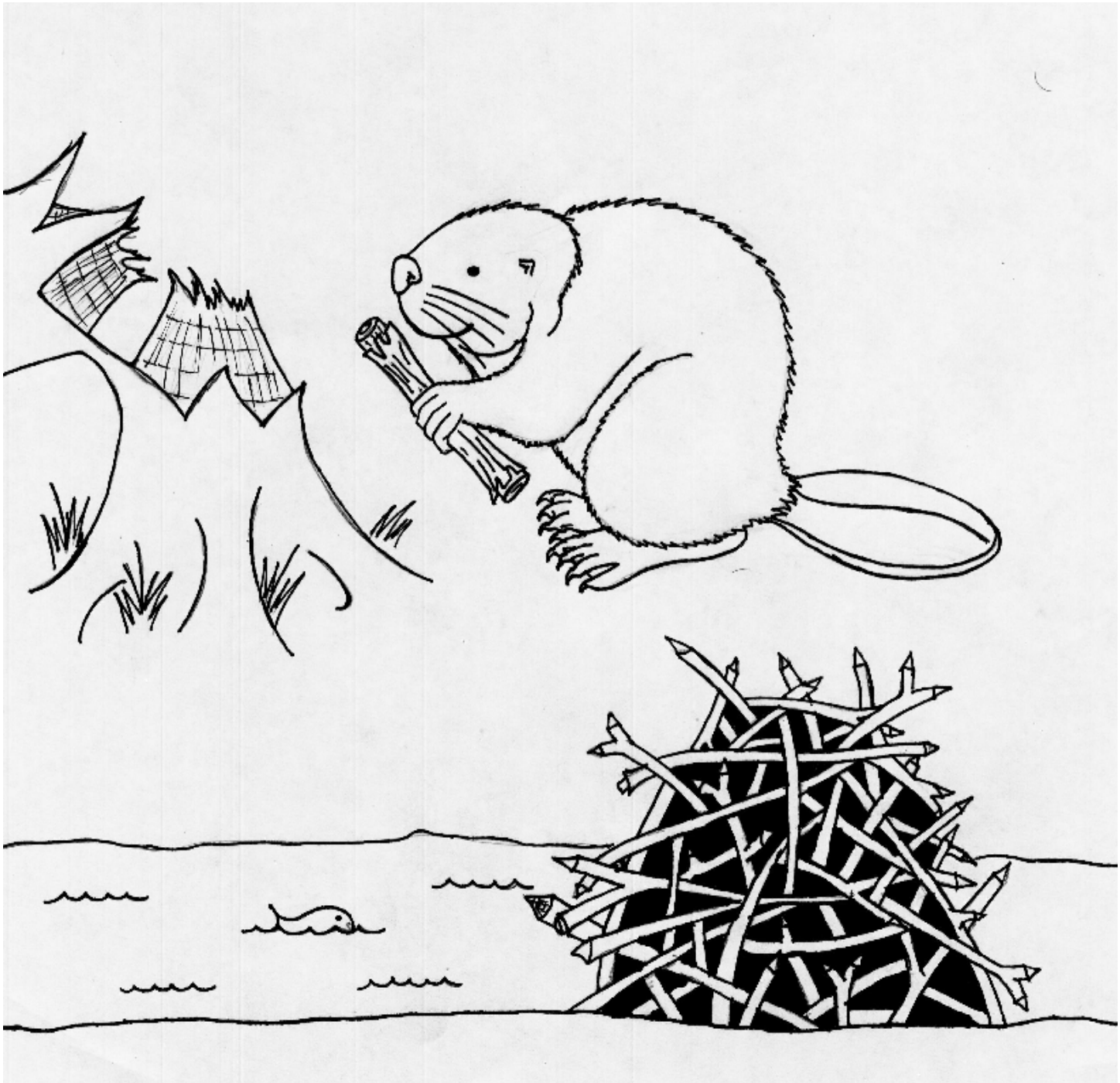
SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

A Beavers Life

Beavers are dark brown rodents that have a flat paddle shaped tail that is used as a rudder while swimming. Beavers like to live in streams, swamps, and lakes, and can be found all over the Slippery Rock Watershed! A beaver likes to build its house, called a hut, in the water. Beavers will also build a dam on a stream so they can have deep water to built their huts! Beavers also have long sharp teeth that they use to chew through wood to build their huts and dams! While beavers look cute and cuddly, they are still a wild animal and should not be played with.

Special thanks to Mikie Kay for the idea for this month's Kids Catalyst. Check out Mikie's original art as the photo of the month!!!!!

When you have colored the picture, send it back to us for a free gift certificate!



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Thanks to The William & Frances Aloe Charitable Foundation, Environmentally Innovative Solutions, LLC, Dominion Peoples, Amerikohl Mining, Inc., Quality Aggregates Inc., Bio-Most, Inc., Allegheny Mineral Corporation and PA DEP for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@streamrestorationinc.org, www.srwc.org. June Distribution: 1053 copies

Highlighting **O**ther **P**artnership **E**fforts (HOPE!)

Pittsburgh Area Creek Connections Student Research Symposium

On April 9, 2003, the second **Pittsburgh Area Creek Connections Student Research Symposium** was held at **Camp Kon-O-Kwee** along the banks of Connoquenessing Creek near Zelienople, PA. Over 300 people participated in the event including students, teachers, and environmental organizations. **Cliff Denholm**, from Stream Restoration Inc., was on-hand with a poster and to teach a group activity on abandoned mine drainage and passive treatment. The symposium kicked off with a welcoming by representatives of the **Connoquenessing Watershed Alliance**. The **Creek Freaks** from Seneca Valley School District informed the audience about the problems facing the Connoquenessing Creek watershed and the positive steps that have been taken to address those issues. Afterwards the day consisted of student presentations and poster sessions for students to interact with other students and environmental organizations. Some of the environmental organizations present included the **Pittsburgh National Aviary**, the **Carnegie Science Center**, **Carnegie Museum of Natural History**, **Pittsburgh Voyager**, and the **Butler County Conservation District**. After lunch students had the opportunity to partake in a variety of focus activities that ranged from sewage treatment to GPS to aquatic organisms.

Creek Connections is a program sponsored through **Allegheny College** that facilitates the involvement of public schools in western Pennsylvania and New York in natural science education through hands-on field and laboratory experiences. Classes participate in research projects and stream monitoring. An on-line database allows the students to share the data that they have collected. Then in April all participating schools and students gather together to share their research with each other at the annual Student Research Symposium. Students presented and displayed their water data and independent research projects allowing them to compare data and research projects that had been conducted in a wide variety of watersheds. Creek Connections now involves over 40 different schools and over 50 different classes. The large involvement has resulted in two separate symposiums. One at Allegheny College for northwestern Pennsylvania and New York region as well as one for the Pittsburgh region.

For more information about the Creek Connections program check out their website at http://creekconnections.allegheny.edu.

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

<u>THIS MONTH'S MEETING:</u> Thursday June 12th at 7pm Jennings Environmental Education Center, pizza and pop will be provided. 5/08/03 Attendance: K. Lanich, J. Reidenbaugh, S. Busler, C. Cooper, M. Dunn, T. Danehy, D. Johnson, V. Kefeli, and C. Denholm

It's I-79 Trash Pick Up Time Again!!!

On Friday June 27th we will once again pick up trash along our stretch of I-79 (between mile marker 100 and 101) We will meet at the "park 'n ride" off exit 99 (west on US 422) at noon for a free quick lunch. Then we will head out to make our little stretch of highway as clean as it can be! We hope you will come out and join us. Don't forget to dress appropriately and we will provide the safety vests and gloves. If you would like more information please call Deanna Treter at 724-776-0161.

Washington Elementary Students Help Plant SR-81

Although April 29th began with a hard rain, the weather cleared early, and the sun was shinning by the time the second grade classes of **Washington Elementary School** (see photo to the right) arrived at the SR-81 passive treatment system. They were there to help **Dale Hockenberry** (PA Game Commission) (See photo on left), **Bob Beran** (Aquascape Wetland and Environmental Services), and **Kim Lanich** (also of Aquascape) plant seedlings in the riparian and upland areas surrounding the system. The approximately 55 students were from the classes of **Amy Criley**, **Jen Fleeger**, and **Amy Tokar**, who, along with student teachers from Slippery Rock University (**Stacy Reed**, **Kelly Sewchok**, and **Tomi Swift**) and several of the students' parents (**Pat Beran**, **Kelli Kimmey**, **Cindy Lott**, **Norma Uber**, and **Lisa Ulrich**), chaperoned the event. The afternoon began with Bob giving a brief ecological lesson and basic planting instructions (roots DOWN, of course!). The adults created planting holes and the students followed behind, placing a seedling in the created hole. The students worked hard and, in less than three hours, managed to plant over **1000 seedlings of 13 different species!!!** Although more than one pair of shoes (and pants, for that matter) was well muddied, the students enjoyed their chance to learn in the great outdoors. Our thanks to all who helped plan and conduct the planting, with a special thank you going to the **<u>Butler County Conservation District</u>** and **Ron Fodor** for donating the left-over seedlings from their annual sale. The SR-81 passive treatment system was funded through a Growing Greener grant.

SRWC Get-Together Was Great Fun!!!

On Friday May 2nd we met at the Epiphany Catholic Church in Boyers, PA for the SRWC's Annual Get-Together. We had <u>good</u> food while having <u>good</u> fun. Thanks to **Quality Aggregates** for donating pirates tickets!! The tickets were just some of the great door prizes given out. And of course we had piñatas. The kids enjoyed breaking them open and gathering up all the candy! Thanks to **Gloria Dematteis** and the **Epiphany Catholic Church** for allowing us to use their facilities and putting up with us. Thanks also to those who came out!!

PHOTO OF THE MONTH

The participants of the Jennings Environmental Education Center Spring Into Action on April 26th!!

PHOTO OF THE MONTH

Jennings Environmental Education Center "Spring Into Action" Is A Huge Success

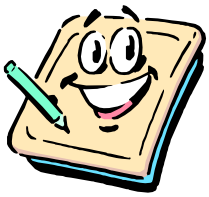
On Saturday April 26th, 110 participants joined forces to get the Jennings Environmental Education Center in Slippery Rock, PA ready for Spring! Some of the projects completed included: general trail work; removal of invasive species from the lower treatment ponds; staining of bridges, feeders, and fences; and placement of stream gauge/ monitoring equipment in Big Run by Old Mill Bridge. A group of students from **VisionQuest** in Franklin did some cosmetic work (seeding, etc.) at the passive treatment system (PTS) site, and a group from **George Junior Republic** in Grove City also worked near the PTS site constructing a fence by the school house. An **Explorers** group cleaned up a section of Big Run, removing fallen trees, log jams, and trash. After completing all this hard work the participants were treated to a free lunch, free t-shirts, and a raffle of outdoor related products. Thanks to all those who went out to help!! (The photo above shows the whole wonderful group of participants after their hard work!)

Watershed Academy Visits SRWC Sites

On Tuesday May 6th, the Watershed Academy for Local Government was held at the **McKeever Environmental Education Center** in Sandy Lake, PA. **Tim Danehy** gave a presentation titled, "Partnering with Municipalities: A Watershed Association Perspectives on the Advantages." **Sherry Carlin** from the Knox District Mining Office gave a presentation titled, "Watershed Impacts: Mining Activities." Sherry also presented posters on Growing Greener that included SRWC Headwaters activites including Goff Station and DeSale Phase III. After the presentations, over 50 people, including township officials, mayors, and DEP personnel, went on a tour of Erico Bridge.

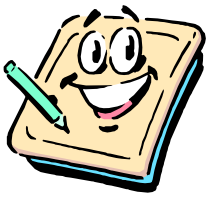
SRWC Participates in Evans City Earth Day Celebration

On Saturday May 3rd, Evans City celebrated Earth Day at the ECDO Park. The celebration included food, face painting, demonstrations, posters, and more. **Deanna Treter** and **Chris Treter** manned the SRWC poster and met lots of interesting people. Hundreds of people attended the festivities and took advantage of the beautiful May weather. The day's activities were geared towards educating the public about a variety of environmental issues. Thanks to **Theresa Vaneman** of **Callery Chemicals** for inviting us to participate. We had a wonderful time and look forward to being a part of next year's celebration!!



The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY



WORD SEEK AND FIND

All the words below can be found in articles from this months Catalyst. Find the words, circle them, and then send this back to us for a free gift certificate! Good Luck!

WORDBANK				
TRASH	STUDENTS	CONNECTIONS	PINATA	SPRING
ACADEMY	EARTH DAY	WETLAND	HIGHWAY	GET-TOGETHER

A	W	E	R	T	Y	U	I	O	P	A	S	D	F	G	H	J	K	L	Z
X	C	V	B	N	M	P	O	I	U	Y	T	R	E	W	Q	L	K	J	H
G	F	D	S	A	T	R	A	S	H	M	N	B	V	C	X	Z	Q	W	E
R	T	Y	U	I	O	P	A	S	D	F	G	H	J	K	L	Z	X	C	V
B	N	M	A	S	D	F	G	H	A	J	K	L	H	I	G	H	W	A	Y
Q	W	E	R	T	Y	U	I	O	C	P	Z	X	C	V	B	N	M	L	K
J	H	G	F	D	S	A	P	O	A	O	I	U	Y	T	R	E	W	Q	M
N	B	V	C	X	Z	Q	W	E	D	R	N	T	Y	U	I	O	P	A	S
D	F	G	H	J	K	L	Z	X	E	C	V	N	B	N	E	M	Q	A	Z
X	S	W	E	D	C	V	F	R	M	T	G	B	E	N	A	H	Y	U	J
M	K	I	S	O	L	P	Q	W	Y	E	R	T	Y	C	R	U	I	O	P
A	S	D	T	F	G	H	J	K	L	Z	X	C	V	B	T	N	M	G	F
D	S	A	U	H	J	K	L	T	Y	U	I	O	P	R	H	I	E	W	Q
B	N	M	D	V	C	X	Z	P	O	R	I	U	Y	T	D	R	O	E	W
Q	A	W	E	T	L	A	N	D	E	S	D	F	G	H	A	J	K	N	L
M	N	B	N	V	C	X	Z	H	Q	W	E	R	T	Y	Y	Y	U	I	S
O	P	P	T	T	T	T	T	I	M	A	S	S	D	F	G	H	J	K	L
M	N	B	S	V	C	E	X	Z	A	L	S	D	P	F	G	H	J	K	L
Q	W	E	R	T	G	T	Y	U	I	L	O	P	A	R	S	D	F	G	H
A	S	D	F	O	A	S	D	F	A	E	S	D	F	A	I	S	D	F	A
Q	W	E	T	R	T	Y	U	I	O	N	P	Q	W	E	R	N	T	Y	U
Z	X	T	C	V	A	T	A	N	I	P	B	N	M	Z	X	C	G	V	B
N	E	M	A	S	D	F	G	H	J	K	L	L	K	J	H	G	F	D	S
G	Z	X	C	V	B	N	M	M	N	B	V	C	X	Z	A	S	D	F	G
Q	W	E	A	L	R	O	K	E	R	W	E	R	T	Y	U	I	O	P	Z

Name _____ Age _____ Address _____

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
DEP SR81	3/1/95				4.4				7	20	1.1		0.9		0.5		55	3
DEP SR81	9/27/95				3.7				0	56	13.7		5.4		0.8		206	20
DEP SR81	10/12/95				3.5				0	58	6.8		6.3		0.4		213	38
DEP SR81	11/2/95		60		3.5				0	48	4.0		4.5		0.5		203	4
DEP SR81	1/25/96				4.6				7	10	0.3		0.7		0.5		55	8
DEP SR81	2/25/97	Estimated	60		3.9				0	20	1.4		1.7		0.0		95	8
DEP SR81	3/20/97	Estimated	60		4.4				6	11	0.5		1.4		0.0		83	12
DEP SR81	3/27/97	Estimated	50		3.8				0	19	1.2		2.1		0.0		112	
DEP SR81	4/15/97				3.9				0	16	1.4		1.9		0.0		105	
DEP SR81	2/10/98	Measured	40		3.6				0	24	2.3		3.0		0.0		136	
DEP SR81	3/24/98				3.9				0	22	1.4		1.7				106	
DEP SR81	5/3/00	Measured	10		5.5				16	114	60.9		8.9		0.0		361	10
DEP SR81	6/11/02	Estimated	12		4.3				6	45	13.4		4.4		0.6		170	28
Min			10		3.5				0	10	0.3		0.7		0.0		55	3
Max			60		5.5				16	114	60.9		8.9		0.8		361	38
Avg			42		4.1				3	36	8.3		3.3		0.3		146	15
Range			50		2.0				16	104	60.6		8.2		0.8		306	35

Description: Abandoned Mine Discharge; PA DEP sampling point

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SR81	5/3/00	Bucket	6	5.4	4.2	719	10		0	105	43.2		7.7		0.2		332	7
SR81	6/26/00	Bucket	5	5.0	3.1	932	11		0	92	33.9		7.6		0.2		415	1
SR81	6/7/01				3.1	912	10		0	99	50.3	35.8	7.9	7.7	0.3	0.3	321	3
SR81	3/14/02	Bucket	4	4.7	3.8	811	9		0	125	70.4	64.7	10.2	9.8	0.2	0.2	440	5
SR81	6/4/02				3.7	791				123	50.3	48.9	8.5	8.5	0.3	0.2	254	7
Min			4	4.7	3.1	719	9		0	92	33.9	35.8	7.6	7.7	0.2	0.2	254	1
Max			6	5.4	4.2	932	11		0	125	70.4	64.7	10.2	9.8	0.3	0.3	440	7
Avg			5	5.0	3.6	833	10		0	109	49.6	49.8	8.4	8.7	0.2	0.2	352	5
Range			2	0.7	1.1	213	2		0	32	36.6	29.0	2.7	2.1	0.2	0.1	186	6

Description: Abandoned Mine Discharge; Formerly the western most of the two discharges

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SR81A	5/3/00	Bucket	10	5.5	4.5	801	10		0	125	52.3		9.6		0.3		443	5
SR81A	6/26/00	Bucket	3	5.6	3.1	956	10		0	116	57.0		8.6		0.1		457	2
SR81A	6/7/01				3.1	953	10		0	100	85.3	42.9	9.4	9.3	0.6	0.2	375	13
SR81A	3/14/02	Bucket	2	4.7	3.4	1026	10		0	130	81.7	66.6	11.8	11.8	0.3	0.3	545	10
SR81A	6/4/02				3.5	925				154	66.2	63.9	10.8	10.7	0.2	0.1	396	4
SR81A	6/21/02	DRY																
Min			2	4.7	3.1	801	10		0	100	52.3	42.9	8.6	9.3	0.1	0.1	375	2
Max			10	5.6	4.5	1026	10		0	154	85.3	66.6	11.8	11.8	0.6	0.3	545	13
Avg			5	5.3	3.5	932	10		0	125	68.5	57.8	10.0	10.6	0.3	0.2	443	7
Range			8	0.9	1.3	225	0		0	54	33.0	23.7	3.2	2.5	0.5	0.2	171	11

Description: Abandoned Mine Discharge; Formerly the eastern most of the two discharges

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SR81 SEEP	8/7/02	Bucket	5	5.2	4.7	660	9		1	99	48.5	47.3	7.4	7.3	0.2	0.2	363	9
SR81 SEEP	10/14/02	Estimated	5	5.3	5.7	714	10		10	105	53.5	52.3	8.2	8.2	0.3	0.2	352	6
SR81 SEEP	12/12/02	Estimated	5	5.5	5.7	702	10		11	105	43.5	42.9	7.4	7.4	0.3	0.2	400	2
SR81 SEEP	3/10/03	Estimated	5	5.6	5.9	720	9		14	88	49.3	48.8	7.9	7.8	0.2	0.2	455	6
SR81 SEEP	4/23/03	Measured	4	5.2	3.8	750	9		0	90	48.3	47.8	7.8	7.8	0.2	0.2	637	5
SR81 SEEP	6/30/03	Bucket	5	5.6	4.2	693	9		0	89	47.1	45.6	7.4	7.3	0.1	0.1	443	9
SR81 SEEP	8/28/03	Bucket	3	5.2	5.3	670	10		5	92	40.5	40.0	7.2	7.1	0.2	0.1	446	4
SR81 SEEP	10/30/03	Bucket	1	5.6	5.5	700	10	16	10	102	47.9	46.5	8.0	8.0	0.1	0.1	464	10
SR81 SEEP	3/25/04	Bucket	4	5.2	4.6	685		17	1	81	59.1	49.8	6.6	6.4	0.2	0.1	355	6
Min			1	5.2	3.8	660	9	16	0	81	40.5	40.0	6.6	6.4	0.1	0.1	352	2
Max			5	5.6	5.9	750	10	17	14	105	59.1	52.3	8.2	8.2	0.3	0.2	637	10
Avg			4	5.4	5.0	699	10	17	6	94	48.6	46.8	7.6	7.5	0.2	0.2	435	6
Range			4	0.4	2.1	90	1	1	14	24	18.6	12.3	1.6	1.8	0.2	0.1	285	8

Description: Seep located on the south side of the constructed wetland near outlet end

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
ALD	8/7/02	Measured	280	6.8	6.3	720	10		51	0	44.7	42.4	7.8	7.6	0.1	0.1	364	13
ALD	10/14/02	Measured	275	6.8	6.4	862	9	119	66	19	54.3	52.9	9.3	9.3	0.2	0.2	466	10
ALD	12/12/02	Bucket	129	6.8	6.3	910	9	117	69	43	47.9	44.0	9.1	9.0	0.1	0.1	512	6
ALD	3/10/03	Measured	155	6.9	6.6	830	5	120	82	27	47.7	46.8	8.1	7.9	0.1	0.1	442	12
ALD	3/27/03	Measured	120		6.4				102	52	47.3		7.2		0.0		374	8
ALD	4/24/03	Measured	150	6.8	6.4	706	9	108	58	-11	40.9	40.8	6.7	5.8	0.1	0.0	439	12
ALD	6/30/03	Bucket	180	6.8	6.4	673	10	107	50	-14	38.4	37.7	6.4	6.4	0.1	0.0	378	7
ALD	8/28/03	Bucket	170	6.8	6.5	709	10	113	50	-10	41.0	40.2	7.1	6.7	0.0	0.0	396	11
ALD	10/30/03	Bucket	220	6.8	6.2	686	9	115	71	-6	38.0	37.8	7.0	6.7	0.1	0.1	367	6
ALD	3/25/04	Bucket	270	6.8	6.3	621		100	60	-9	42.2	18.9	6.0	5.4	0.1	0.0	306	19
Min			120	6.8	6.2	621	5	100	50	-14	38.0	18.9	6.0	5.4	0.0	0.0	306	6
Max			280	6.9	6.6	910	10	120	102	52	54.3	52.9	9.3	9.3	0.2	0.2	512	19
Avg			195	6.8	6.4	746	9	112	66	9	44.2	40.2	7.5	7.2	0.1	0.0	404	10
Range			160	0.1	0.3	289	5	20	52	66	16.4	34.0	3.3	3.8	0.2	0.2	206	13

Description: Anoxic Limestone Drain sampled at the 6" outlet pipe

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SP	8/7/02	Assumed	280	6.8	6.1	678	14		34	0	31.4	25.3	7.8	7.6	0.1	0.1	346	38
SP	10/14/02	Assumed	275	6.8	5.9	805	10		15	8	43.7	32.6	9.4	9.3	0.2	0.1	497	24
SP	12/12/02	Assumed	129	6.9	6.3	940	7		51	42	44.6	36.0	9.0	8.8	1.0	0.1	481	26
SP	3/10/03	Assumed	155	6.8	6.5	737	5		39	5	37.2	30.2	8.1	8.1	0.1	0.1	483	14
SP	4/24/03	Assumed	150	6.8	6.3	670	12	77	28	-16	33.9	25.8	6.9	6.7	0.1	0.1	442	26
SP	6/30/03	Assumed	180	6.7	6.3	624	12	69	31	-20	27.4	17.8	6.3	6.2	0.0	0.0	368	24
SP	8/28/03	Assumed	170	6.8	6.3	680	14	74	30	-22	31.2	22.6	7.0	6.8	0.0	0.0	386	5
SP	10/30/03	Assumed	220	6.8	6.1	668	10	84	34	2	31.1	22.5	6.9	6.9	0.1	0.0	359	26
SP	3/25/04	Assumed	270	6.8	6.2	622		83	41	-19	62.6	32.2	5.5	5.5	0.3	0.0	253	10
Min			129	6.7	5.9	622	5	69	15	-22	27.4	17.8	5.5	5.5	0.0	0.0	253	5
Max			280	6.9	6.5	940	14	84	51	42	62.6	36.0	9.4	9.3	1.0	0.1	497	38
Avg			203	6.8	6.2	714	11	77	34	-2	38.1	27.2	7.4	7.3	0.2	0.0	402	21
Range			151	0.2	0.7	318	9	15	36	63	35.1	18.3	3.9	3.8	1.0	0.1	245	33

Description: Settling Pond sampled at spillway

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
WL	8/7/02	Assumed	280	6.5	6.2	707	15		30	0	14.9	12.8	7.8	7.4	0.1	0.0	331	8
WL	10/14/02	Assumed	275	6.8	5.9	782	8	30	9	4	20.1	14.6	9.1	8.7	0.1	0.1	479	25
WL	12/12/02	Assumed	129	6.9	6.3	836	3	55	32	33	26.2	24.1	8.5	8.3	0.1	0.1	465	7
WL	3/10/03	Assumed	155	7.0	6.5	896	1		44	7	26.8	22.2	8.4	8.3	0.1	0.0	551	37
WL	3/27/03	Estimated	135		6.2				36	51	26.4		7.1		0.0		360	34
WL	4/24/03	Assumed	150	6.8	6.5	664	19	28	23	-15	20.0	8.1	6.8	6.3	0.0	0.0	551	15
WL	6/30/03	Assumed	180	6.5	6.4	618	15	39	29	-19	8.2	4.6	6.0	5.9	0.0	0.0	355	4
WL	8/28/03	Assumed	170	6.5	6.5	677	18	30	25	-18	5.2	1.4	6.7	6.2	0.1	0.1	371	4
WL	10/30/03	Assumed	220	6.7	6.2	650	8	35	30	-18	11.4	7.9	6.6	6.5	0.1	0.1	387	9
WL	3/25/04	Assumed	270	6.8	6.3	614		52	33	-18							253	10
Min			129	6.5	5.9	614	1	28	9	-19	5.2	1.4	6.0	5.9	0.0	0.0	253	4
Max			280	7.0	6.5	896	19	55	44	51	26.8	24.1	9.1	8.7	0.1	0.1	551	37
Avg			196	6.7	6.3	716	11	38	29	1	17.7	12.0	7.4	7.2	0.0	0.0	410	15
Range			151	0.5	0.6	282	18	27	35	70	21.7	22.7	3.0	2.8	0.1	0.1	299	33

Description: Wetland sampled at effluent of constructed wetland

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
NATURAL WL	12/12/02			6.8	6.4	809	3		32	11	19.7	19.3	8.5	8.2	0.1	0.1	405	14
NATURAL WL	4/24/03			6.8	6.4	614	15	32	21	-9	11.0	6.2	6.9	5.4	0.1	0.0	416	12
NATURAL WL	6/30/03			6.7	6.6	606	15		27	-21	2.4	2.0	3.7	3.4	0.0	0.0	342	4
NATURAL WL	8/28/03			6.8	7.0	620	19	33	25	-10	1.3	1.1	2.9	2.8	0.5	0.1	344	5
NATURAL WL	10/30/03			6.8	6.4	583	7	23	22	-12	9.2	1.8	3.0	2.9	0.2	0.1	347	7
NATURAL WL	3/25/04			6.6	6.4	482		46	20	-11	2.8	2.5	2.3	2.3	0.0	0.0	253	10
Min				6.6	6.4	482	3	23	20	-21	1.3	1.1	2.3	2.3	0.0	0.0	253	4
Max				6.8	7.0	809	19	46	32	11	19.7	19.3	8.5	8.2	0.5	0.1	416	14
Avg				6.8	6.5	619	12	34	25	-9	7.7	5.5	4.5	4.2	0.1	0.0	351	9
Range				0.2	0.6	327	16	23	13	33	18.3	18.2	6.2	6.0	0.5	0.1	164	10

Description: Naturally existing wetland; Provides additional treatment before water enters Slippery Rock Creek; Sampled in channel along Kohlmyer Road before entering Slippery Rock Creek

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SR81 UP	6/26/00			6.2	6.5	324	23		16	0	2.1		0.7		0.1		128	1
SR81 UP	6/7/01			6.0	6.2	329	21		7	1	2.3	1.1	0.8	0.8	0.1	0.1	155	2
SR81 UP	3/14/02			5.7	5.0	321	12		2	8	4.2	0.8	1.1	1.0	0.3	0.2	119	1
SR81 UP	8/7/02			6.3	6.2	401			14	0	3.9	2.4	1.5	1.4	0.1	0.1	188	12
SR81 UP	10/14/02			5.8	5.2	457	10		2	7	2.4	2.1	1.2	1.2	0.2	0.2	227	3
SR81 UP	12/12/02			5.8	6.3	385	1		7	5	2.3	2.1	1.8	1.8	0.2	0.2	155	2
SR81 UP	4/24/03			5.8	5.6	335	10		3	5	0.8	0.5	1.1	1.0	0.2	0.2	176	2
SR81 UP	6/30/03			6.0	6.3	324			8	-2	1.4	0.9	1.3	1.2	0.1	0.0	146	2
SR81 UP	8/28/03			6.2	6.8	727	22	21	19	-11	1.5	0.6	0.7	0.6	0.1	0.0	124	5
SR81 UP	10/30/03			6.3	6.2	260	7	9	10	-2	0.9	0.5	0.4	0.4	0.1	0.1	119	7
SR81 UP	3/25/04			6.2	5.9	206		6	4	3	0.5	0.3	0.7	0.6	0.1	0.1	72	2
Min				5.7	5.0	206	1	6	2	-11	0.5	0.3	0.4	0.4	0.1	0.0	72	1
Max				6.3	6.8	727	23	21	19	8	4.2	2.4	1.8	1.8	0.3	0.2	227	12
Avg				6.0	6.0	370	13	12	8	1	2.0	1.1	1.0	1.0	0.1	0.1	146	4
Range				0.6	1.8	521	22	15	17	19	3.6	2.1	1.4	1.4	0.2	0.2	155	11

Description: Slippery Rock Creek; Sampled upstream of SR81 passive treatment system

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SR81 DN	6/26/00			6.4	6.6	311	24		19	0	3.0		0.7		0.0		120	1
SR81 DN	6/7/01			6.0	6.0	347	20		7	1	1.1	0.4	0.7	0.7	0.1	0.1	124	3
SR81 DN	3/14/02			6.0	6.1	296	5		4	2	1.1	0.9	0.9	0.9	0.2	0.1	121	1
SR81 DN	8/7/02			6.3	6.1	410	19		17	0	4.2	3.6	1.9	1.8	0.1	0.1	186	15
SR81 DN	10/14/02			6.1	5.1	478	10		2	7	4.2	3.8	1.9	1.9	0.3	0.2	240	5
SR81 DN	12/12/02			6.1	6.1	474	1		7	10	2.7	2.2	1.9	1.9	0.2	0.1	203	4
SR81 DN	4/24/03			6.0	5.8	333	10		3	3	1.1	0.9	1.2	1.2	0.2	0.2	180	3
SR81 DN	6/30/03			6.2	6.4	329			9	-3	1.5	1.0	1.3	1.3	0.1	0.0	140	1
SR81 DN	8/28/03			6.4	6.9	280	20	24	19	-11	1.5	0.7	0.7	0.7	0.2	0.1	129	5
SR81 DN	10/30/03			6.4	6.2	273	6	12	10	-2	0.8	0.6	0.4	0.4	0.1	6.0	121	4
SR81 DN	3/25/04			6.3	5.9	209		8	4	3	0.6	0.3	0.7	0.6	0.1	0.1	77	3
Min				6.0	5.1	209	1	8	2	-11	0.6	0.3	0.4	0.4	0.0	0.0	77	1
Max				6.4	6.9	478	24	24	19	10	4.2	3.8	1.9	1.9	0.3	6.0	240	15
Avg				6.2	6.1	340	13	15	9	1	2.0	1.4	1.1	1.1	0.1	0.7	149	4
Range				0.4	1.7	269	23	16	17	20	3.7	3.5	1.5	1.5	0.2	6.0	163	14

Description: Slippery Rock Creek; Located downstream of passive treatment system; Similar to PA DEP sampling point 64

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
63	7/25/96				5.7				12	3	1.7		0.6		0.0		118	4
63	8/15/96				5.8				14	4	1.7		0.6		0.0		113	
63	9/18/96				5.9				12	5	1.1		0.4		0.0		59	
63	10/24/96				6.2				16	0	1.0		0.5		0.0		83	10
63	12/19/96				5.8				10	9	1.0		0.6		0.0		84	
63	2/25/97				5.8				11	6	1.0		0.6		0.0		78	4
63	3/12/97				6.0				11	4	0.6		0.7		0.0		70	
63	3/20/97				5.6				10	5	0.8		0.7		0.0		74	24
63	4/15/97				6.1				14	3	0.9		0.7		0.0		70	
63	6/19/97				5.8				12	2	3.0		0.8		0.8		97	
63	8/20/97				5.6				11	15	2.5		1.5		0.0		171	
63	9/17/97				5.1				9	22	2.4		1.2		0.0		197	
63	10/8/97				5.4				10	12	1.7		1.0		0.0		178	
63	10/15/97				5.4				10	15	3.0		0.9		0.5		216	
63	12/4/97				5.9				13	4	0.9		0.7		0.0		72	
63	12/11/97				5.7				12	4	0.8		0.5		0.0		64	
63	1/21/98				2.7				0	204	1.5		1.1		0.0		64	6
63	2/10/98				5.8				11	1	1.8		1.1		0.0		109	
63	3/24/98				5.9				11	3	0.6		0.6		0.0		50	8
63	4/29/98				5.6				9	3	0.5		0.6		0.0		67	4
63	5/19/98				5.9				11	2	1.2		0.8		0.0		100	
63	6/30/98				6.2				17	7	2.2		1.3		0.0		162	
63	9/16/98				4.2				7	19	7.1		1.1		1.0		306	
63	10/14/98				5.9				14	2	1.7		0.4		0.0		166	4
63	12/9/98				6.1				16	0	1.5		0.4		0.0		237	
63	3/31/99				5.9				11	4	1.4		0.9		0.0		123	
63	6/16/99				5.7				13	7	1.7		0.5		0.0		139	
63	9/14/99				6.4				26	0	2.1		0.4		0.0		245	
63	11/23/99				5.8				17	22	12.3		1.6		0.0		274	

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
63	3/28/00				5.9				11	8	1.5		0.8		0.0		101	
63	2/22/01				5.9				11	3	0.6		2.7		0.0		112	6
63	4/18/01				5.9				9	2	0.8		0.5		0.0		71	
63	10/31/01				5.1				14	37	2.6		1.7		0.0		228	4
63	2/21/02				5.9				12	28	2.3		1.1		0.0		147	
63	7/29/02				6.1				10	28	1.3		0.5		0.0		61	24
63	3/31/03				6.1				10	28	0.8		1.0		0.0		83	
Min					2.7				0	0	0.5		0.4		0.0		50	4
Max					6.4				26	204	12.3		2.7		1.0		306	24
Avg					5.7				12	14	1.9		0.9		0.1		127	9
Range					3.7				26	204	11.8		2.3		1.0		256	20

Description: Slippery Rock Creek; Main Branch below Hilliards Tributary; Upstream from Ferris and SR81 treatment systems; PA DEP Sampling Point

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
64	7/25/96				5.5				10	7	1.5		0.7		0.0		121	
64	8/15/96				5.7				11	6	1.3		0.6		0.0		119	
64	9/18/96				5.5				9	6	0.6		0.4		0.0		53	
64	10/29/96				6.1				13	5	1.0		0.6		0.0		85	10
64	12/19/96				5.6				14	7	0.8		0.6		0.0		85	
64	2/19/97				5.4				10	19	1.4		0.9		0.0		101	
64	3/12/97				5.6				9	7	0.8		0.7		0.0		72	
64	3/20/97				5.2				9	5	0.7		0.7		0.0		80	10
64	4/15/97				6.0				11	2	0.8		0.7		0.0		75	
64	7/10/97				4.3				4	17	1.3		0.9		0.7		176	
64	8/20/97				5.1				8	22	2.2		1.8		0.0		185	
64	9/17/97				5.1				8	15	1.1		1.4		0.0		214	12
64	10/8/97				5.8				16	4	1.0		1.1		0.0		182	
64	10/15/97	Measured	1470		5.7				11	9	1.2		1.2		0.0		224	
64	12/4/97				6.0				14	2	1.3		0.8		0.0		86	
64	12/11/97				5.5				11	4	1.0		0.6		0.0		66	
64	1/21/98				6.0				12	6							118	
64	1/23/98				6.1				17	7	1.8		1.3		0.0		97	
64	2/10/98				5.8				11	1	1.6		1.1		0.0		107	80
64	3/24/98				5.9				11	6	0.5		0.6		0.0		54	8
64	4/29/98				5.7				10	5	0.5		0.5		0.0		73	6
64	5/19/98				6.1				12	3	1.6		0.9		0.0		103	8
64	6/30/98				6.3				18	3	1.4		1.4		0.0		167	8
64	9/1/98				4.9				9	11	0.9		1.2		0.0		226	
64	9/16/98				4.0				3	15	0.8		1.5		0.6		288	
64	10/14/98				4.5				7	9	1.4		1.0		0.0		156	4
64	12/9/98				4.3				6	14	1.1		1.6		0.0		253	4
64	3/31/99				5.1				9	4	0.5		0.9		0.0		106	
64	6/16/99				6.0				16	6	3.7		1.5		0.0		145	

SR81 Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	T. Fe (mg/L)	D. Fe (mg/L)	T. Mn (mg/L)	D. Mn (mg/L)	T. Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
64	9/14/99				5.7				13	5	2.7		1.3		0.0		175	
64	11/23/99				4.8				8	9	2.1		1.6		0.0		197	
64	3/28/00				5.1				9	13							112	
64	7/5/00				6.5				19	0	1.8		0.9		0.0		109	
64	9/20/00				6.5				22	0	1.7		0.9		0.0		152	
64	10/18/00				6.0				14	0	0.7		0.5		0.0		132	66
64	2/22/01				6.1				11	2	0.4		0.6		0.0		89	
64	4/18/01				6.0				9	2	0.4		0.4		0.0		68	
64	4/24/01	Estimated	14000		5.8				9	3	0.4		0.4		0.0		78	
64	5/31/01				6.0				15	0	1.0		0.6		0.0		109	8
64	10/31/01				5.6				17	31	4.6		1.8		0.0		167	8
64	2/21/02				5.1				10	43	0.7		1.1		0.0		95	10
64	7/25/02				6.3				18	31	3.7		1.7		0.0		169	10
64	1/7/03				6.0				10	42	0.4		0.8		0.0		67	
64	3/27/03				5.5				7	45	4.3		0.8		0.6		95	
64	4/30/03				5.8				10	40	1.3		1.2		0.0		131	
64	7/29/03				6.2				16	40	1.1		0.4		0.0		65	
64	3/31/04				5.8				9	56	2.6		0.8		0.0		94	24
Min			1470		4.0				3	0	0.4		0.4		0.0		53	4
Max			14000		6.5				22	56	4.6		1.8		0.7		288	80
Avg			7735		5.6				11	13	1.4		0.9		0.0		126	17
Range			12530		2.5				19	56	4.2		1.4		0.7		236	76

Description: Slippery Rock Creek; Main Branch; Downstream from Ferris and SR81 treatment systems; PA DEP sampling point