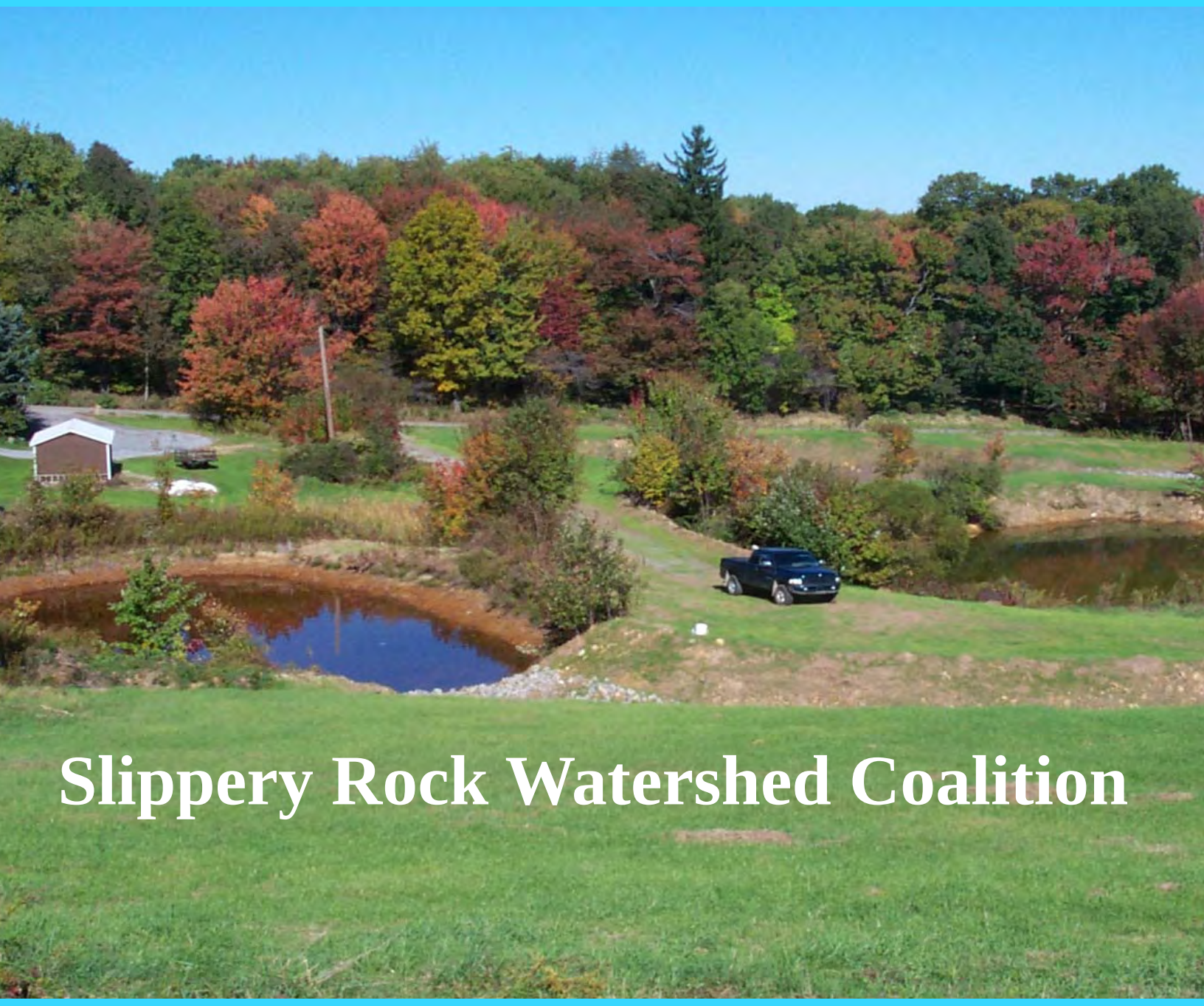
De Sale Restoration Area Phase III

A Public Private Partnership Effort

Venango Township, Butler County, PA

June 2004



Slippery Rock Watershed Coalition

Stream Restoration Incorporated

A PA Non-Profit Organization 501(c)(3)
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Date: June 30, 2004

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

Re: Final Report for ME# 351407; Project # NW10324
De Sale Restoration Area Phase III, Venango Twp., Butler Co., PA
630102/FR-trans

Enclosed is the final report for the above noted project.

This report describes the fourth of five major restoration projects within the De Sale Priority Area: 5 described in the PA DEP, Knox DMO, 1998, Slippery Rock Creek Watershed Comprehensive Mine Reclamation Strategy. These projects could not have been accomplished without the help of the PA Department of Environmental Protection, Butler County Commissioners, Western PA Watershed Program and the generous contributions of our other partners. Participants in the Slippery Rock Watershed Coalition were gratified to recently showcase the De Sale Phase III passive system in a tour that included restoration professionals from Brazil, Venezuela, and Korea as well as Montana, Illinois, West Virginia, and Pennsylvania.

Passive treatment of the severely degraded mine drainage (with iron concentrations at times over 200 mg/l and manganese concentrations over 150 mg/l) at this site is not only of interest relating to the development of passive technology but also of substantial importance to the watershed ecosystem. Within the last few years, fish are being documented in the formerly “dead” Seaton Creek.

Thank you again for playing such a key role in the restoration efforts of the Slippery Rock Watershed Coalition.

Your patience and assistance has been very much appreciated. If there are any questions or comments, 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

DE SALE RESTORATION AREA: PHASE III FINAL REPORT

Seaton Creek Watershed, Slippery Rock Creek Headwaters
Venango 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 (25-year design life) for two combined mine drainage discharges impacting an unnamed tributary to Seaton Creek. Design basis (from raw water monitoring conducted by PA DEP and other project partners): 60 gpm max. flow rate (12 gpm avg.), 2.8 pH, no alkalinity, 100 mg/l iron, 100 mg/l manganese, and 20 mg/l aluminum.

- Implemented a 9-component (in series) passive treatment system which also utilized 3 pre-existing treatment ponds: Collection Pond (pre-existing; 3,740 SF); Collection Ditch (300' length); Forebay (1,900 SF), Vertical Flow Pond 1 (two-tier, 8 cells, underdrain system; 900 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate overlain by ½ -foot spent mushroom compost); Flush Pond (15,000 CF); Settling Pond 1 (pre-existing; 11,300 SF); Vertical Flow Pond 2 (two-tier, 6 cells, underdrain system; 800 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate overlain by ½ -foot spent mushroom compost); Settling Pond 2 (pre-existing; 4,325 SF); Horizontal Flow Limestone Bed (800 tons, AASHTO #1, 90% $CaCO_3$, limestone aggregate).

- Reclaimed a pre-existing sludge pond and revegetated ~2-acre "kill zone".

- Continued monitoring of Seaton Creek Watershed by Grove City College and Urban Wetlands Institute.

- Developed prototype for "Datashed" (**www.datashed.org**) for use by Grove City College students as part of the monitoring program.

- Conducted site tours for environmental professionals (includes international representatives from Korea, Brazil, Venezuela), community groups, watershed education programs, etc.

- Kept photographic log.

- Submitted electronic updates, quarterly status reports, and a final report; administered contract.

DEP Grant Program: Environmental Stewardship and Watershed Protection Grant
Growing Greener Initiative - $166,000

In-Kind/Matching: Butler County Commissioners; Western PA Watershed Program; Beran Environmental Inc.; The Meyer Family; Amerikohl Mining, Inc.; Urban Wetland Institute; Grove City College; BioMost, Inc.; WOPEC; Quality Aggregates Inc.; Environmentally Innovative Solutions, LLC; Slippery Rock Watershed Coalition; Stream Restoration Inc.

PUBLIC-PRIVATE PARTNERSHIP: CONSTRUCTION AND MONITORING

Water Monitoring, Construction Inspection, Aerial Mapping, Terrain Conductivity
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

PA Dept. of Environmental Protection, Bureau of Abandoned Mine Reclamation
Rachel Carson State Office Building, PO Box 8476, Harrisburg, PA 17105-8476
SCHUECK, Joseph, Chief, Division of Acid Mine Drainage Abatement (717) 783-1311

Landowner
MEYER, Howard & Florence, 110 Park Lane Drive, Slippery Rock, PA 16057

Passive Treatment System Construction
Amerikohl Mining, Inc., 202 Sunset Drive, Butler, PA 16001
STILLEY, John, President; CHRISTIE, Jeff, PE (724) 282-2339

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

WOPEC, Rt 2, Box 294B, Lewisburg, WV 24901
HILTON, Tiff, Mining Engineer (304) 645-7633

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

Aquatic Life and 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 Incorporated, 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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DE SALE RESTORATION AREA PHASE III FINAL REPORT

VENANGO TOWNSHIP, BUTLER COUNTY, PA

A SEATON CREEK MINE DRAINAGE ABATEMENT PROJECT
Slippery Rock Creek Headwaters

submitted to the

Pennsylvania Department of Environmental Protection

EXECUTIVE SUMMARY

Participants in the Slippery Rock Watershed Coalition received partial funding from the PA Department of Environmental Protection through the Growing Greener initiative to install a passive system to treat two acidic, metal-bearing, discharges and to provide related education and public outreach activities. Through additional funding from the Butler County Commissioners and Western PA Watershed Program, and generous in-kind contributions and financial donations from numerous partners, this project has been successfully implemented.

Permitting, design, and construction were completed within 13 months without increase in the original contract costs. This economic, efficient, and effective implementation was made possible by a coordinated team approach developed prior to submission of funding requests. This public-private partnership effort included government agencies, private industry, nonprofits, a local college, and volunteers. Water monitoring data, terrain conductivity, and topographic mapping, provided by the PA DEP Bureau of Abandoned Mine Reclamation combined with monitoring and mining history data by the Knox District Mining Office, were key to successful project development.

To date, of the 15 passive systems installed within the Slippery Rock Creek Watershed, De Sale Phase III addresses the “worst” quality mine drainage. Even though the drainage only averages 12 gpm (60 gpm max.), PA DEP monitoring has documented the pH of seeps to be as low as 2.7 and total iron, manganese, and aluminum concentrations as high as 279 mg/l, 236 mg/l, and 34 mg/l, respectively. After collecting and combining the seeps, monitoring to date indicates the raw water has a 3.2 pH, 102 mg/l total Fe, 103 mg/l total Mn, and 20 mg/l total Al.

The passive treatment system includes nine components, three of which were pre-existing treatment ponds that were modified and incorporated into the system design: Collection Pond (pre-existing); Collection Ditch, Forebay, Vertical Flow Pond 1, Flush Pond, Settling Pond 1 (pre-existing), Vertical Flow Pond 2, Settling Pond 2 (pre-existing); Horizontal Flow Limestone Bed. The system construction was completed on 9/11/02 and final effluent flow was observed on 12/24/02. The improvement in discharge quality is characterized as follows; (Raw/*treated*) 3/*6*+ pH; 0/6*0* mg/l alkalinity; 580/*50* mg/l acidity; 100/<*1* mg/l Fe; 100/<*7* mg/l Mn; 20/<*1* mg/l Al. Currently, the system is neutralizing >75 lbs/day of acidity and preventing >30 lbs/day of metals from entering the receiving stream.

De Sale Phase III is a “Sister” project to De Sale Phase I and Phase II, completed in 2000 through the PA DEP “Reclaim PA” and Growing Greener programs, respectively. The combined effect of these three innovative passive treatment systems and a 55-acre land reclamation project (Chernicky site), completed in 1998, have made a dramatic impact to the water quality of Seaton Creek, which can be most easily illustrated at sampling point #48 located at the McJunkin Road bridge. At this location over 1½ miles downstream of the systems, Seaton Creek has significantly decreased metal loadings and the pH has increased from 4.8 to 6.4. The pH improvement in Seaton Creek was nearly simultaneous with completion of De Sale Phase I & II.

As part of the education and monitoring efforts, an online data management tool, “Datashed”, was developed which enabled “real-time” compilation and evaluation of Grove City College student volunteer monitoring data. Future monitoring entered into this database will enable the evaluation of the long-term system effectiveness.

COMPREHENSIVE TIMELINE

Key: DEP Inspection, Tour, News Item

Date	Description
03/09/01	De Sale Phase III (3rd Round) Growing Greener Grant application submitted
04/20/01	Site investigation
07/24/01	Contract Start Date
08/01/01	Letter announcement of project approval by PA DEP Secretary David Hess
08/31/01	PA DEP Grants Center proposed grant agreement
09/25/01	Growing Greener Training
10/—/01	SRWC "The Catalyst" article "Butler County Commissioners Donate $180,000 to Slippery Rock Watershed Restoration Projects" and "Jack Dams at De Sale"
11/05/01	Field Meeting with Elicker, Carlin, Mirza, Vandyke, Bowman, and Stilley
04/22/02	Construction Cost Comparison, Revised Conceptual Passive Treatment Design, Contract, Scope of Work, Simplified Budget, and Detailed Budget submitted to PA DEP Knox DMO
05/08/02	Scope of Work, Simplified Budget, and Detailed Budget submitted to PA DEP Knox DMO
05/09/02	Contract, Scope of Work, Simplified Budget, Detailed Budget, and DRAFT Goals and Accomplishments submitted to PA DEP Grants Center
05/11/02	Site inspection
06/15/02	Site inspection
06/26/02	DEP forwards executed Growing Greener Grant Agreement (ME351407; NW10324)
06/28/02	Site inspection
07/01/02	Terrain conductivity mapping forwarded 7/1/02 from BAMR
07/05/02	Erosion and Sedimentation Control Plan submitted to PA DEP Knox DMO
07/11/02	Working Capital Request submitted to PA DEP
07/12/02	Working Capital Request approved by PA DEP
07/15/02	Site inspection and field meeting
07/17/02	Quarterly Report submitted; Amerikohl Mining, Inc. Noncoal Surface Mining Conservation and Reclamation Act exemption approved by PA DEP Knox DMO
07/19/02	Passive Treatment System Design Plan submitted to PA DEP Knox DMO
07/19/02	Dozer and excavator idle, collection ditch installed, water flowing through ditch into forebay, collection sump (west) installed, water flowing into westernmost pre-existing pond, VFP, HFLB partially excavated, muskrat observed in pre-existing pond, silt fence in place below site, diversion ditches not constructed, additional grading on sludge disposal pond area, DEP insp. (T. Elicker); Amerikohl Mining requested and granted exemption to remove excess material from site; Passive Treatment System Design plan submitted to PA DEP Knox DMO
07/23/02	Fish Survey of Seaton Creek
07/26/02	Site inspection and field meeting
07/31/02	Project Summary submitted to Butler Co. Planning Commission; excavator loading trucks with topsoil/clay, HFLB completed (geotextile, pipe, limestone in place), discharge channel below HFLB limestone aggregate lined, geotextile and bottom VFP1 limestone layer placed, permanent diversion ditch in place, silt fence in place, seeps collected in collection channel and diverted around construction area through forebay and pre-existing pond; DEP insp. (T. Elicker)
08/01/02	Site inspection and field meeting
08/02/02	Site inspection and field meeting
08/06/02	Butler County Contract Executed (contract dated 07/09/02)

08/08/02	Excavator loading trucks with subsoil/clay material for offsite use (as per noncoal mining waiver request dated 7-16-02, to be completed by 8-1-02), VFP2 excavated, water (portion) pumped from lower pre-existing pond, seeps collected in collection channel and diverted around construction area, permanent diversion ditch and silt fence in place; DEP insp. (T. Elicker)
08/13/02	Excavator preparing to install VFP1 discharge pipes, lower tier piping in VFP1, limestone to be placed 8/14/02, rock-lined spillway between lower pre-existing pond and HFLB, seeps collected & diverted from construction area, diversion ditch & silt fence placed; DEP insp. (T. Elicker)
08/16/02	Upper VFP1 tier of pipe being placed, VFP1 discharge pipes in place below embankment, limestone (2') placed between tiers of pipe, seeps collected in collection ditch and diverted around construction area through forebay, hay bales placed where seeps leave site as silt fence covered with sediment; DEP insp. (T. Elicker); site inspection
08/22/02	Seaton Creek Assessment
08/23/02	Dozer grading west of collection ditch, excavator constructing spillway between forebay and VFP1, all pipe, limestone, and compost in VFP1, pipes extended through embankment to flush pond and to settling pond spillway, valves on flush pipes, water from lower pre-existing pond flowing through HFLB, grass starting to grow on regraded sludge pond area, discussed site conditions with Jeff Christie; DEP insp. (T. Elicker)
08/29/02	Lower VFP2 tier piping placed, geotextile and bottom layer of limestone placed, next layer of limestone stockpiled in corner of VFP2, spillway under construction between forebay and VFP1 majority of water collected and conveyed to forebay, lower pre-existing pond discharging through HFLB, emergency spillway constructed on flush pond embankment; DEP insp. (T. Elicker)
09/—/02	SRWC “The Catalyst” article “Fish Found in Slippery Rock and Seaton Creek”
09/05/02	Placing limestone in VFP2, excavator extending west end of collection ditch to existing pond, loading and offsite trucking of excess material, east end of collection ditch graded, VFP1 discharging to flush pond through upper flush pipes, discussed site conditions with Jeff Christie; DEP insp. (T. Elicker)
09/06/02	Site inspection and field meeting
09/11/02	Construction of treatment system completed, compost on top of VFP2 and discharge pipes in place, collection ditch extended to pre-existing pond, rock-lined spillway in place between pond and collection ditch, spillway constructed between settling pond and VFP2, spillways and emergency spillways rock-lined, grading completed, site partially seeded, mulch on site, additional seeding and mulching to be done today; DEP insp. (T. Elicker) site inspection
10/08/02	Butler County Reimbursement Request submitted
10/08/02	Grasses “good catch”, legumes starting, VFP1 not discharging water covering part of compost, no discharge from system, raw & downstream samples; DEP insp. (T. Elicker)
10/10/02	Quarterly Report submitted
10/14/02	Site inspection; water monitoring
11/02/02	VFP1 discharging
11/06/02	Site inspection; riser from pre-existing treatment pond plugged to allow flow from SP1 to VFP2
11/14/02	“Good catch” grasses/legumes, forebay discharging, no discharge from VFP1 pipe staining indicates previous discharge, pre-existing pond discharging to VFP2, no discharge from VFP2 with water level below surface of compost, no final effluent; DEP insp. (T. Elicker)
11/26/02	Scope of Work and Budget change request submitted
12/02/02	Scope of Work and Budget change request approved by PA DEP Knox DMO
12/05/02	Reimbursement request submitted to PA DEP Knox DMO
12/06/02	Site inspection; tightened valves

12/11/02	Snow covered; VFP1 discharging thru 4 of 8 pipes; pre-existing pond discharging to VFP2; no discharge from VFP2; no final effluent; DEP insp. (T. Elicker)
12/12/02	Site inspection; water monitoring
12/24/02	VFP1 (6 of 8 pipes discharging) to SP1 to VFP2 (2 of 6 pipes discharging; 1 flush pipe leaking) to SP2 to HFLB ~5 gpm final effluent; DEP insp. (T. Elicker)
01/13/03	Quarterly Report submitted
02/---/03	"De Sale Phase III Construction Completed...And A Lovely Day For Boating" article in SRWC monthly newsletter, *The Catalyst*
03/10/03	Site inspection; water monitoring
03/14/03	VFP1 (7 of 8 pipes discharging) to SP1 to VFP2 (5 of 6 pipes discharging) to SP2 to HFLB ~40 gpm final effluent; water sampling; DEP insp. (T. Elicker)
04/03/03	Grant extension request submitted to and approved by PA DEP Knox DMO
04/17/03	Quarterly Report submitted
04/24/03	Site inspection; water sampling; SP2 baffle curtain installed; VFP1 & VFP2 outlet pipes leveled
05/02/03	Final effluent ~10 gpm; field pH 7; SP2 baffle curtain installed; DEP insp. (T. Elicker)
06/—/03	"Watershed Academy Visits SRWC Sites" article in SRWC monthly newsletter, *The Catalyst*
06/17/03	Discharges collected in pre-existing pond and CD to forebay to VFP1 (8 of 8 pipes discharging) to SP1 to VFP2 (6 of 6 pipes discharging) to SP2 to HFLB 12 gpm final effluent; water sampling; good growth of grasses and cover crop with clover & trefoil starting; DEP insp. (T. Elicker)
06/25/03	Site inspection; water sampling
06/30/03	Site inspection; water monitoring
07/10/03	Quarterly Report submitted
08/28/03	Site inspection; water sampling; school of fish observed in Seaton Creek at Mcjunkin Road
09/04/03	Site inspection;
09/11/03	Discharges collected in pre-existing pond and CD to forebay to VFP1 (8 of 8 pipes discharging) to SP1 to VFP2 (6 of 6 pipes discharging) to SP2 to HFLB 10 gpm final effluent; water sampling; good growth of grasses and legumes; DEP insp. (T. Elicker)
10/15/03	Quarterly Report submitted
10/29/03	Site inspection; water monitoring
10/30/03	Discharges collected in pre-existing pond and CD to forebay to VFP1 (8 of 8 pipes discharging) to SP1 to VFP2 (6 of 6 pipes discharging) to SP2 to HFLB 12 gpm final effluent; water sampling; good growth of grasses and legumes; silt fence to be removed; DEP insp. (T. Elicker)
12/---/03	"Fish in Seaton Creek" Photo of the Month in SRWC monthly newsletter, *The Catalyst*
01/14/04	Quarterly Report submitted
03/24/04	Site inspection; water monitoring
03/29/04	Flushing of VFP1 & VFP2 top pipe tiers; VFP1 & VFP2 bottom tier outflow pipes adjusted
03/30/04	Both VFPs recently flushed and discharging thru bottom tier piping; final effluent 20 gpm; water sampling; site well vegetated; silt fence to be removed; DEP insp. (T. Elicker)
04/01/04	Quarterly Report submitted
04/09/04	Site inspection; field water monitoring
04/16/04	Site included in 9th Annual SRWC Symposium field tour; visitors from Brazil, Venezuela, Korea, MT, WV, PA
04/28/02	Site inspection; field water monitoring
05/---/04	"9th Annual SRWC Symposium an International Flare!" article in SRWC monthly newsletter, *The Catalyst*
05/25/04	Site inspection; field checked As-builts; final effluent field pH 6.8
06/24/04	Repair of broken valve; Installation of site sign

PROJECT DESCRIPTION

Introduction

In northern Butler County in western Pennsylvania, coal mining has been conducted in a 27-square mile area of the Slippery Rock Creek headwaters for over 100 years. Mining towns 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 effects 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 Creek 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 PA DEP, Knox District Mining Office (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.

Based on the 1998 Comprehensive Mine Reclamation Strategy Report (CMRS) by the Pennsylvania Department of Environmental Protection, Knox District Mining Office, De Sale was one of the areas (Priority Area 5) most heavily impacted by abandoned mines within the headwaters. Seaton Creek (stream # 34751; segment #4571), the receiving stream for this area, was assigned a high priority for restoration due to these impacts [1998 PA DEP 303(d) list].

About 100 acres of pre-act surface coal mining (including coal refuse disposal) activities on the Middle Kittanning coalbed (Kittanning Fm.; Allegheny Gp.) surrounded the two unnamed tributaries, which form the northeastern uppermost reaches of Seaton Creek. The easterly, unnamed tributary is substantially improved by a passive treatment system (online 5/26/00) at the De Sale Phase I restoration area. This system and the extensive education and public outreach efforts were funded through the Commonwealth's "Reclaim PA" initiative and matching/in-kind contributions. (Refer to De Sale Phase I Final Report, July 2000.) The westerly, unnamed tributary is improved by a passive treatment system (online 9/28/00) at the De Sale Phase II restoration area. Funding for De Sale II was received through the PA DEP "Growing Greener" initiative and again through substantial participant contributions. De Sale Phase II treats, except during high flow events, the entire westerly watercourse, whose contributory drainage area is dominated by degraded seeps from pre-1977 abandoned surface mining activities. (Refer to De Sale Phase II Final Report, June 2002.)

The De Sale Phase III restoration efforts are addressed in this final report. Funding was received through the PA DEP "Growing Greener" initiative, Butler County Commissioners, Western PA Watershed Program, and other participant in-kind services

and donations. The De Sale Phase III passive system treats two additional discharges and other seepage that emanate from an old surface mine on the Middle Kittanning coalbed.

Completion of these three phases combined with the stream improvements associated with the reclaimed Abel/Dreshman (Chernicky site) and passive systems at Goff Station and, recently completed, Erico Bridge project areas are predicted to substantially improve the water quality throughout the entire length of Seaton Creek to the confluence with the main branch of Slippery Rock Creek.

Mining History

A surface coal mine operation (MDP #10800122) on the Middle Kittanning coalbed was previously conducted by the former Pengrove (Adobe) Coal Company that resulted in two post-mining discharges. The discharges were actively treated with approximately 20 (50 lb) bags of soda ash briquettes per day while the company was operating. According to a Hyrdogeologic Investigation Report by the PA DEP Knox DMO completed in 1994, the calculated total annual cost to operate the system was $38,000 per year with an estimated bond amount needed for perpetual active treatment at 1.6 million dollars.

According to the Slippery Rock Creek Watershed CMRS, the discharges associated with this site were responsible for 26% of the iron load and 7% of the acid load, which enters Seaton Creek from the De Sale Priority Area. (See Table I below for pre-construction discharge characteristics.)

Table I. Pre-Restoration Drainage Characteristics

Sample Point	Flow	pH	Acidity	Iron	Manganese	Aluminum	Sulfates
10A	4	3.1	406	73	83	3	963
10B	2	4.2	744	197	137	21	1917
10C	12	3.4	293	24	72	9	1040

Sample points 10A and 10B are untreated AMD discharges. Sample point 10C is the combined drainage at the effluent of the pre-existing treatment ponds. Based on discrepancies in flow and sulfate concentrations, it is assumed that additional water was entering the system. Average values; flow rate in gallons per minute; pH measured in standard units (s.u.); average pH not calculated from H-ion concentrations; acidity in mg/L of $CaCO_3$; iron, manganese and aluminum are total metal concentrations in mg/L; sulfates in mg/L;

Site Location

Phase III is located in Venango Township, Butler County along State Route 58 about 2 miles west of Eau Claire, PA. The passive system was constructed on the property of Howard and Florence Meyer. There is currently no residence on the property. The site is located on the 7½‘ USGS Eau Claire topographic map (PR1979) at latitude 41° 08’ 29” and longitude 79° 50’ 21”. (Refer to Location Map.)

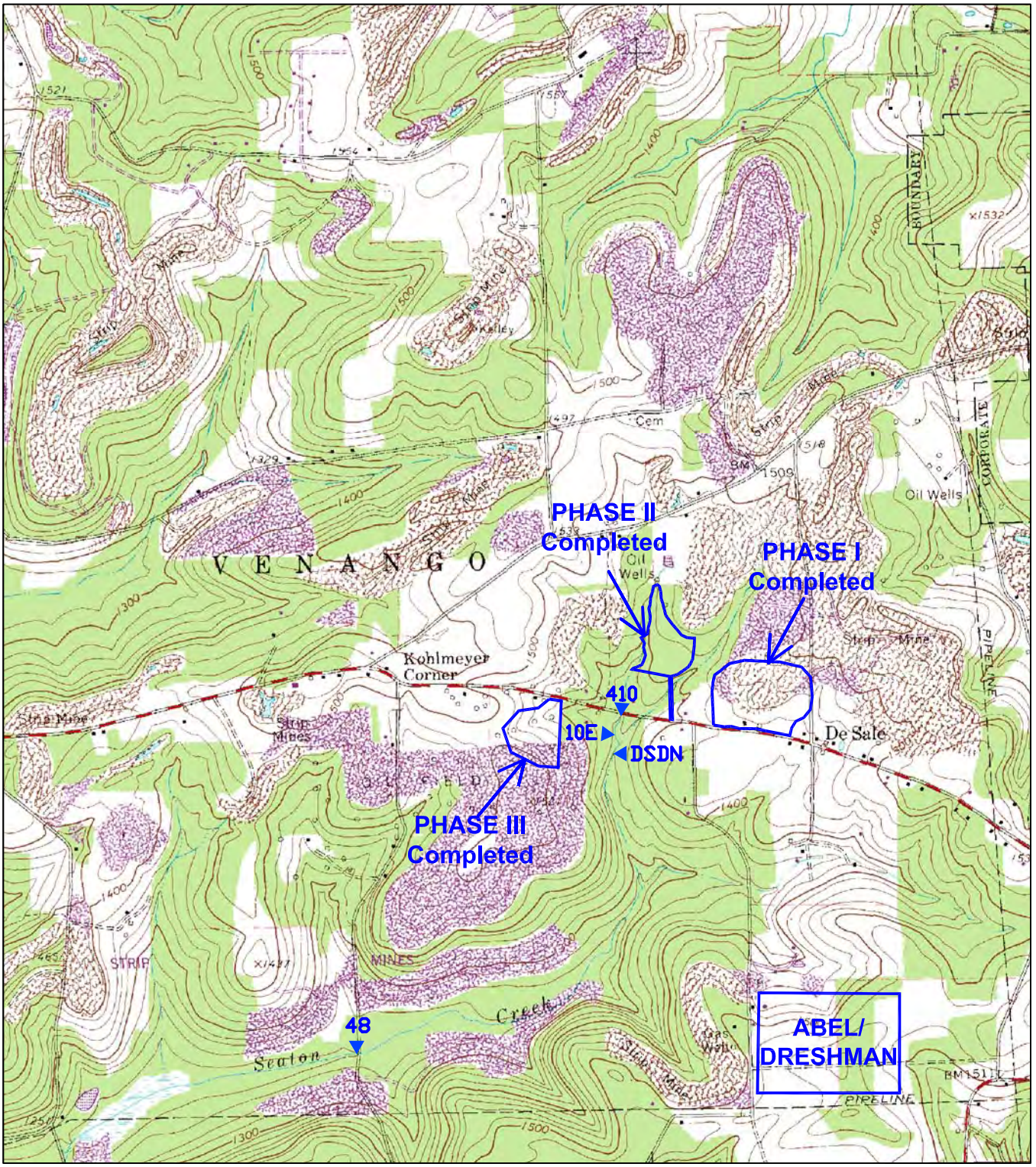


FIGURE 1: PROJECT LOCATION - USGS 7.5' EAU CLAIRE, PA (PR1979)
DE SALE RESTORATION AREA - PHASE I, PHASE II, AND PHASE III

Slippery Rock Watershed Coalition
Venango Township, Butler County, PA
Stream Restoration Incorporated
June 2004, Scale 1" = 2000'

Site Preparation

Erosion and Sediment Pollution Controls were installed upon completion of a written plan. Controls included a diversion ditch upgradient and silt fence downgradient of the earth disturbance activities. Requirements for a water obstruction and encroachment permit were waived under Pennsylvania Code Title 25, Chapter 105.12(a)(15). Amerikohl Mining, Inc. addressed the road bond and highway occupancy permit requirements. Passive system design plans were completed by BioMost, Inc. and WOPEC and submitted to the PA DEP, Knox District Mining Office. PA One Call relating to underground utility locations was contacted. The site of the passive treatment system was cleared and grubbed.

Passive Treatment System Installation

The passive treatment system installed at De Sale Phase III consists of the following nine components in series **(See plans and photo section.)**:

1. Collection Pond (Pre-existing Pond #1)
2. Collection Ditch
3. Forebay
4. Vertical Flow Pond 1
5. Flush Pond
6. Settling Pond 1 (Pre-existing Pond #2)
7. Vertical Flow Pond 2
8. Settling Pond 2 (Pre-existing Pond #3)
9. Horizontal Flow Limestone Bed

Spent mushroom compost was placed in the Vertical Flow Ponds in a layer directly overlying the limestone aggregate. Limestone aggregate was used in the spillways, Vertical Flow Ponds, and Horizontal Flow Limestone Bed. Quality Aggregates Inc., Boyers Quarry, Boyers, PA is the source of the high-calcium (90% $CaCO_3$), marine, Vanport limestone (Clarion Fm.; Allegheny Gp.) used at the site.

Collection Pond: The Collection Pond (Pre-existing Pond #1) was part of the original soda ash briquette chemical treatment system located on site and collects discharge 10A. The pond was modified by removing the 8-inch PVC discharge pipe on the northeastern corner and by installing a rock-lined spillway on the southeastern corner in order to discharge to the Collection Ditch, that conveys the water to the Forebay.

Collection Ditch: The Collection Ditch dimensions are approximately: 350 feet length; 5 feet bottom width; 21 feet top width; 4 feet total depth (~1 foot water depth with ~3 feet freeboard). This component was installed to collect seeps emanating from a diffuse zone along the toe of spoil. This seep zone was previously collected, in part, by a French drain and monitored as discharge 10B. The ditch conveys the seeps and the 10A discharge from the Collection Pond to the Forebay. A small earthen berm was added to the top outside of the northern edge of the ditch excavation along the parking/access road area as a safety measure.

Forebay: The Forebay receives the combined drainage (10A, 10B, and other seeps) from the Collection Ditch and is primarily used to settle solids prior to entering Vertical

Flow Pond 1. The Forebay dimensions are approximately: 18 feet bottom width; 52 feet top width; 42 feet bottom length; 72 feet top length; 8 feet total depth (~4 feet water depth with ~4 feet freeboard); 2H:1V inside slopes. The principal and only outlet is a riprap spillway that discharges directly into Vertical Flow Pond 1.

Vertical Flow Pond 1 (VFP1): The primary purpose of a Vertical Flow Pond, utilized for drainage containing significant dissolved ferric iron and/or dissolved aluminum, is to neutralize acidity by generating alkalinity. Geotextile was used to line the bottom and sides of the pond to the top of the treatment media. Bedding stone (AASHTO #57, limestone aggregate, ½-foot in thickness) was placed on the geotextile and the lower underdrain piping system was installed. Two feet of AASHTO #1, 90% $CaCO_3$, limestone aggregate was then placed on and around the lower layer of pipes. A second (upper) underdrain similar to the first was installed and a second two-foot layer of limestone aggregate was placed, spread, and leveled. A layer, about ½-foot in thickness, of spent mushroom compost was then spread over the limestone.

The underdrain system was installed with the intention of optimizing flow distribution and flushing effectiveness of accumulated iron and aluminum solids. Two layers of pipes or tiers were installed with each tier divided into 4 quadrants or cells giving a total of 8 cells within the pond. Each cell discharges through an individual adjustable riser. The underdrain was constructed of 4-inch and 6-inch, Schedule-40, Solid-Core, PVC pipe. Perforated, 4-inch, laterals were placed on 4.5-foot centers and connected to a solid header with a pressure-rated tee. Perforations were hand-drilled with two, 5/8-inch perforations approximately 30° from the top of the pipe. The perforation spacing was equal to the lateral spacing (4.5 feet). Four separate header pipes were used for each underdrain; thus, dividing the surface area into, approximately equal, quadrants. Each 6-inch header pipe was extended from the treatment media through the breastwork to an individual 6-inch, cast iron gate valve. Prior to the gate valve, a tee was installed about midway through the breastwork to create a riser, which leads to the primary outlet for that cell. Each outlet included a 4-inch to 3-inch rubber reducer into which a 3-inch riser (1.5-foot section with 3-inch, 90° elbow) was inserted. The reducer was equipped with two, stainless steel, hose clamps. The 4-inch hose clamp fastened the reducer to the 4-inch riser pipe. The 3-inch clamp is used to vertically adjust the 3-inch riser to control the flow rates within each cell.

Flush Pond (FP): The purpose of the Flush Pond is to provide holding capacity for settling of solids from flushing events of Vertical Flow Pond 1. A valved, draw-down device (4-inch diameter) was added in order to have the capability to lower the water level within the pond prior to a flushing or a maintenance event.

Settling Pond 1 (SP1): Vertical Flow Pond 1 is followed by Settling Pond 1 (Pre-existing Pond #2). The pond provides for oxidation and settling of metal solids during normal operation of the system. This pond was part of the original chemical treatment system. Several modifications were made for integration into the passive treatment system. A riprap spillway was added on the southeastern corner to allow flow from VFP1 to enter SP1. A riprap spillway was also added to the northwestern corner to convey flow from SP1 to Vertical Flow Pond 2. Flow, however, could not be conveyed to VFP2 until the pre-existing 12” riser, that conveyed water from this pond to Pre-existing Pond #3, was

plugged. This was accomplished by mixing cement in 5-gallon buckets, transporting the buckets in a small aluminum boat (in-kind contribution by Beran Environmental, Inc.) to pour the cement inside the riser. Once the riser was plugged, the water level in the pond began to rise which allowed SP1 to discharge via rock-lined spillway into VFP2.

Vertical Flow Pond 2 (VFP2): As the mine water was severely degraded, a second Vertical Flow Pond in series was necessary. It serves the same function as VFP1. The design of VFP2 is similar to VFP1 except there are only 3 cells in each tier for a total of 6 cells and 6 discharge pipes. The outlet pipes discharge into a spillway to Settling Pond 2. A small earthen berm was added to the top outside western edge of the pond excavation along the access road area as a safety measure.

Settling Pond 2 (SP2): Vertical Flow Pond 2 discharges to Settling Pond 2 (Pre-existing Pond #3). The pond provides for oxidation and settling of metal solids during normal system operation and holding capacity for settling solids from VFP2 flushing events. This pond was part of the original chemical treatment system. The pond required modification for integration into the passive treatment system. A rock-lined spillway was added to convey flow from SP2 to the Horizontal Flow Limestone Bed. In addition, a directional, curtain-type, baffle was placed lengthwise across SP2 to discourage short-circuiting, especially with proximity of the influent to the effluent spillways.

Horizontal Flow Limestone Bed (HFLB): As much of the alkalinity generated by the VFPs is consumed through the precipitation of metals, the primary function of the Horizontal Flow Limestone Bed is to provide an alkalinity “boost” before discharging to the stream. A secondary function, which has received national interest, is the ability of the HFLB to remove manganese. Removing dissolved manganese by active chemical treatment is traditionally problematic due to the high pH requirement. With this component, however, high pH does not appear to be needed, probably due to several factors including establishment of substrate, low concentrations of dissolved iron, availability of dissolved oxygen, bacteriological activity, and other factors.

Water, conveyed from SP2 to the HFLB through a rock-lined spillway, is encouraged to flow horizontally through the limestone aggregate (~5 feet in thickness) to a perforated header along the opposite end near the base of the component. The water in the header is conveyed in a 6” pipe bedded in AASHTO#57 river gravel. A riser pipe extends to within one foot of the top of the limestone, the design water level. The final effluent then flows in a riprap-lined spillway to an unnamed watercourse.

Sludge Pond Reclamation

In addition to the passive treatment system installation, a sludge-drying pond, part of the old chemical treatment system, was regraded to approximate original contour and seeded with grasses and legumes.

Land Reclamation

After collecting the severely degraded water, a ~2-acre “kill zone” was respread with soil material and revegetated with grasses and legumes.

PASSIVE TREATMENT SYSTEM PERFORMANCE

Drainage Treatment

Completed in September 2002, the De Sale Phase III passive treatment system began discharging in December 2002. In addition to monitoring by BioMost Inc. and the PA DEP, sampling has been conducted by Grove City College.

Even though monitored for the last 18 months, the results must be considered preliminary when considering a 25-year system design life. Table II identifies the preliminary influent and effluent characteristics through each component.

Table II. Drainage Quality through De Sale Phase III Passive Treatment System

Component	Component Effluent							
	Flow	pH (field)	Alkalinity (field)	Acidity	Fe	Mn	Al	Sulfate
Collection Pond (raw)	NM	3.14	0	393	90	90	1	1760
Collection Ditch (raw)	NM	3.20	0	583	102	103	20	1647
Forebay (raw)	NM	3.26	0	558	113	119	26	2823
VFP1	14	5.16	55	211	39	102	6	2212
SP1	NM	4.82	10	166	9	76	5	1875
VFP2	19	6.41	62	72	4	73	1	1818
SP2	NM	6.83	61	70	1	68	1	1936
HFLB (final)	19	6.84	62	54	<1	67	<1	1338

Average values - sample set 6 or 7; flow in gpm; not measured (NM); lab pH not averaged from H-ion concentrations; alkalinity, acidity, and dissolved metals expressed in mg/L; (See attached analyses.)

Overall, the system appears to be working well, especially in comparison to the severe degradation of the untreated raw mine drainage which can be characterized as being very acidic (558 mg/L acidity) with very high concentrations of dissolved iron and manganese (113 mg/L and 119 mg/L, respectively) and relatively high concentrations of dissolved aluminum (26 mg/L). The final effluent of the system which discharges from the Horizontal Flow Limestone Bed (HFLB) can be described as circum-neutral, (6.84 pH) alkaline water (62 mg/L alkalinity) with measured acidity (54 mg/L) reflecting the dissolved manganese concentration. At <1 mg/L, the dissolved iron and aluminum have been successfully removed from the drainage with dissolved manganese concentrations decreased by over 40% to 67 mg/L. The acidity remaining in the discharge of the system is “potential” acidity, generated as dissolved manganese hydrolyzes.

Based upon comparison of sulfate concentrations and flow measurements both before and after installation of the passive system, there appears to be additional less severely polluted water entering the system possibly through Settling Pond 1 that dilutes the drainage. Due to the influx of this additional water, a more accurate depiction of water quality improvement as a direct result of the passive system can be best described through an evaluation of pollutant loadings in pounds per day. (See Table III below.)

Table III. Loadings through De Sale Phase III Passive Treatment System

Component	Alkalinity (field)	Acidity	Fe	Mn	Al
Collection Pond (raw)	0	46.9	13.3	10.2	0.1
Forebay (raw)	0	88.0	19.0	18.6	3.7
VFP1	2.6	36.6	6.2	15.1	1.1
SP1	0.9	36.4	3.1	14.0	1.2
VFP2	9.3	18.0	0.9	15.5	0.5
SP2	8.0	18.9	0.2	15.0	0.5
HFLB (final)	11.2	11.6	0.1	12.7	0.04

Average values in pounds per day; iron, manganese, and aluminum loadings calculated from dissolved metal concentrations

As can be seen from the loadings table by comparing the raw water (Forebay effluent) with that of the final discharge (HFLB effluent), on average the system is removing 76 lbs/day of acidity, 19 lbs/day of iron, 6 lbs/day of manganese, and nearly 4 lbs/day of aluminum. This equates to 27,900 lbs/year of acidity; 6,900 lbs/year of dissolved iron; 2,100 lbs/year of dissolved manganese; and 1,300 lbs/year of dissolved aluminum.

Function of Individual Components

Collection Pond and Collection Ditch: The Collection Ditch conveys the raw water from the Collection Pond (DEP sample point 10A) and intercepts additional more severely degraded seeps (DEP sample point 10B) and conveys the combined flow to the Forebay.

Forebay: Based upon other successful passive systems, a slight decrease in metal concentrations probably occurs within the component due to oxidation and/or settling caused by a decrease in water velocity. A decrease in metal concentration, however, has not been documented as influent (outlet of Collection Ditch) and effluent samples were not regularly collected.

Vertical Flow Pond 1: Vertical Flow Pond 1 (VFP1) has been successfully functioning with a performance comparable to similar systems constructed in western Pennsylvania. Over 51.4 lbs/day (nearly 60% of the total loading) of acidity are being neutralized and over 19 lbs/day (45% of total loading) of metals are being retained within the system. On average, there is a decrease in the dissolved iron concentration by approximately 66% and a decrease in aluminum concentration by over 75%. There also appears to be a decrease in manganese concentration by about 14%.

Settling Pond 1: Settling Pond 1 (SP1) is removing approximately 3 lbs/day of dissolved iron and 1 lb/day of dissolved manganese. This accounts for approximately 16% and 5% of the total dissolved iron and manganese loadings, respectively. On average, there is a 76% decrease in dissolved iron concentrations, a 25% decrease in dissolved manganese concentrations, and 17% decrease in dissolved aluminum concentrations by VFP1 and SP1. A portion of the decrease in metals in this component is probably due to dilution especially the manganese and aluminum concentrations.

Vertical Flow Pond 2: Vertical Flow Pond 2 (VFP2) has been successfully functioning, neutralizing about 18 lbs/day (21% of the total loading) of acidity and retaining about 3 lbs/day (7% of total loading) of metals. At this stage in the system, on average, there has been a decrease in the dissolved iron concentration by approximately 56% and a decrease in aluminum concentration by 80%.

Settling Pond 2: Settling Pond 2 (SP2) is removing approximately 0.7 lbs/day of dissolved iron and 0.5 lbs/day of dissolved manganese. This accounts for only about 4% and 3% of the total dissolved iron and manganese loadings, respectively. On average, there is a 75% decrease in dissolved iron concentrations and a 7% decrease in dissolved manganese concentrations from VFP2 to SP2. Essentially no significant decrease in aluminum has been observed.

Horizontal Flow Limestone Bed: Horizontal Flow Limestone Beds have been installed both at De Sale Phase I and Phase 2. The HFLBs in both instances are successfully removing dissolved manganese and adding alkalinity to the mine drainage. At De Sale Phase III, on average, however, the alkalinity in the HFLB effluent is about the same as the influent, although the acidity decreases by about 16 mg/L. The HFLB is neutralizing 7 lbs/day of acidity and removing about 0.1 lbs/day of iron and 2 lbs/day of manganese. The noticeable improvement in water quality appears to be associated with a decrease in sulfates. The flow may be supersaturated with respect to gypsum, which may be precipitating. Manganese removal may be inhibited by lack of dissolved oxygen, lack of nutrients necessary for microbial activity, gypsum coating, presence of ferrous iron (not supported by sample analyses), or other processes. Although some manganese is removed, on average, nearly 70 mg/L of dissolved manganese remain in the final effluent. Based on the available water monitoring data, the dissolved iron concentration of the drainage entering the HFLB is sufficiently depleted to encourage the formation of manganese solids. One distinguishing difference between this HFLB and others is that the HFLB is not preceded by a wetland. The wetland component at other systems may be a source for nutrients and dissolved organic matter necessary for microbial metabolism or might even be a source of the microorganisms (Art Rose, PhD, Geochemist, 2004, personal communication). This assumes that the process is predominantly biological. Project partners have discussed the possibility of “seeding” or inoculating the HFLB with substrate/effluent from De Sale I and/or II component in order to “culture” a manganese-oxidizing microbial population. Monitoring dissolved oxygen may also aid in understanding the function of the system.

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

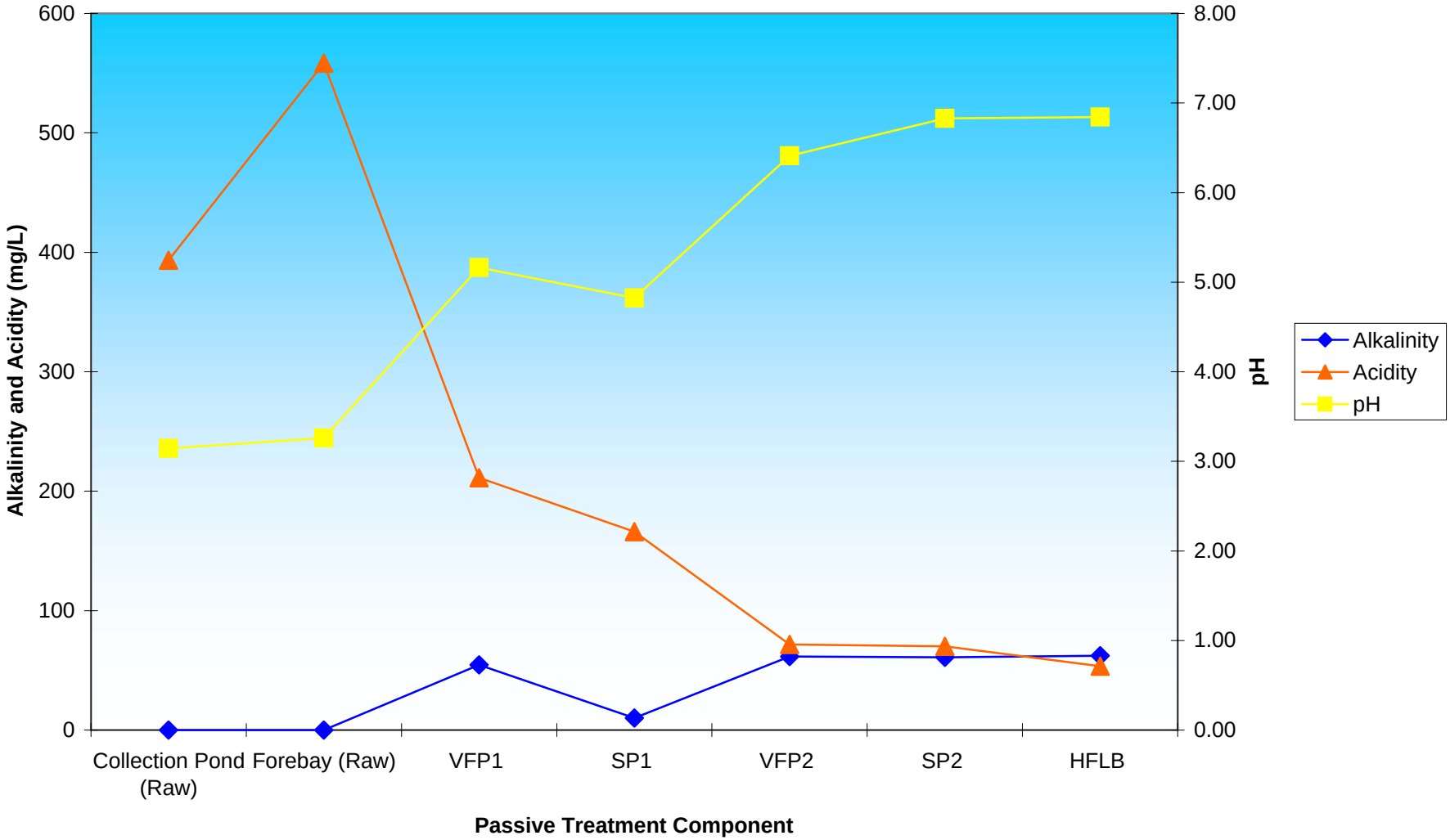


Figure 2.

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

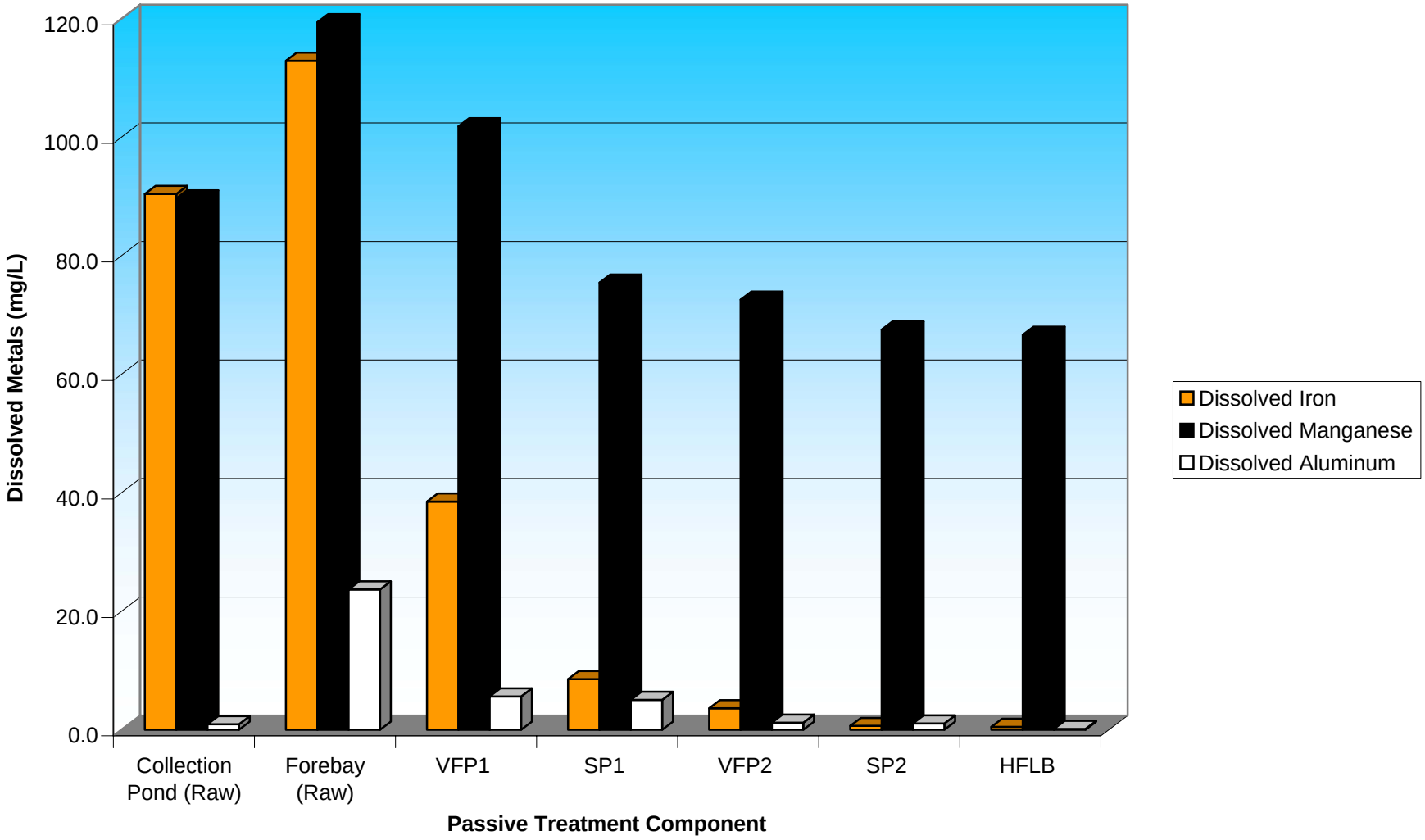


Figure 3.

Comparison of Loadings Through the Passive System in Pounds Per Day

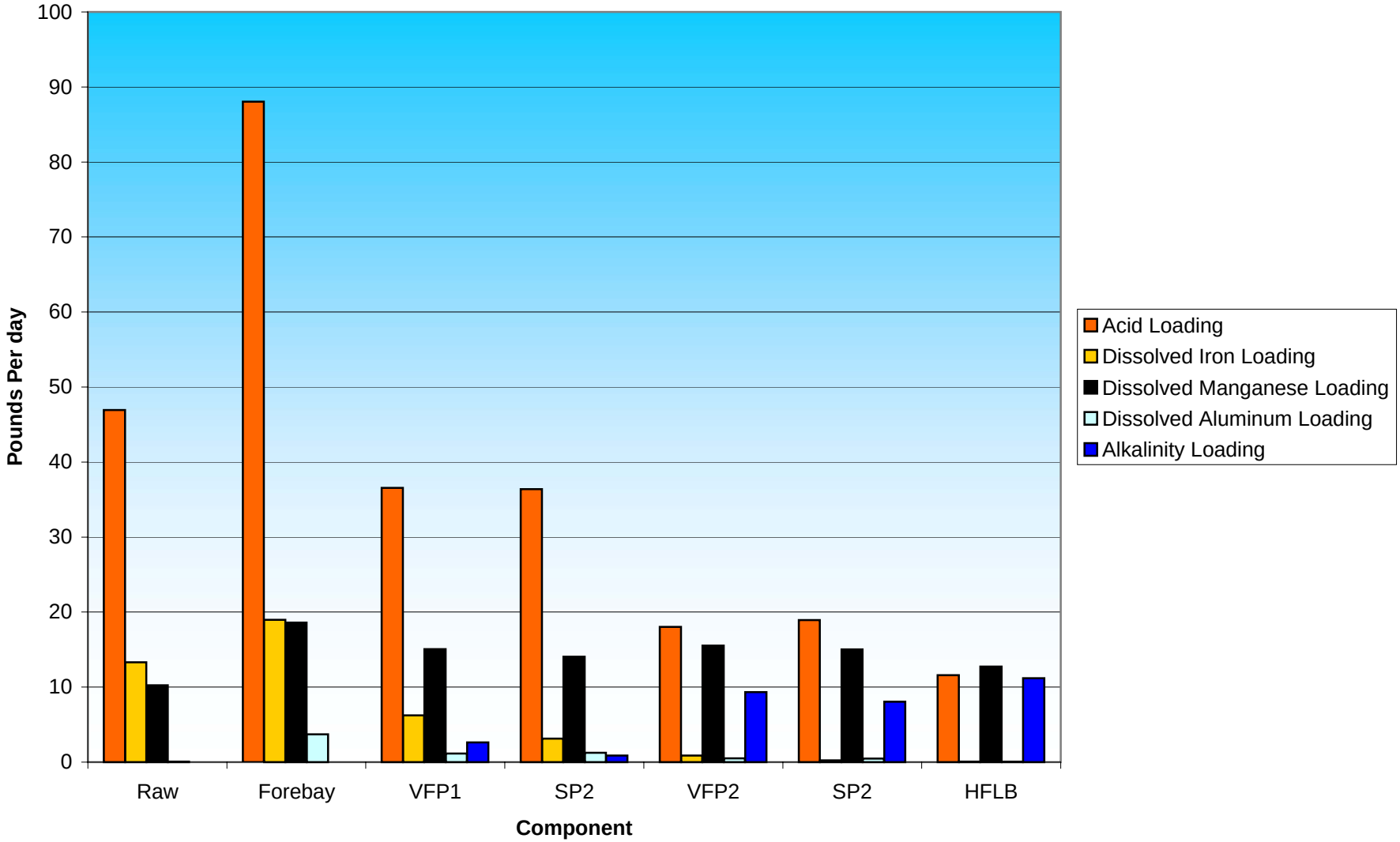


Figure 4.

"Stacked" Comparison of Pollutant Loadings Through the Passive Treatment System in Pounds Per Year

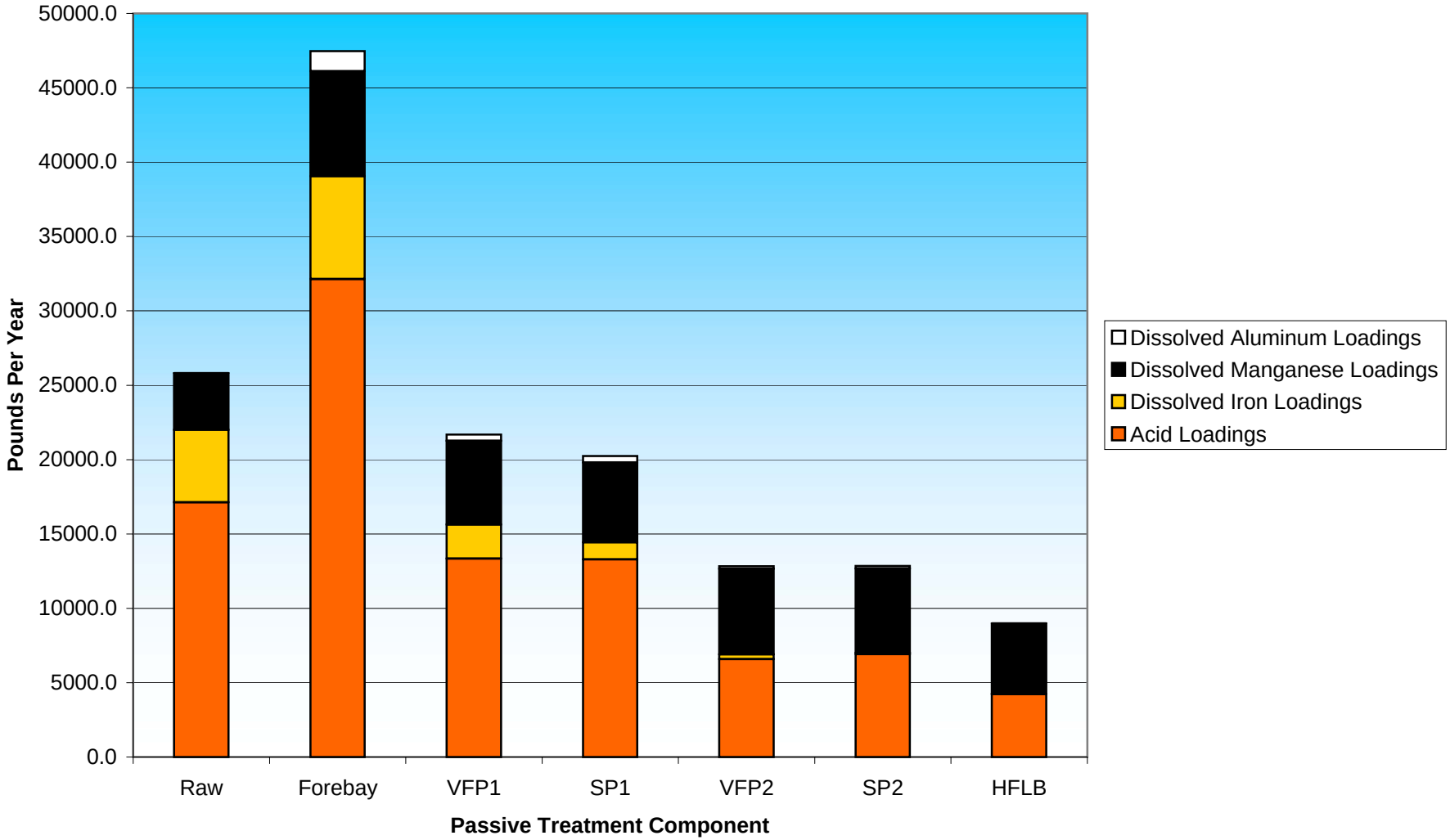


Figure 5.

MEASURABLE ENVIRONMENTAL RESULTS

Site Drainage Quality Improvement

Based on the water quality data collected by various project partners, the De Sale Phase III passive system is successfully treating the mine drainage at the site. The entire system was first noted to be discharging in December 2002. Water monitoring to date has included the raw untreated water and passive treatment components. The average water quality for the raw (untreated) mine drainage and the final effluent of the passive system is presented in Table IV below.

Table IV. Discharge Quality "Before and After"

Sample	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum
Raw (Forebay effluent)	3.26	0	558	113	119	24
Treated (HFLB effluent)	6.84	62	54	<1	67	<1

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

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 Seaton Creek annually:

- 27,900 lbs/year of acidity
- 7,400 lbs/year of total iron
- 2,300 lbs/year of total manganese
- 1,400 lbs/year of total aluminum

Stream Quality Improvement

As previously noted, three passive systems have been installed and ~63 acres of abandoned mine lands have been reclaimed within the uppermost reaches of Seaton Creek.

Name	Description	Completion Date
Chernicky (Abel-Dreshman)	55 ac. reclaimed with CFB coalash	1998/09/---
De Sale Phase I (DS1)	8 ac. reclaimed with CFB coalash; passive system installed	2000/05/10
De Sale Phase II (DS2)	passive system installed	2000/08/29
De Sale Phase III (DS3)	passive system installed	2002/09/11

As can be observed on the Location Map, the Chernicky Land Reclamation project is located downstream of all De Sale restoration projects and below the confluence of the eastern and western unnamed tributaries. The eastern unnamed tributary is the receiving stream for De Sale Phase I. The western tributary is the receiving stream for De Sale Phase II and III passive systems. (DS2 is upstream of DS3.)

Table V. Stream Water Quality "Before and After"

Sample Point #	Location	De Sale Priority 5 Projects Completed	pH (lab)	Alk (lab)	Acd	Fe	Mn	Al
410 (23; 10D)	Western tributary; below DS2 & above DS3	None	3.6	1	165	8	38	7
		DS2	6.3	49	12	2	22	2
10E	Western tributary; below DS2 & 3	DS2 (pre-DS3)	5.7	22	56	2	26	4
		DS2, DS3	6.3	25	9	1	15	1
48	Seaton Creek; below DS1, 2, 3, Chernicky	None	4.8	10	58	1	16	4
		DS1, 2, Chernicky (pre-DS3)	6.4	27	7	1	9	<1
		DS1, 2, 3, Chernicky	6.4	16	3	<1	8	<1

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

Notes:

- Sample point 410, which is also known as DEP sampling point 23, is located at the culvert along State Route 58 which is upstream of the De Sale Phase III system and downstream about 500 feet from the De Sale Phase II passive treatment system effluent.
- Sampling point 10E is the unnamed westerly tributary to Seaton Creek (downstream of sample point 410) collected below where the discharge from De Sale III enters and upstream of the confluence with the easterly tributary. Collected data is from PA DEP.
- Sampling point 48 is located on Seaton Creek at the bridge on McJunkin Road about 1½ miles downstream of the De Sale passive systems. Collected data is from PA DEP and other project partners.

Passive Treatment System: The final effluent can be characterized as an alkaline-manganese discharge with low concentrations of iron and aluminum. The total iron and aluminum concentrations meet standard surface mine permit effluent limits. On average, the system is neutralizing about 76 lbs/day of acidity and preventing about 28 lbs/day of metals from entering the unnamed tributary to Seaton Creek.

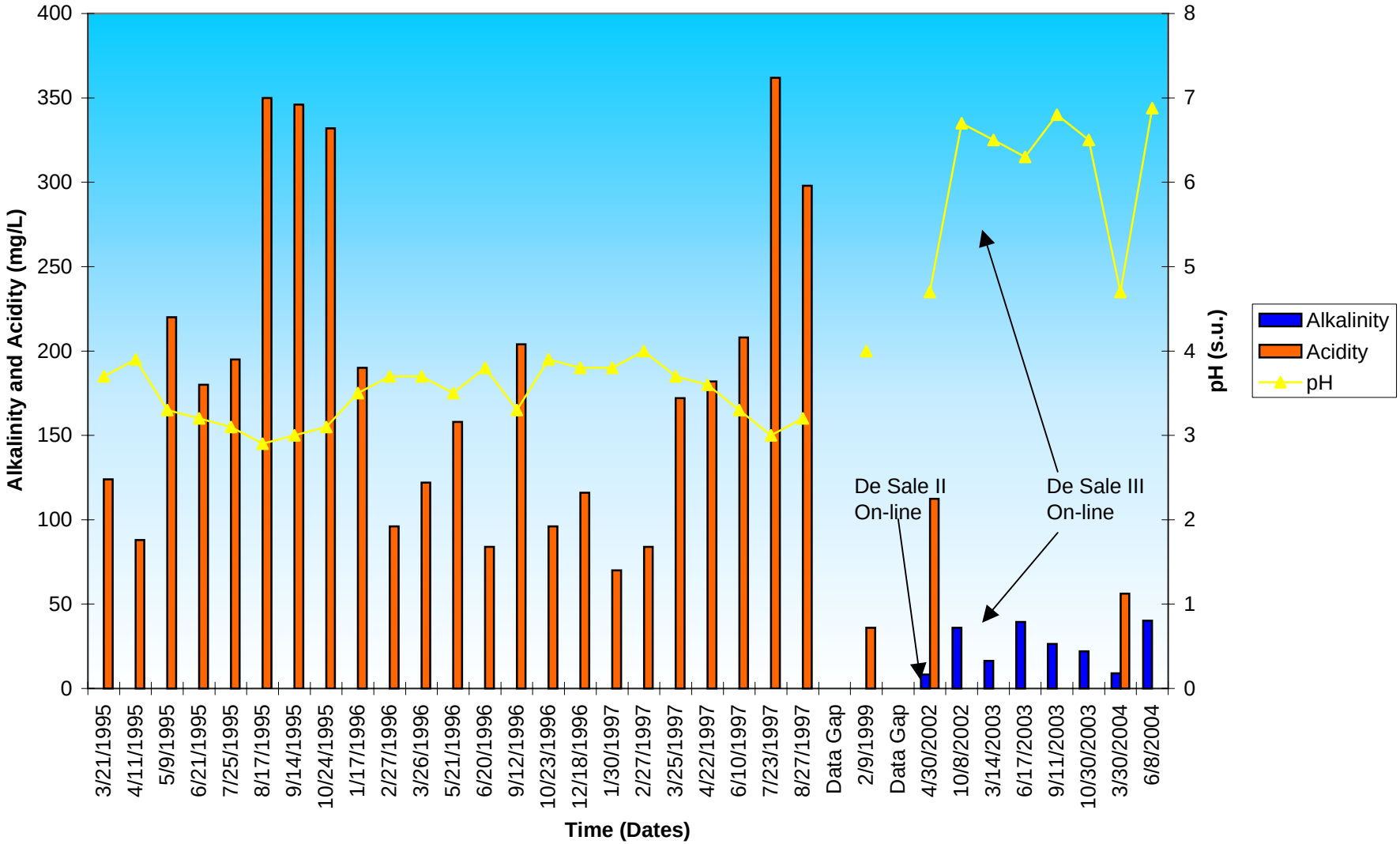
Impact Upon Receiving Stream: As the discharges 10A and 10B contribute significantly to the flow of the westerly unnamed tributary (receiving stream) to Seaton Creek the impact to the stream was practically instantaneous once the mine drainage was turned into the treatment system as can be seen by both Table V above and the accompanying graphs for sample point 10E. The stream, which had been an acidic, low pH, iron-aluminum-manganese-laden watercourse, is now circum-neutral, containing significantly lower concentrations of metals.

Collective Impact Upon Seaton Creek: The De Sale Phase I, II, and III passive treatment systems along with the land reclamation of the Chernicky (Abel-Dreshman) site have significantly improved the water quality of Seaton Creek. Seaton Creek sample point 48 is located at the bridge along McJunkin Road. The point is downstream of the De Sale Restoration Area and upstream of the Erico Bridge Restoration Area. As can be seen from Table V the water quality improved significantly after the completion of Chernicky and the installation of De Sale Phases I and II. Again

the impact was almost instantaneous, changing from a deteriorated acidic low pH, metal-laden, stream to an alkaline low-metal stream. (See Table V and attached graphs.) Fish surveys conducted in late summer of 2001 and 2002 revealed that fish are now present in this section of Seaton Creek. Previous aquatic surveys by Grove City College students indicated that there were essentially no macroinvertebrates and no fish. With the installation of the De Sale Phase III system there appears to be minor improvement to Seaton Creek at sample point 48 (See Table V and attached graphs.) in the overall averaged data.

Continued water monitoring of the systems and receiving is necessary to document the long-term effectiveness of passive technology to treat mine drainage. An annual electro-fishing and macroinvertebrate survey program is being developed, contingent on available resources, to document the sustainability of biological and substrate recovery of these streams.

Comparison of pH, Alkalinity, and Acidity at Stream Sampling Point 10E Over Time



"Stacked" Comparison of Total Metal Concentrations at Stream Sampling Point 10E Over Time

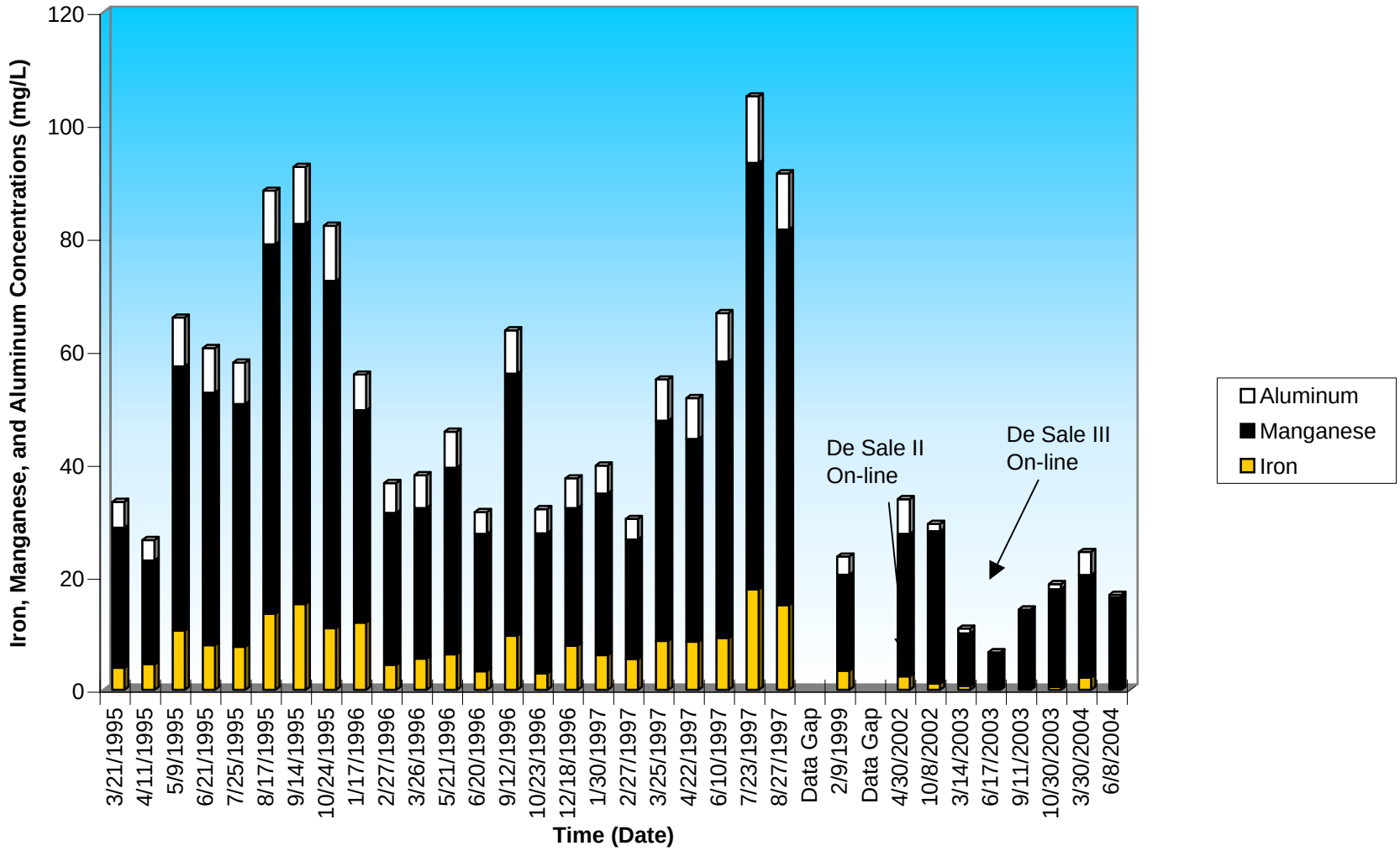
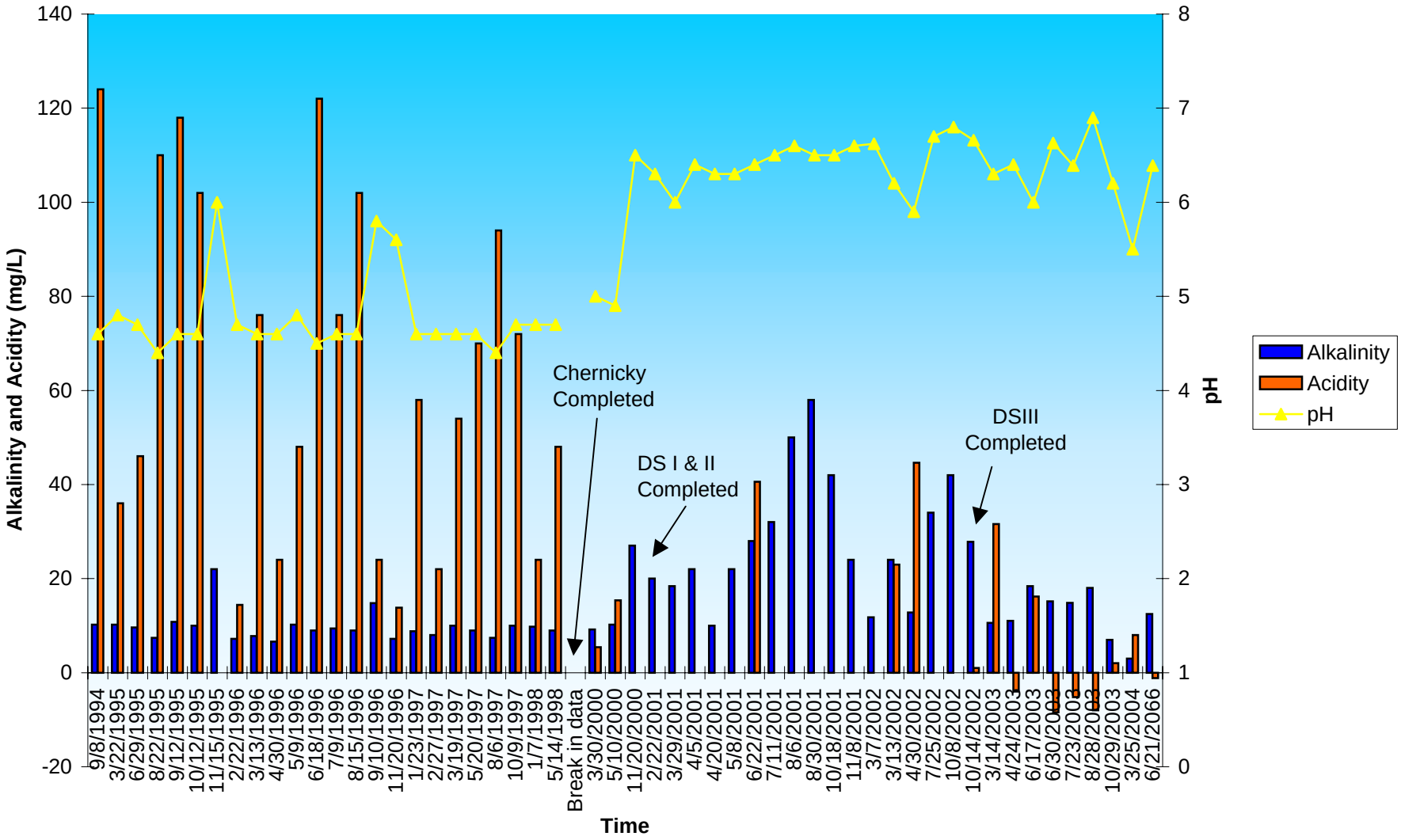
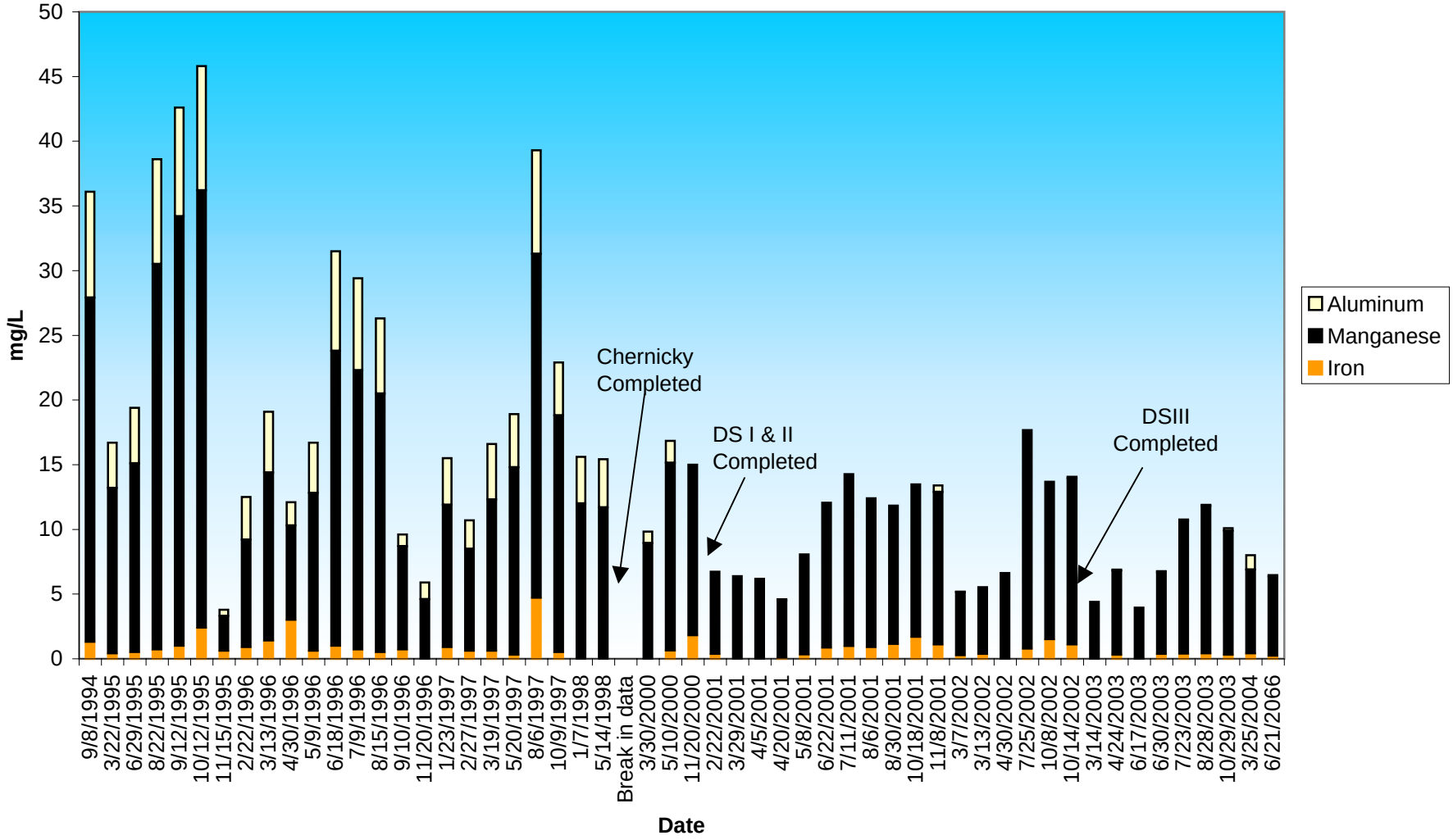


Figure 7.

Comparison of pH, Alkalinity, and Acidity of Seaton Creek at McJunkin Road Over Time



"Stacked" Comparison of Total Metal Concentrations of Seaton Creek at McJunkin Road Over Time



A surface coal mine operation previously conducted by the former Pengrove (Adobe) Coal Company resulted in two post-mining discharges **(Above)** which were actively treated while the company was operating **(Below)**.

View of a portion of the “kill zone” associated with a diffuse seep zone in the foreground and sludge drying ponds in the background **(Top).** The mine drainage from the site entered one of the unnamed headwater tributaries of Seaton Creek **(Below).**

The passive treatment system was designed by BioMost, Inc., and constructed by Amerikohl Mining, Inc. The installation of the collection ditch can be seen in both the top and bottom photos.

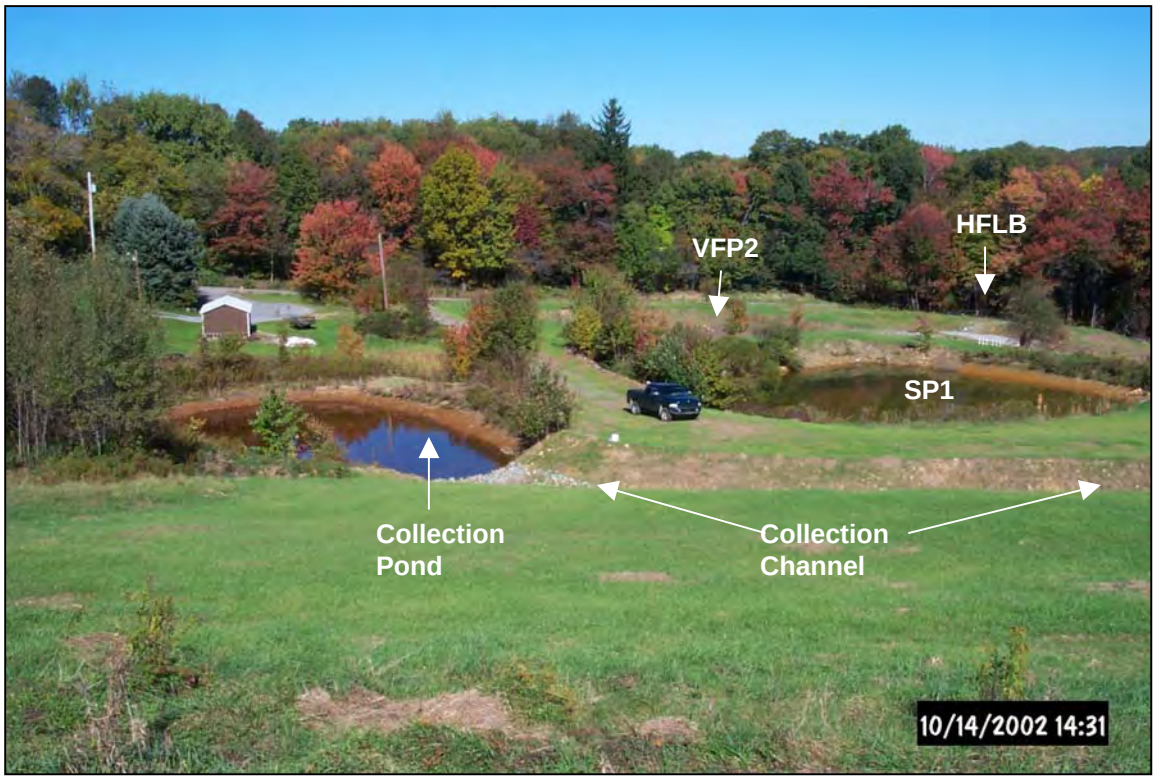
The lower tier of pipes were bedded in stone in Vertical Flow Pond 1 **(Above)**. Construction of the basin for the Horizontal Flow Limestone Bed **(Below).**

View of the De Sale Phase III passive system under construction **(Above)**. To the left, an excavator is digging the collection ditch. In the center is Vertical Flow Pond 1. To the right is a dozer constructing the basin for the Horizontal Flow Limestone Bed. During construction several unknown buried pipes were discovered **(Below)**.

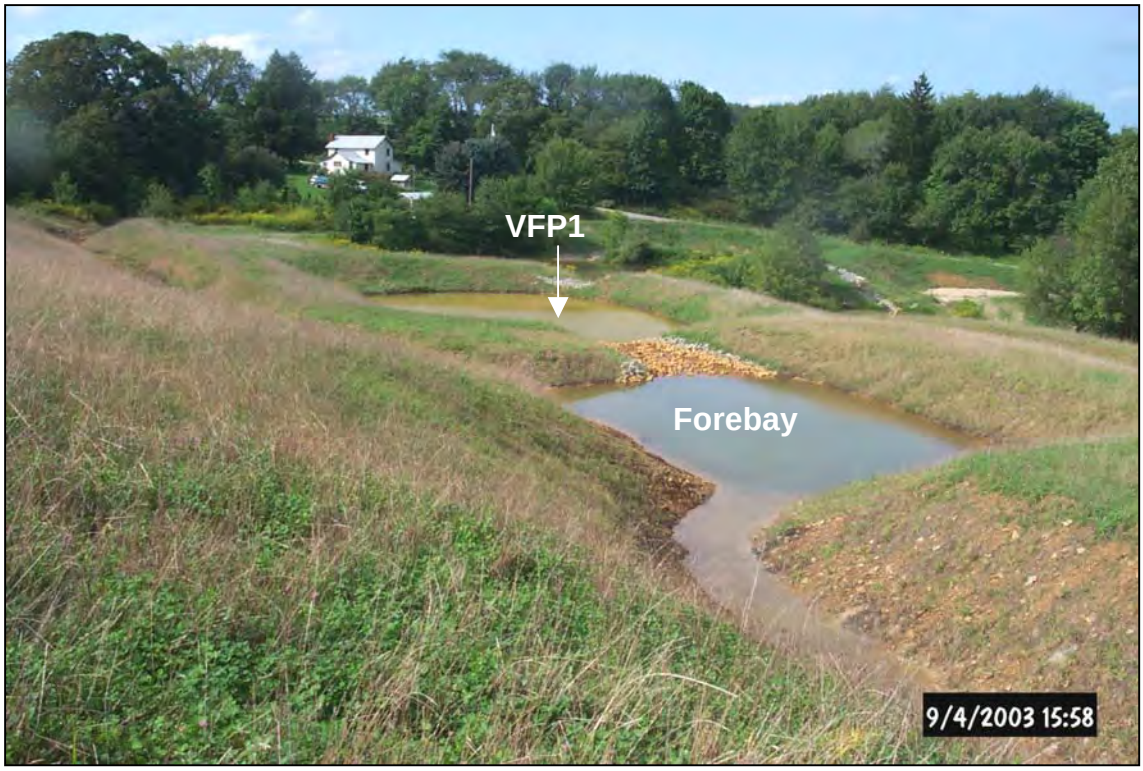
Installation of the Vertical Flow Pond 1 flush pipes.

View of the forebay and a portion of the collection ditch during installation of the flushing pipes of Vertical Flow Pond 1 **(Above).** The sludge drying beds on top of the hill were reclaimed and the land returned to approximate original contours **(Below)**.

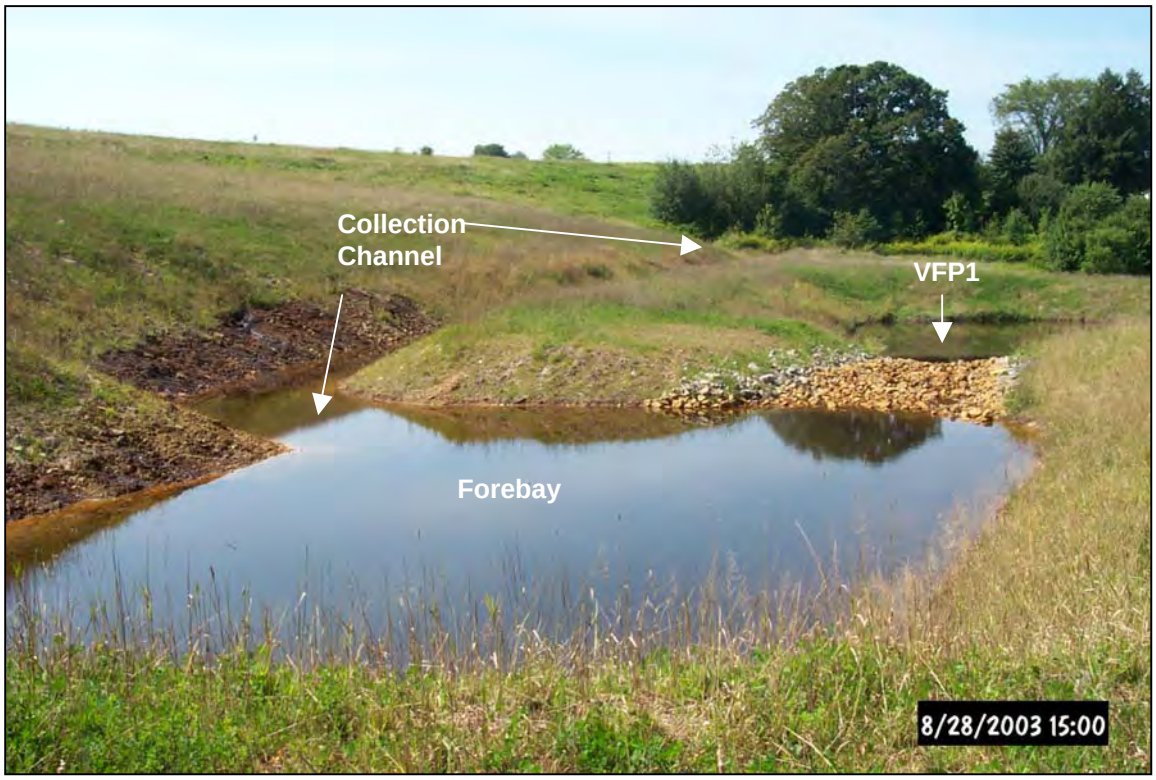
Once the construction was completed, water was not able to flow from the pre-existing Settling Pond 1 to Vertical Flow Pond 2 until the riser that had previously conveyed water to pre-existing Settling Pond 2 was plugged. This was accomplished by filling in the riser with cement which was mixed on land and then transported in a small boat loaned free of charge by Bob Beran, local resident and president of Beran Environmental Services, Inc.



View of the completed De Sale Phase III passive treatment system, which incorporated three previously existing ponds in the design.



One of the pre-existing ponds located at the site was already collecting a portion of the degraded water from the site **(Above)**. A collection trench **(Below)** was installed to collect seeps **(Below)** at the toe of spoil as well as convey the water from the collection pond to the forebay.



The collection channel conveys the discharge into the forebay to remove solids before entering Vertical Flow Pond 1 **(Below)**.

The effluent of Vertical Flow Pond 1 (VFP1) then enters the pre-existing Settling Pond 1 (SP1) for oxidation and precipitation of metals before entering Vertical Flow Pond 2 (VFP2) **(Below).**

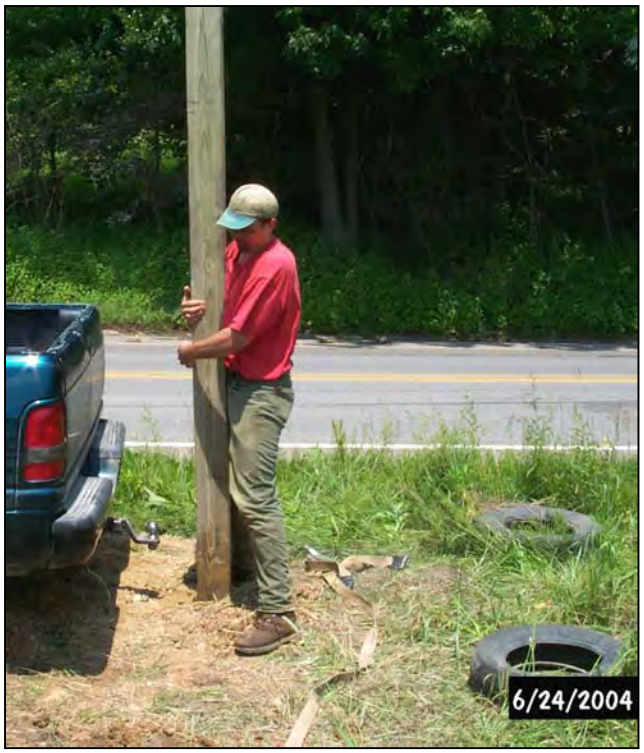
The effluent of Vertical Flow Pond 2 (VFP2) then enters pre-existing Settling Pond 2 (SP2) for additional oxidation and precipitation of metals before flowing into the Horizontal Flow Limestone Bed **(Above)**. To increase retention time within SP2 a directional baffle curtain was installed **(Below)**.

As a result of improved water quality in Seaton Creek due to land reclamation and the installation of passive treatment systems including De Sale Restoration Area Phases I, II, and III fish are now returning to the creek probably for the first time in a 100 years

In order to maintain sufficient hydraulic conductivity through the treatment media the vertical flow ponds were flushed.

Interns from Grove City College are conducting research through a USGS grant on the efficiency of passive treatment systems in the headwaters of Slippery Rock Creek effectively combining research and education/outreach. One of the interns, Candace McClure, helped to created the original Operation & Maintenance forms used by the students that were uploaded onto Datashed.

The 2004 Slippery Rock Watershed Coalition Symposium Field Tour included a stop at De Sale Phase III. The tour was also a pre-conference tour offered by the American Society of Mining and Reclamation (ASMR), which included international guests from Venezuela, Brazil, and South Korea.



Tim Danehy **(Top Left)** and intern Candice Candiello-Buzzelli **(Top Right)** installing the De Sale Restoration Area Site Sign **(Below).**

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Rachel Carson State Office Building
P. O. Box 8476
Harrisburg, PA 17105-8476
July 1, 2002

Bureau of Abandoned Mine Reclamation

717-783-1311
FAX 717-783-0470

Ms. Margaret Dunn
Stream Restoration Incorporated
3016 Unionville Road
Cranberry Twp, Pa. 16066

Dear Ms. Dunn:

Geophysical mapping was recently completed at the DeSale Phase 3 site in the area of the proposed passive treatment system. The results of that mapping effort are enclosed. The flows from two discharges up gradient of the proposed system average 3 and 5 gpm. The discharge below the proposed system averages 20 gpm according to BAMR files. It therefore appears that some water may be entering subsurface that is showing up only at the lower discharge point.

Mapping was completed using a Geonics EM 31 electromagnetic terrain conductivity meter. Readings were recorded every 25 feet on lines 25 feet apart. Readings were also recorded in both the horizontal and vertical dipole modes. The plot that is marked shallow is most responsive to the near surface materials and is limited to a total depth of about 9′. The plot marked deep is responsive to deeper conditions and "ignores" the near-surface features. The interpretation is rather simple: the higher the number on the contour interval, the more saturated or more conductive the subsurface conditions. Since the earth is a poor conductor of electricity and AMD is an excellent electrolyte, the higher values are interpreted to be associated with subsurface AMD.

On the plot labeled "shallow", the approximate locations of the discharges and some of the other surface features are noted. Arrows are drawn to indicate the most likely flow path of the subsurface AMD. Any type of French drain installed to direct the AMD to your system would most likely intercept AMD if it were constructed at the location of the arrows. I am aware that there are constraints involving elevations, but the deeper the interceptor ditch can be dug, the better. As far as I am aware, the flagging was left in place.

I hope this information is useful to you in the construction of your project. If you have any questions regarding the interpretation, please call me. Roger Bowman can answer any questions about the layout of the survey.

Sincerely,

Joseph Schueck

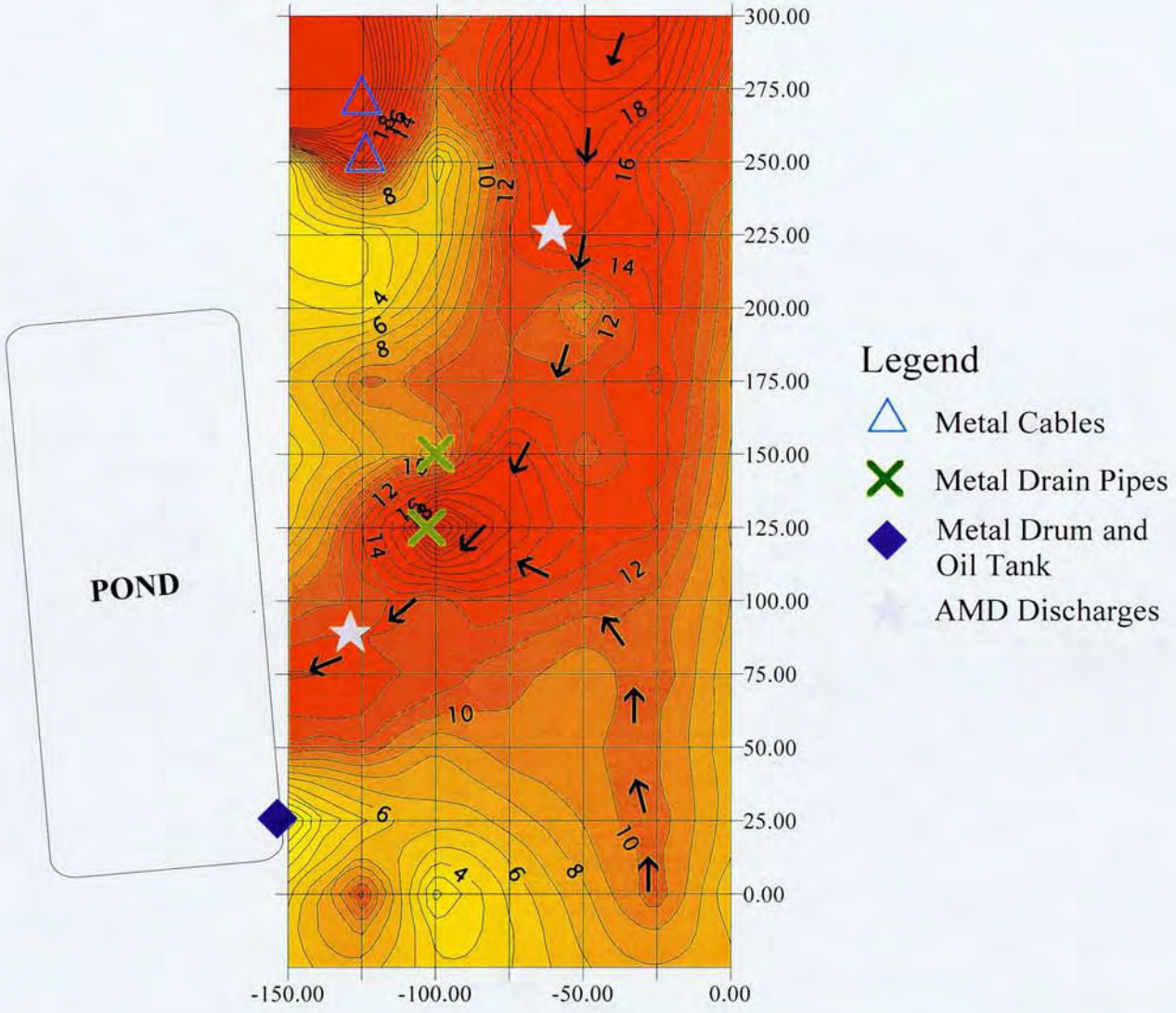
Joseph H. Schueck
Chief
Division of Acid Mine Drainage Abatement
Bureau of Abandoned Mine Reclamation

Enclosures

cc: Roger Bowman

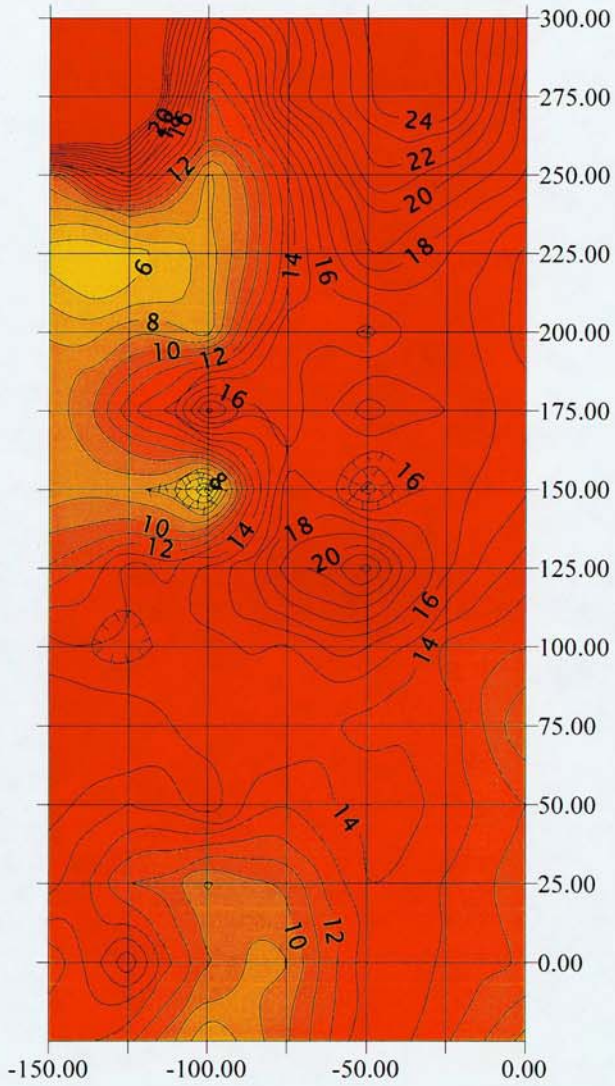
EM31 Conductivity for Desale Phase 3

(Shallow)



EM31 Conductivity for Desale Phase 3

(Deep)



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 De Sale Phase III 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 De Sale Phase III section of Datashed:

- De Sale Phase III Project Page
- De Sale Phase III Downloads Page
- De Sale Phase III Project Aerial Location Map
- Directions to De Sale Phase III from Grove City College
- De Sale Phase III Passive Treatment System O&M Inspection Report
- De Sale Phase III Site Schematic
- Example Report for De Sale Phase III HFLB
- Example Graph for De Sale Phase III Sampling Point 10E

Powered by APACHE

MySQL

Powered by MapServer

php

De Sale Phase III

Site Type: Passive Treatment System
Latitude: 41 08 29
Longitude: -79 50 21
Determined by GPS: No
Elevation: 1420
Quad: Eau Claire
Stream: Seaton Creek
Watershed: Slippery Rock Watershed
Municipality: Venango Township
County: Butler
Year Constructed: 2002
Primary Funding Partners: DEP Growing Greener
Other
Treatment Technologies: VFP
Settling Ponds
Others
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)
RAW	13.83	3.1	3.08	2610.83	13.33	--	--	399.21	103.2	101.03	89.26	87.64	0.95	0.79	1670.38	10.33	--	392.2	--
Forebay	13.43	3.26	3.22	3256.86	12.5	--	--	558.45	120.97	112.91	124.01	119.39	25.91	23.67	2822.73	11.14	--	584.32	--
HFLB	18.86	6.84	6.92	1996.17	15	62.33	60.24	53.51	0.83	0.53	68.17	66.66	0.3	0.16	1338.35	8.83	--	105.44	--

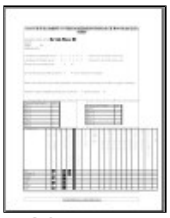
* Records with no value are not included in statistical calculations.
** Dissolved metals used for calculated acidity values when available. Acidities calculated from total metals may be exaggerated.

Datashed

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

Home > **Projects** > **Slippery Rock Watershed** > De Sale Phase III

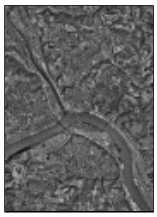
De Sale Phase III


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**.
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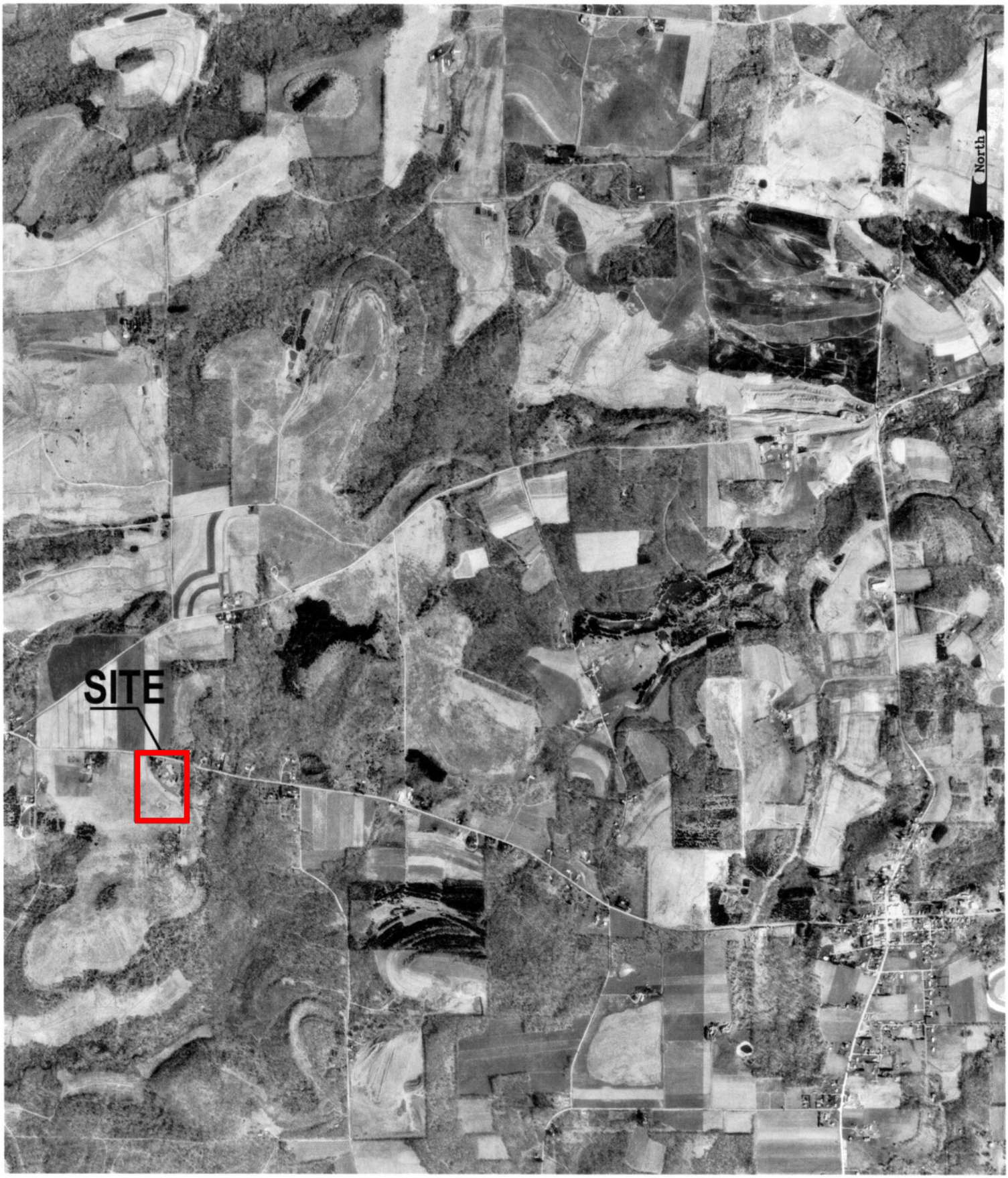


PROJECT LOCATION MAP: USGS DIGITAL ORTHOPHOTO (EAU CLAIRE, PA)

DE SALE RESTORATION AREA - PHASE III

Venango Township, Butler County, PA

Slippery Rock Watershed Coalition

***in cooperation with* Stream Restoration Incorporated**

July 2002, Scale 1 : 24,000

2000 1000 0 2000

BioMost, Inc., Mining and Reclamation Services
Cranberry Twp., PA:630102/63Aerial

Directions to De Sale Phase III from Grove City College:

Turn left out of Grove City College traveling east onto SR-58. Continue on SR-58 straight through the traffic light at Harrisville (Sheetz is on the left). Go straight through the next stop sign at the intersection with SR-308. Continue for approximately 2.5 miles on SR-58. The access road to the site is just past a two-story white house on the right. You should be able to see the ponds from SR-58. Park along the access road.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

Rev 06/2004

Inspection Date:		Project Name:	De Sale Restoration Area – Phase III
Inspected by:		Municipality:	Venango Township
Organization:		County:	Butler State: PA
Time Start:	End:	Project Coordinates:	41° 08' 29'' Lat 79° 50' 21'' Long
Receiving Stream:	Unnamed Tributary	Sub-watershed:	Seaton Creek 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 ditch or spillway by number i.e. 2a = Collection Pond)
1. Collection Ditch				
2. Rock-Lined Spillways				
a. Collection Pond				
b. Forebay				
c. VFP 1				
d. SP 1				
e. VFP 2				
f. SP 2				
g. HFLB				

C. Passive Treatment System Components

Component	Erosion Rills (Y/N)	Berms Stable (Y/N)	Vegetation Successful (Y/N)	Siltation Significant (Y/N)	Water Level Change (Y/N)	Valves Operable (Y/N)	Maintenance Performed and Remaining (Indicate which component i.e. VFP 1)
Coll. Pond							
Forebay							
VFP 1							
FP							
SP 1							
VFP 2							
SP 2							
HFLB							

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. Flow Measurements for VFP – Use Bucket and Stopwatch method (Indicate no flow by entering "0" in Gallons Measured)

[A maximum of 8 pipes will be discharging for VFP 1. A maximum of 6 pipes will be discharging for VFP 2. A maximum of 1 pipe will be discharging for HFLB.]

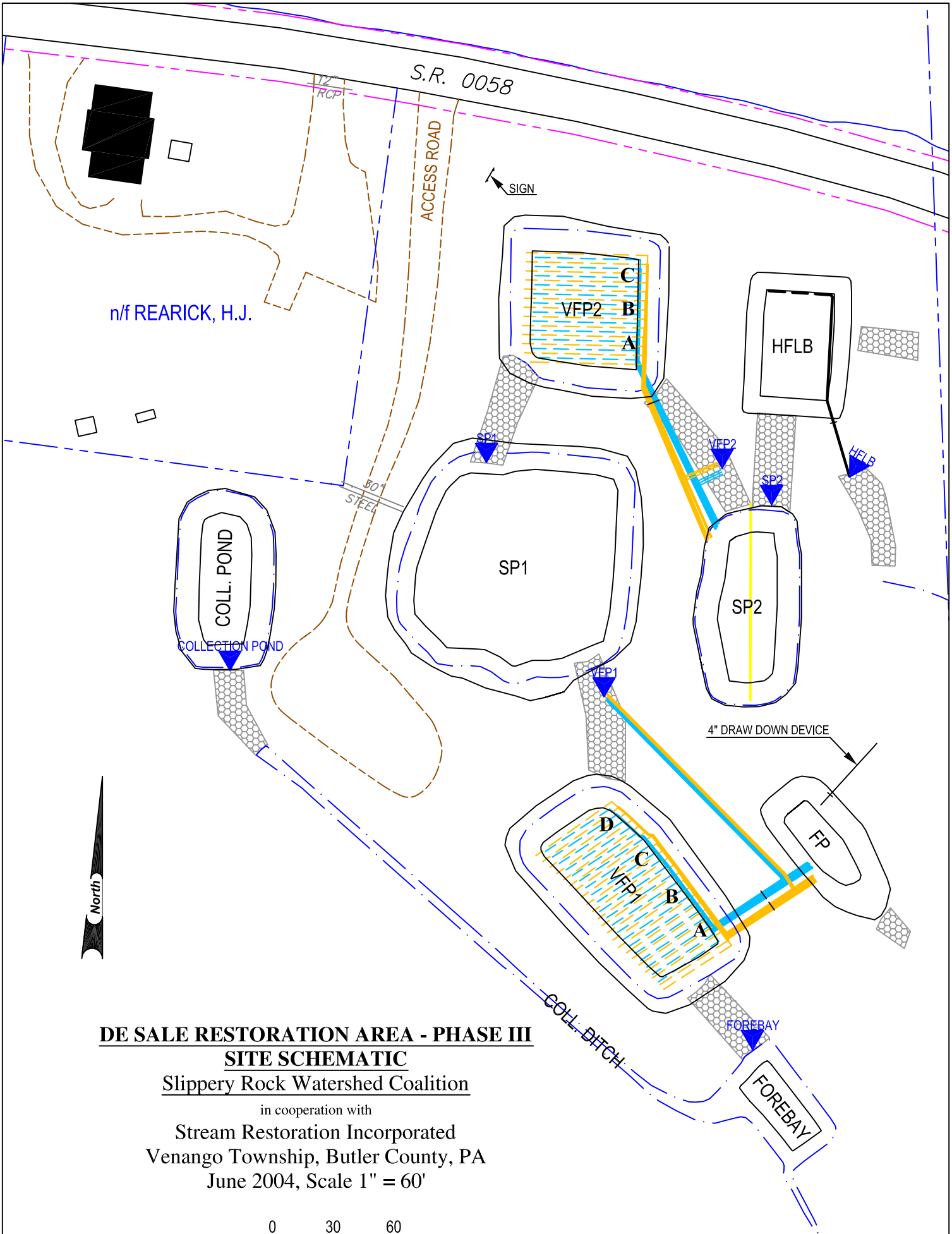
VFP 1				
Pipe #	pH	Alk.	Flow	
			gals.	sec.
1V				
1F				
2V				
2F				
3V				
3F				
4V				
4F				
5V				
5F				
6V				
6F				
7V				
7F				
8V				
8F				

VFP 2				
Pipe #	pH	Alk.	Flow	
			gals.	sec.
9V				
9F				
10V				
10F				
11V				
11F				
12V				
12F				
13V				
13F				
14V				
14F				

I. 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.									
Collection Pond											
Collection Ditch											
Forebay											
VFP 1											
SP 1											
VFP 2											
SP 2											
HFLB											
410											
10 E											
48											



DE SALE RESTORATION AREA - PHASE III
SITE SCHEMATIC

Slippery Rock Watershed Coalition

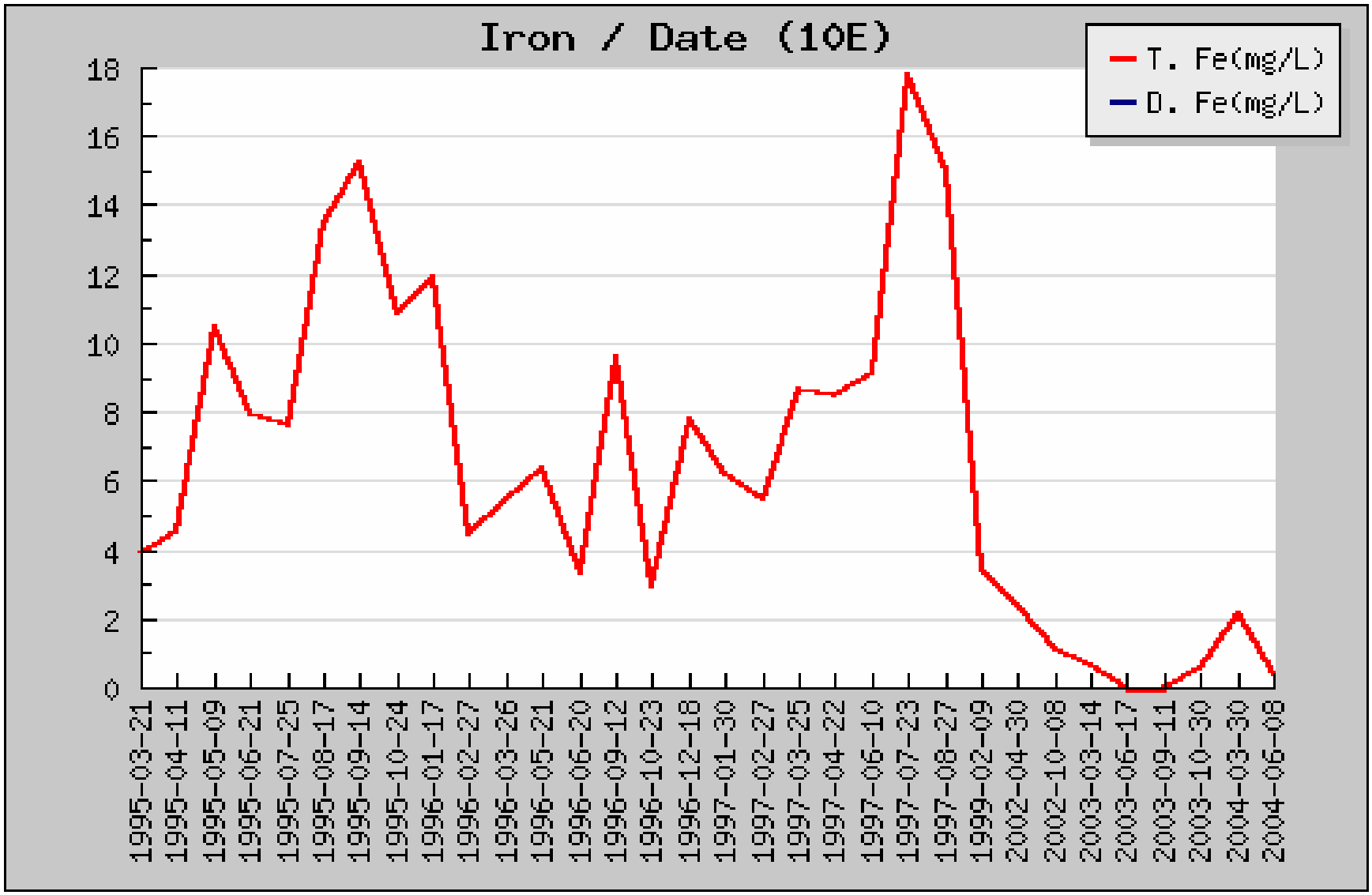
in cooperation with

Stream Restoration Incorporated
Venango Township, Butler County, PA
June 2004, Scale 1" = 60'

De Sale Phase III Water Quality Data - HFLB

Sample Site	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)	DO (mg/L)	Calc Acid (mg/L)	TDS (mg/L)
HFLB	2002-12-12	Not Flowing	0	7.2	--	--	--	65	--	--	--	--	--	--	--	--	--	--	--	--	--
HFLB	2003-03-10	Measured	30	6.86	7.08	1525	0	63	69.71	7.68	0.23	0.09	38.46	38.03	0.27	0.11	885.1	9	--	69.99	--
HFLB	2003-04-24	Measured	10	7	7.03	2555	12	70	66.39	80.8	1.07	0.12	73.89	72.91	0.14	0	1838	12	--	132.92	--
HFLB	2003-06-30	Bucket	7	7.05	7.09	2518	20	67	63.74	41.82	2.64	2.05	69.25	65.51	0.13	0.07	1851.4	9	--	123.29	--
HFLB	2003-08-28	Bucket	4	7.18	7.4	2212	18	74	76.96	21.38	0.74	0.72	69.96	68.15	0.22	0.07	1782.7	10	--	125.71	--
HFLB	2003-10-29	Bucket	13	6.97	6.72	754	10	--	50.47	84.8	0.1	0.07	91.87	90.38	0.11	0.08	368.5	5	--	165.07	--
HFLB	2004-03-25	Assumed	38	6.09	6.21	2413	--	35	34.17	84.55	0.17	0.12	65.61	65	0.93	0.45	1304.4	8	--	121.05	--
HFLB	2004-04-09	Bucket	30	6.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.02	--
		Minimum:	0	6.09	6.21	754	0	35	34.17	7.68	0.1	0.07	38.46	38.03	0.11	0	368.5	5	--	0.02	--
		Maximum:	38	7.2	7.4	2555	20	74	76.96	84.8	2.64	2.05	91.87	90.38	0.93	0.45	1851.4	12	--	165.07	--
		Average:	16.5	6.84	6.92	1996.17	12	62.33	60.24	53.51	0.83	0.53	68.17	66.66	0.3	0.13	1338.35	8.83	--	105.44	--
		Range:	38	1.11	1.19	1801	20	39	42.79	77.12	2.54	1.98	53.41	52.35	0.82	0.45	1482.9	7	--	165.05	--
		Median:	11.5	6.99	7.06	2312.5	12	66	65.07	61.31	0.49	0.12	69.61	66.83	0.18	0.08	1543.55	9	--	123.29	--
		Loading (lb/day):	--	--	--	--	--	11.24	10.93	11.46	0.09	0.05	12.69	12.49	0.1	0.04	--	--	--	--	--

* 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.



A graph from Datashed showing total and dissolved iron concentrations over time for downstream sample point 10E.

THE EFFICIENCY OF PASSIVE TREATMENT SYSTEMS AND THEIR IMPACT ON SEATON CREEK[1]

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

Abstract. The Slippery Rock Creek Watershed has been impact by acid mine drainage for over 100 years. Since 1997, fourteen passive treatment systems have been installed within the watershed treating over 300 million gallons of mine drainage annually. The current study focuses on the impact of mine drainage discharges on Seaton Creek and Murrin Run, the two major tributaries to the head-waters of Slippery Rock Creek. In this study, the efficiencies of six passive treatment systems were analyzed as to their impact on receiving streams. The passive treatment systems installed at Desale I, II, and III are comprised of settling ponds, vertical flow ponds (VFP), aerobic wetland and horizontal limestone beds (HFLB). Two passive treatment systems were installed Goff Station with each system being comprised of two vertical flow ponds and an aerobic wetland. The system at Erico Bridge consists of an anoxic limestone drain that discharges into an aerobic wetland system. For each system monitoring points were located at discharge and above and below each stage in the various systems. At each sampling interval, the pH, alkalinity, and dissolved oxygen were recorded at each monitoring location and water samples were collected for laboratory analysis of acidity, alkalinity, pH, conductivity, total dissolved solids, sulfates, total and dissolved metals (iron, manganese, aluminum). Although each system varied in their efficiency, in all systems the pH increased from <3 to between 6.0 and 7.2 and alkalinity exceed acidity in the final discharge to receiving streams. The systems comprised of a combination of vertical flow ponds and aerobic wetlands were effective in removing iron and manganese and the concentrations of these metals were < 4 mg/l in the final discharge even in those systems where the concentration of iron and aluminum exceeded 50 mg/l in the inflows to the systems. But, only these systems with horizontal limestone beds as the final treatment system were effective in removing manganese from the mine drainages. As a result of the improvement in water quality in the receiving streams, macroinvertebrates and fish are beginning to re-colonize these streams systems. During the last two years, caddisflies, mayflies, dragonflies, damselflies, crayfish and three fish species have been collected in both Seaton Creek and Murrin Run below the discharges from these passive treatment systems.

Additional Key Words: Passive Treatment Systems, water quality, aquatic communities

---

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

[2] Emily Coughlin, James Dunne, are senior Biology and Chemistry 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 a Professor of Biology at Grove City College, Grove City, PA and Shaun Busler, Biologist, Stream Restoration, Inc., Cranberry Township, PA 16066.

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

---

[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

6:00 p.m. Registration, Refreshments & Poster Session

Symposium Moderator: *Nancy Wells*
Environmental Education Major
Slippery Rock University

6:30 p.m. Welcome
Slippery Rock University Representative

6:35 p.m. Student Involvement in Research and Field Study: A Retrospect
Cliff Denholm
Environmental Scientist
Stream Restoration, Inc.

6:45 p.m. The Efficiency of Passive Treatment Systems and their Impact on Seaton Creek

Emily Coughlin, Jeremy Benjaminson, Justin Tretter, James Dunne, Candace McClure
Dept of Biology, Grove City College
(Supervising: *Fred J. Brenner*, Grove City College, *Shaun Busler*, Stream Restoration Inc.

The Slippery Rock Creek Watershed has been impacted by acid mine drainage for over 100 years. Since 1997, fourteen passive treatment systems have been installed within the watershed treating over 300 million gallons of mine drainage annually. The current study focuses on the impact of mine drainage discharges on Seaton Creek and Murrin Run, the two major tributaries to the headwaters of Slippery Rock Creek. In this study, the efficiencies of six passive treatment systems were analyzed as to their impact on receiving streams. The passive treatment systems installed at DeSale I, II and III were comprised of settling ponds, vertical flow ponds (VFP), aerobic wetland and horizontal limestone beds (HFLB). Two passive treatment systems were installed Goff Station with each system being comprised of two vertical flow ponds and an aerobic wetland. The system at Erico Bridge consists of an anoxic limestone drain that discharges into an aerobic wetland. For each site, monitoring points were located at the discharge and above and below each component. At each monitoring point, the pH, alkalinity, and dissolved oxygen were recorded and water samples were collected for laboratory analysis.

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

<u>THIS MONTH'S MEETING:</u> Thursday February 13th at 7pm Jennings Environmental Education Center, pizza and pop will be provided. 1/9/03 Meeting Attendance: D. Johnson, C. Cooper, V. Kefeli, C. Denholm, W. Taylor, S. Busler, J. Belgredan, K. Lanich, J. Reidenbaugh, C. Treter, and D. Treter

2002 Year In Review!!
A Year Full of Many Great Things!!!!!!!!

Conferences

- SME in Phoenix, Arizona --- 2/24
- PA State Assoc. Twp. Supervisors --- 4/16
- WV Symposium --- 4-16
- Butler Co. Association Twp. Officials --- 5/16
- ASMR at Lexington Kentucky --- 6/9-13
- Watershed Academy --- 6/13
- AMD/AMR meeting --- 6/14-15
- First Annual Riverboat Cruise --- 9/19
- PA Watershed Conference (Greensburg) --- 9/20-21
- PA Energy Leadership Council (Greentree) --- 9/23
- New Castle of the World Summit at SRU --- 9/30
- AWRA Conference in Philadelphia --- 11/3-7
- POWR Annual meeting --- 11/15

Passive System Construction

- Erico Bridge Drilling --- 2/2002
- DeSale Wetland Planting --- 5/11
- Erico Bridge Wetland Planting --- 5/11
- SR 96 Construction Begins --- 5/30
- SR 96 Completed --- 6/2002
- SR 81 Wetland Planting --- 7/17
- Erico Bridge Drilling --- 7/18-19
- De Sale III Completed 9/2002

Recognition

- ASMR Reclamationist of the Year (Margaret Dunn) --- 6/2002
- Governors Award for Environmental Excellence --- 9/25
- Butler Outdoor Club Annual Dinner (award finalist) --- 11/2

Outreach/Educational Activities

- Stream Assessment with the PA DEP --- 1/2002
- PASDA recognizes Goff Station and SRI --- 1/2002
- Cliff Denholm speaks at MS3 Sustainable Systems Seminar at SRU --- 2/13
- Bob Beran MS3 Seminar Series at SRU --- 4/3
- Lorenzo de la Puente (Peru) visits the SRWC --- 4/3
- SRWC Symposium: Community Watershed Tour 4/7; Student Evening Symposium 4/11; 7th Annual Symposium 4/12
- Rosa Ocana of Peru visits the SRWC --- 4/11-12
- Margaret Dunn Speaks to PA Geological Society --- 4/17
- Tribune Review article about "Peruvian Company Gets Local Advice" --- 4/21
- Jennings Spring-into-action --- 4/27
- PA Cleanways (Butler County) Big Run Cleanup --- 4/27
- Kids Day at College (SRU) --- 4/27
- Get-Together --- 5/1
- Pennsylvania River Sweep --- 6/15
- Butler County Juvenile Court System wetland plantings every Tuesday --- 6/11 – 8/27
- University of Oklahoma tours SRWC --- 6/14
- Fish Survey of Seaton Creek --- 8/2002
- Mist netting at Goff Station --- 8/14
- Jennings coring of VFP --- 8/15
- Adopt a Highway I-79 Cleanup --- 8/16
- "ABC's of Our Watershed" debuts --- 9/19
- Home school students tour watershed --- 9/26
- SRWC addresses SRU masters program --- 9/30
- Watershed Weekly --- 10/3
- Adopt a Highway I-79 Cleanup --- 11/1
- PA Magazine highlights Goff Station Bat Hibernaculum --- 11-12/2002

PHOTO OF THE MONTH

Valentine Kefeli presenting at Grove City College (see article below)

PHOTO OF THE MONTH

Dr. Valentine Kefeli Presents at Grove City College

On Thursday, January 16th, **Valentine Kefel**i addressed students at **Grove City College** about "The Stalin Doctrine of the Totalitarian State." He spoke to about 25 students taking an intercession class with **Dr. Paul Kengor**, an associate professor of political science. In addition to the students, a journalist and several participants of the **Slippery Rock Watershed Coalition** attended including **Margaret Dunn, Tim Danehy, Shaun Busler, and Cliff Denholm**. Valentine lived through nearly 60 years of communism in the Soviet Union and experienced first hand the Stalin regime. Valentine divided the Stalin era into several time spans from the beginning of the Bolshevik Revolution to his death in 1953. He brought photographs and magazine articles of key individuals and events that students passed around during the presentation. Many of the facts surrounding the time period are only now emerging with the fall of the Soviet Union and the opening of the KGB archives. **Thank you so much Valentine for your enlightening presentation! Congratulations Valentine and Galina on receiving your American citizenship!!!!!**

Margaret Dunn To Become President-Elect of the ASMR

Margaret Dunn, Stream Restoration Incorporated, was recently elected as President-Elect of the **American Society of Mining and Reclamation (ASMR).** Margaret will serve one year as President-Elect and then will become President the following year at the 2004 national meeting which is tentatively planned to be held in Morgantown, WV.

ASMR is an international organization with participants from private industry, government agencies, academia, and nonprofit organizations who are involved in mining and reclamation. An Annual Meeting is held in which topics such as land reclamation, biodiversity, and AMD are addressed. Many of the world's leading experts on passive treatment systems present and discuss the latest technology in this ever advancing field.

Still Saving The Date!!!

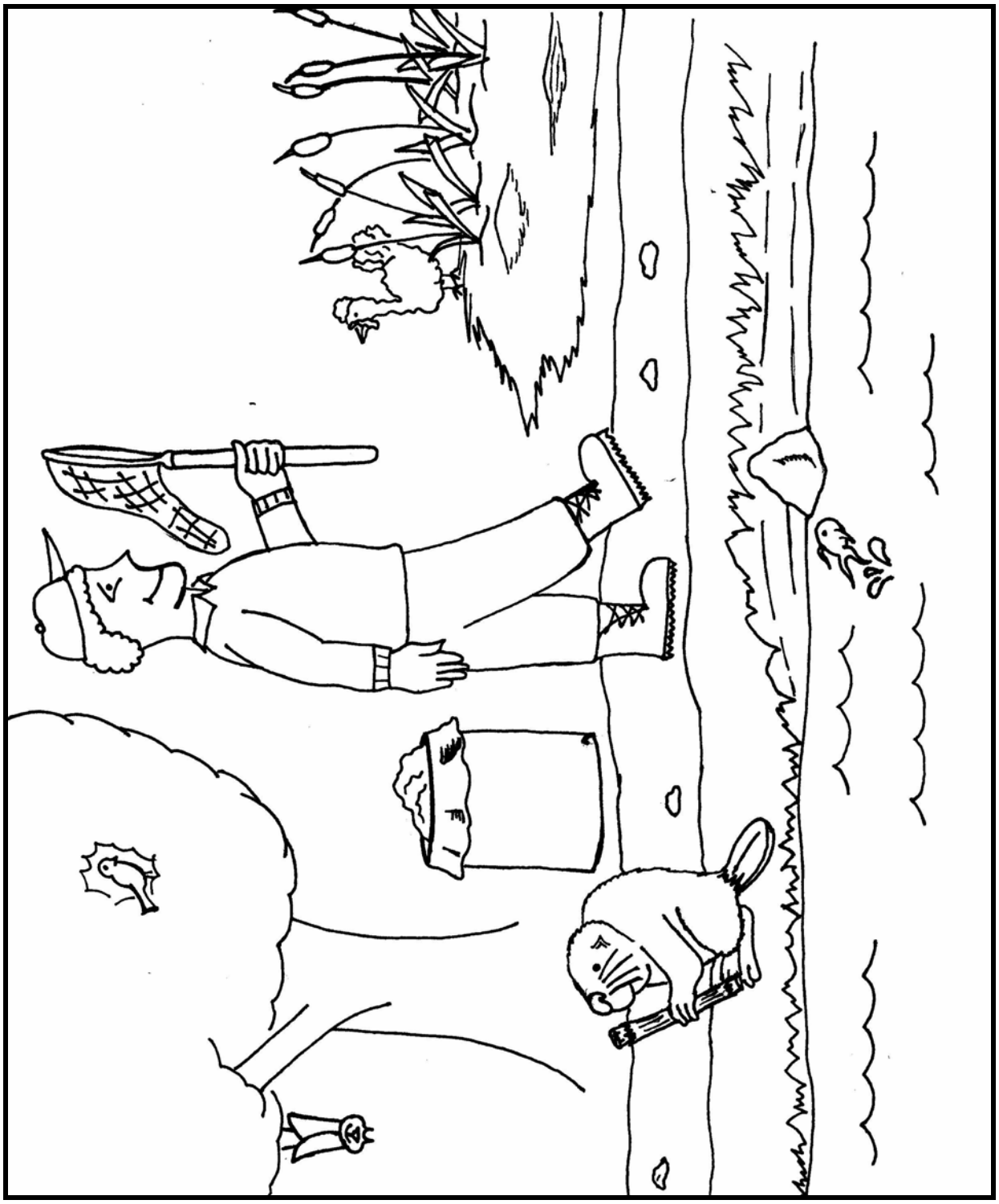
The 8th Annual Symposium will take place on Friday, April 11th at Jennings Environmental Education Center! The college evening presentations will take place on Thursday, April 10th at Grove City College. And last but not least on Sunday, April 13th the Community Day will take place at Jennings. We hope to see you all there! More information will be in future Catalyst!!!

The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

Kids Catalyst Year In Review

On the front of this Catalyst is the Year in Review, well here is your turn. We have hidden elements from last years Kids Catalysts in this picture. Find all the things in the list below and circle them. Then color the picture and send it back to us for a gift certificate. Good Luck!!!



See if you can find the following themes of the 2002 Kids Catalysts!

Hiker Joe	Trash	Net	Fish	Bat
Turkey	Stream	Bird	Wetland	Beaver

Name _____ **Age** _____ **Address** _____

Slippery Rock Watershed Coalition c/o Stream Restoration Incorporated
A PA Non-Profit Organization
3016 Unionville Road
Cranberry Twp., PA 16066

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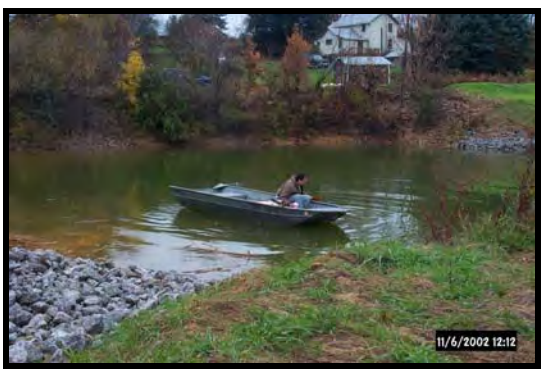
Thanks to The William & Frances Aloe Charitable Foundation, Amerikohl Mining, Inc., Quality Aggregates Inc., BioMost, Inc., Allegheny Mineral Corporation and PA DEP for their support. For more information contact: Slippery Rock Watershed Coalition, c/o Stream Restoration Incorporated (PA non-profit), 3016 Unionville Road, Cranberry Twp., PA 16066, (724)776-0161, fax (724)776-0166, sri@salsgiver.com, www.srwc.org. February Distribution: 961 copies

De Sale Phase III Construction Completed…

Construction of the **De Sale Phase III Passive Treatment System** was completed in September of 2002. The unique and innovative system which includes a forebay, two vertical flow ponds, 2 settling ponds, and a horizontal flow limestone bed, was designed by **BioMost, Inc.** and utilized several existing treatment ponds from the old active system that had been abandoned a number of years ago. **Amerikohl Mining, Inc.** constructed the system.

...And A Lovely Day For Boating

On one cold and snowy November day, **Cliff Denholm** and **Tim Danehy** went boating on one of the settling ponds to plug an existing riser. The riser originally conducted water from one previously existing treatment pond to another. In order to get the water to flow into the newly constructed vertical flow pond, the riser had to be plugged. So, they borrowed an aluminum boat from **Bob Beran, Aquascape,** and used some old 2X4s that were lying around as paddles. They mixed up several 5 gallon buckets full of concrete on land, loaded it onto the boat, and "paddled" out into the settling pond where they dumped the concrete into the riser, barely avoiding tipping the boat. The system is now flowing. Look for updates about De Sale Phase III in future issues of the *Catalyst.* The three De Sale passive systems have significantly improved Seaton Creek, which was previously documented to be the most heavily impacted tributary to Slippery Rock Creek. Since the construction of Phase I&II fish have been found for the first time in probably a century.



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

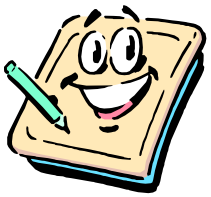
On Saturday April 26th, 110 participants joined forces to get the Jennings Environmental Education Center in Slippery Rock, PA ready for Spring! Some of the projects completed included: general trail work; removal of invasive species from the lower treatment ponds; staining of bridges, feeders, and fences; 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.

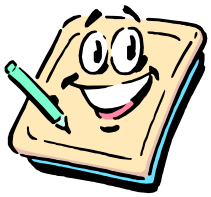
SRWC Participates in Evans City Earth Day Celebration

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
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Name _____ Age _____ Address _____

Slippery Rock Watershed Coalition c/o Stream Restoration Incorporated
A PA Non-Profit Organization
3016 Unionville Road
Cranberry Twp., PA 16066

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.

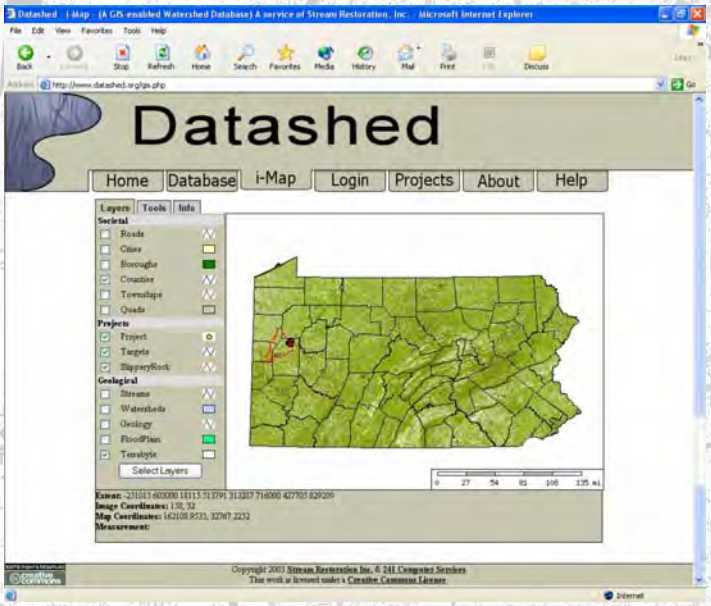
For more information about the Creek Connections program check out their website at http://creekconnections.allegheny.edu.

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

THIS MONTH'S MEETING: Thursday December 11th at 7pm Jennings Environmental Education Center, pizza and pop will be provided. 11/13/03 Meeting Attendance: S. Busler, C. Cooper, C. Denholm, M. Dunn, D. Johnson, V. Kefeli, J. Reidenbaugh, W. Taylor

Unveiling "Datashed"



Stream Restoration Incorporated and **241 Computer Services** are excited to announce the creation of a fully-featured, GIS enabled, internet database designed to assist watershed groups, academic institutions, private industry, government agencies, and others. The **Datashed** site was originally created to aid in the operation and monitoring of passive treatment systems, but has potential for many more uses.

Datashed features include:

- Access to important documents, such as Operation and Maintenance Plans and inspection sheets
- Password-protected submissions of data and photos
- Direct printing of reports from the internet
- Robust statistical calculations
- Dynamically generated graphs of data uploaded to the site
- Alerts to users of possible problems with passive systems based on defined criteria in the inspection sheets
- GIS capabilities that allow easy viewing of geographic data and directs users to additional content

A prototype has been developed for **Grove City College** students monitoring the passive treatment systems in the headwaters of Slippery Rock Creek. Stream Restoration Inc. hopes this web site is helpful in assisting watershed groups in documenting and maintaining data they collect in the field. Although still a work in progress, several elements of Datashed are currently in a usable format. Check out the site at **www.datashed.org**. Contact **Shaun Busler** of Stream Restoration Inc. at 724-776-0161 for more information.

Stream Restoration Inc. greatly appreciates the work of **241 Computer Services** developer **Peter Drake**. Peter, a graduate of Grove City College, founded 241 Computer Services and has developed more than 20 commercial web pages. His superior skills in web site design and web programming are evident in his work. He designed for Stream Restoration Inc. the **easy-to-use on-line registration page** for September's **2nd Annual Ohio Watershed Riverboat Cruise**. For more information about this company, visit their website at **www.241computers.com**.

Ohio River Watershed Celebration Featured on Watersheds.tv

Real people are making a difference to protect our environment and you can, too! This is the mission of the Environmental Fund for Pennsylvania/GreenWorks. EFP/GreenWorks utilizes a combination of multi-media technologies to share informative and entertaining stories that explain the various roles individuals can play in caring for our world. By doing so, it is the aim of EFP/GreenWorks to inspire people every day to take part in the effort to make our planet a cleaner, healthier, and happier place for everyone. Visit www.greenworks.tv to learn more! A popular feature of GreenWorks is Watersheds.tv, an innovative multi-media program that brings the watershed community and hundreds of volunteers right into your home. A different story is featured each week at **www.greenworks.tv/watershedstv/featuredtopic.htm**. Thanks to producer **Kelly Meinhart**, the 2nd Annual Ohio River Watershed Cruise was the feature story on Watersheds.tv in early November. If you missed it, you can access the feature in the archives of the Watersheds.tv web page. **Maggie Hall** of **DEP** provided text for the feature and **Melissa Busler** of **Stream Restoration Incorporated** provided photos of the event. Over 425 individuals participated in the fun and informative cruise. Next fall plan on joining us when we cruise the Ohio River!!

Watersheds.tv Producer Kelly Meinhart

PHOTO OF THE MONTH

PHOTO OF THE MONTH

Look closely and you will see several fish in this picture (if your eyesight is good). What is the big deal? You are looking at a photo of fish swimming in Seaton Creek (at McJunkin Road), a tributary in the Slippery Rock Watershed which was formerly lifeless! The photographed site is located downstream of the DeSale treatment systems and upstream of Erico Bridge. Seeing different sizes of fish suggests they are reproducing!

WHERE ARE THEY NOW?

Investigating Maintenance, Performance, And Continuous Treatment (IMPACT)

Have you ever wondered what became of your favorite passive treatment system? Has it been forgotten? Does it feel neglected? You have not heard much about it lately, and you are wondering how it is doing. Wonder no more! Each month a passive system will be highlighted. We travel back in time to the year 1995 for this month's featured treatment system: **SR 114 B & D**, an anoxic limestone drain (ALD) system in PA State Game Lands #95 in Washington Township, Butler County.

Before Construction

SR 114

1995

After Construction

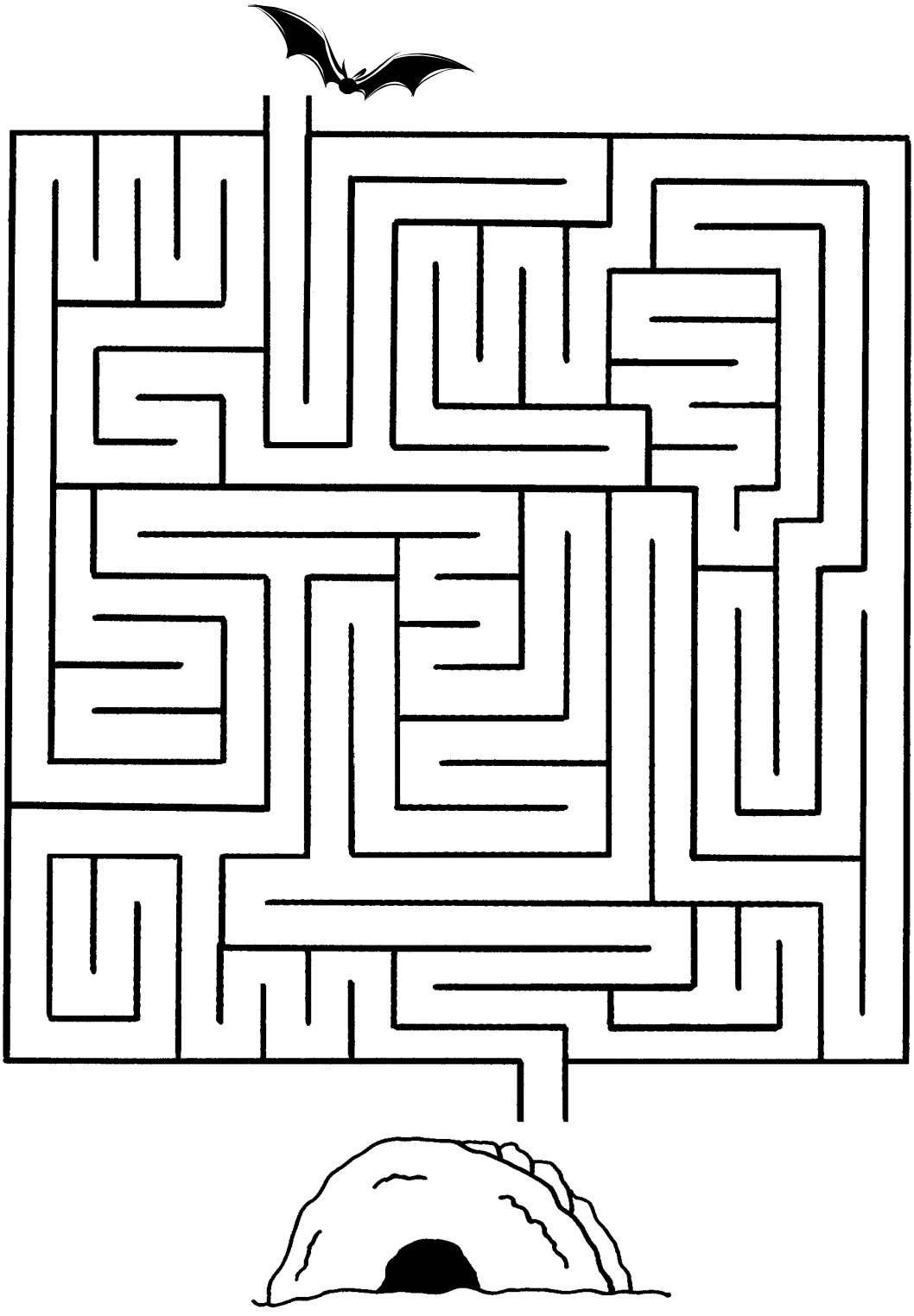
Construction: 2 anoxic limestone drains (350 & 1150 tons); settling ponds (11,000 SF); wetlands (17,500 SF)
Project Participants: Hedin Environmental, CDS Associates, Inc., PA Game Commission, Jesteadt Excavating, PA Bureau of District Mining Operations Knox Office, Stream Restoration Inc.
Monitoring: Quarterly water monitoring by PA DEP, Knox DMO; Slippery Rock University; Grove City College
Comments: The average combined flow of the discharges is >150 gpm. Prior to treatment, drainage is acidic with about 40 mg/L of dissolved ferrous iron and about 1 mg/L or less of manganese and aluminum. The Anoxic Limestone Drains have operated without maintenance for over 8 years. Effluent from the ALDs is consistently net alkaline with about 120 mg/L lab alkalinity. A trash rack in one of the settling ponds requires about one hour of maintenance annually to remove leaves and debris. Natural, previously impacted, wetlands provide additional settling of iron solids.

The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

AMAZING MAZE

Winter is on its way! Because temperatures become cold and not much food is available, some animals hibernate during the cold winter months. Several bat species hibernate, while others migrate to warmer regions where insects are available to eat. Bats that hibernate like to do so in caves or mines. Their heart beat slows from over 1000 beats per minute (when in flight) to only 1 beat every 4 or 5 seconds. Hibernating bats can lose as much as one half of their pre-hibernation weight during hibernation! Can you help the bat below reach his cave to hibernate before winter comes? If you can complete the maze, mail your paper in to us and we will send you a gift certificate!



NAME: _____ AGE: _____

STREET ADDRESS: _____

CITY _____ STATE _____ ZIP _____

Slippery Rock Watershed Coalition c/o Stream Restoration Incorporated
A PA Non-Profit Organization
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Cranberry Twp., PA 16066

Thanks to The William & Frances Aloe Charitable Foundation, Environmentally Innovative Solutions, LLC, Dominion Peoples, Amerikohl Mining, Inc., Quality Aggregates Inc., BioMost, 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. Dec. Distribution: 1143 copies

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

21st Annual ASMR Meeting

Calling all watershed groups! The American Society of Mining and Reclamation (ASMR) will be holding its 21st Annual Meeting in a joint conference with the Surface Mine Drainage Task Force in Morgantown, WV, on April 18-22, 2004. Held at the new Morgantown Radisson Conference Center, this event will provide valuable opportunities for watershed volunteers, scientists, regulators, and mining and reclamation personnel to exchange information and share ideas.

In conjunction with the annual **Slippery Rock Watershed Coalition Symposium** on April 16 and 17, a pre-conference, two-day field trip will include visiting the **Jennings Environmental Education Center** to participate in the "Construct Your Own Passive System Simulation" and/or several of the 15 systems in the watershed. Planned on the return trip is a tour of the over 20-component passive complex at **Ohiopyle State Park**, which includes Hybrid Flow Ponds, Horizontal Flow Limestone Beds, an Anoxic Limestone Drain, Vertical Flow Ponds, a Diversion Well, Naturally-Functioning Wetlands, and more.

At the conference, there will be short courses and workshops on stream restoration and channel design, satellite imagery, the geochemistry of acid mine drainage, and more. Technical sessions will include presentations on acid mine drainage, wetlands, invasive and native species, soils and overburden, forestry and wildlife, mine closure, passive treatment, revegetation, and others. There will be posters and exhibits. **Displays from watershed groups are welcome.** This is a great opportunity for those in watershed groups to get involved in building partnerships to work together in this forum for applied reclamation. For additional information, visit:

http://www.wvu.edu/~agexten/landrec/land.htm or

http://www.wvu.edu./~agexten/lanrec/2004TFS/1stCall.pdf

and click on 2004 ASMR and Task Force Meeting; or, contact Jeff Skousen at (304) 293-6256, email: jskousen@wvu.edu

THE CATALYST

SLIPPERY ROCK WATERSHED COALITION MONTHLY ACTIVITIES UPDATE

<u>THIS MONTH'S MEETING:</u> The Get-Together will be held on May 13 at the Boyers Sportsmen Club from 6 PM to 8 PM. April meeting was cancelled due to Slippery Rock Watershed Coalition's Annual Symposium at Jennings Environmental Education Center.

9th Annual SRWC Symposium an International Flare!

On Friday, April 16 approximately 50 folks took part in our 9th (Can you believe that its been almost a decade since we started?!) annual Symposium at Jennings Environmental Education Center. Visitors came from as far away as **Korea, Brazil, and Venezuela**!!! As usual, **Janice Belgraden** did a wonderful job moderating this event!!

Wendy Beeching and **Jerry Macurak** started off the Symposium with a presentation on the oil and gas well plugging project being conducted in the headwaters area of South Branch Slippery Rock Creek. **Shaun Busler** gave a brief description and live demonstration of **Datashed**, an online, GIS database, and how it can assist in the Operation and Maintenance of passive treatment systems. **Cliff Denholm** described the interrelationships among JEEC, the SRWC, and ASMR, relating to technology transfer. Cliff stressed how ASMR strives to encourage communication among researchers, private industry, and government agencies.

Tim Danehy summarized the environmental improvements being made in the watershed, resulting from the installation of 15 passive treatment systems, which include 14 vertical flow ponds, 7 anoxic limestone drains, 3 horizontal flow limestone beds, and 12 constructed wetlands covering over 10 acres!!! These systems remove >200 tons of iron and 8 tons of aluminum annually!

Symposium participants took a walking tour of the passive treatment systems at **Jennings** after a brief overview of local mining and restoration history. Everyone then traveled to the headwaters of Slippery Rock Creek to tour the **Erico Bridge Restoration Area**, which has the largest known ALD in PA, and the **De Sale Restoration Area - Phase III**. The day ended with a delicious buffet dinner at Quaker Steak and Lube in Cranberry Township. (**A special thanks to Environmentally Innovative Solutions, LLC and Quality Aggregates Inc. for their generosity!!!!)**

Symposium attendees journeyed to beautiful **Ohiopyle State Park** on Saturday, April 17 to tour the multi-faceted Harbison Walker passive treatment complex, featuring over 20 components. What an appropriate setting to present **<u>John Dawes, Western PA Watershed Program</u>,** with the **2004 SRWC Appreciation Award!!!** (See back page.)

Thanks **Bruce Golden, Western PA Coalition of Abandoned Mine Reclamation,** for the wonderful photos of the event including the panorama below of a potion of the treatment complex at Ohiopyle State Park!

SRWC Student Symposium

The Student Symposium, showcasing student research in water quality, biology, ecosystem recovery, and soil science, was held on Wednesday, April 14 at Slippery Rock University. Following a time of networking, students from **Slippery Rock University, Westminster College, and Grove City College** gave15-minute audiovisual presentations of their research to professors, organizations, professionals, watershed volunteers, and their peers. It was clear to the 36 attendees how crucial partnerships are to the success of any project. Thanks **Slippery Rock University** and **Dr. Valentine Kefeli** and **Dr. Bruno Borsari** for making this possible! **A special thanks to Malcolm Crittenden, PA DEP, Cambria Office for sharing outstanding outreach efforts by the Wells Creek watershed group.**

PHOTO OF THE MONTH

SRWC Symposium field tour of Erico Bridge, Venango Twp., Butler Co. What a beautiful day to be in the field!!! But, look at the flow!!! This is the highest flow, est. >1000 gpm, observed from the ALD (8,300 tons limestone).

PHOTO OF THE MONTH

ASMR 2004—Wonderful West Virginia!

The American Society of Mining and Reclamation held its 21st Annual Meeting on April 18-22 in Morgantown, WV in conjunction with the 25th Annual West Virginia Surface Mine Drainage Task Force Symposium. Held at a facility overlooking the Monongahela River, the conference gave attendees important opportunities to network and get up-to-date on the latest research and discoveries in the fields of AMD passive treatment, active treatment, revegetation, forestry, remining, overburden, wildlife, hydrology, minesoils, tailings, and watershed restoration. Experts in reclamation shared their knowledge, watershed groups interacted and learned from each other, and all benefited from the dozens of poster presentations and displays available.

Seven fieldtrips were offered to conference-goers, including trips led by the SRWC to Ohiopyle State Park and to the Jennings Environmental Education Center to join the 9th Annual Slippery Rock Watershed Coalition Symposium. ***(See page 1.)***

As part of the conference, Cliff Denholm presented on Operation and Maintenance considerations for the Ohiopyle State Park passive treatment complex. Dr. Fred Brenner, SRWC and Grove City College, with co-authors Shaun Busler, SRI, and Scott Alexander, DEP, gave a presentation on the passive treatment work at Fox Run in Mercer County, PA. Posters and displays from participants in the SRWC included : **Environmentally Innovative Solutions, LLC, Jennings Environmental Education Center, Stream Restoration Inc., and SRWC.** And, we were even on **television(!!!)** with Margaret Dunn describing the value of partnership efforts and watershed restoration.

Margaret Dunn of the SRWC and Stream Restoration Inc. was sworn in as the new President of ASMR! Congratulations, Margaret!! She replaces Jeff Skousen of West Virginia University, who did a tremendous job in organizing this year's conference.

The 2005 Annual Meeting of ASMR will take place June 19-24 at beautiful Beaver Run Resort and Conference Center in Breckenridge, Colorado. We hope you will make plans to "raise reclamation to new heights" by being a part of ASMR 2005! **Because of the presence and interest of watershed groups at the 2004 conference, the ASMR National Executive Committee voted unanimously to offer a $1000 scholarship to a watershed group in order to send a representative(s) to give a presentation at the 2005 ASMR conference in Breckenridge!!! (Information regarding the application will be provided when available.)**

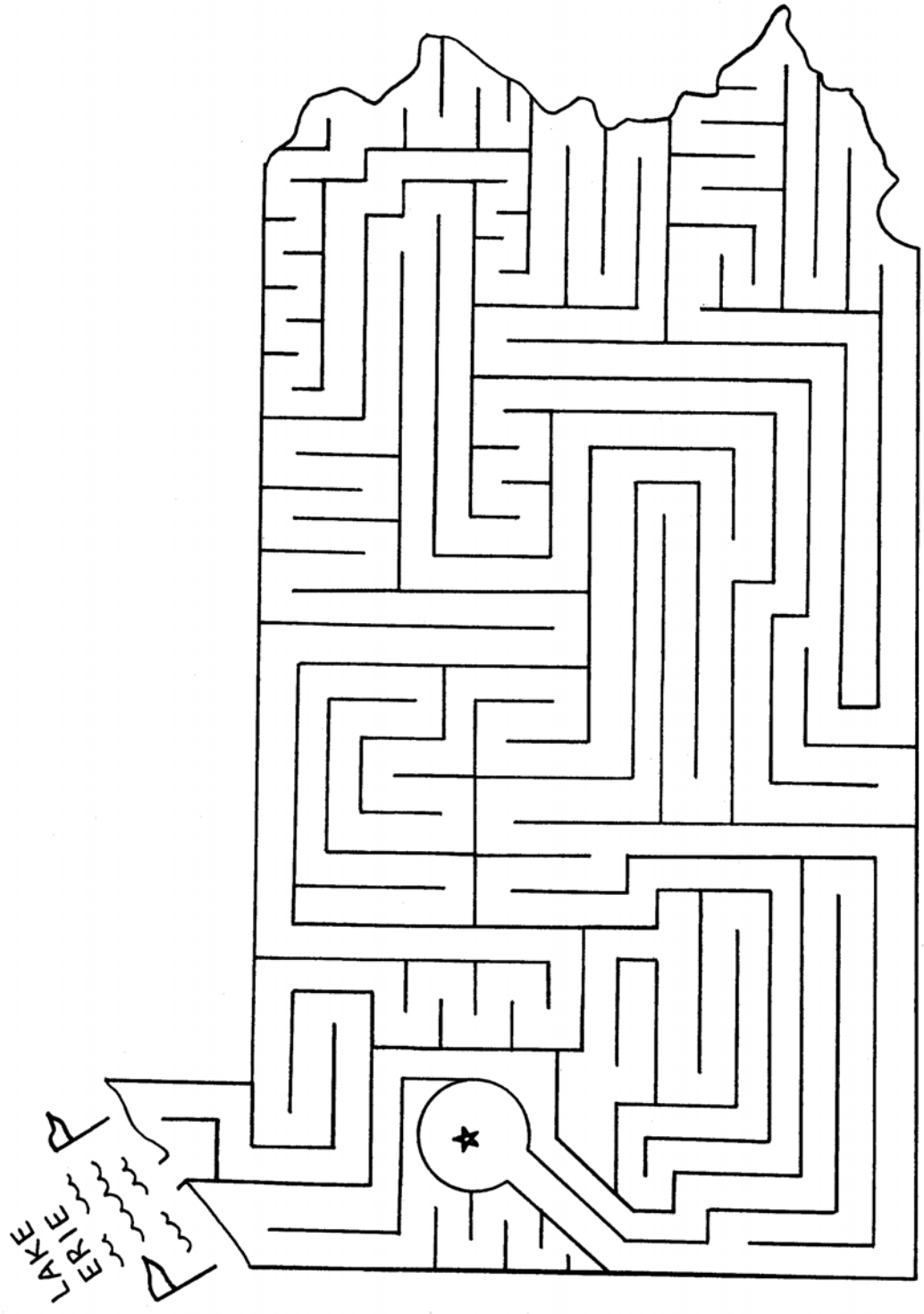
Thank you Jeff Skousen, Dick Barnhisel, and all the other organizers for making this such a worthwhile experience "to learn from the best".

The KIDS Catalyst

SLIPPERY ROCK WATERSHED COALITION FUN ACTIVITY

MARVELOUS MAZE MADNESS

Have you ever wondered where in the world IS the Slippery Rock Creek Watershed? We are located where the star is shown in this drawing of Pennsylvania. In our streams, you are likely to find fish like bluegill, brown trout, rock bass, white sucker, mottled sculpin, blacknose dace, johnny darter, common shiner, bluntnose minnow, and creek chub. In this maze, your job is to find your way across Pennsylvania from the Slippery Rock Creek Watershed to Lake Erie, where fish like the lake trout, brown trout, carp, longnose sucker, walleye, yellow perch, and smallmouth bass are found. After you finish the maze, you can mail your paper to us for a free gift certificate!



Name _____ Age _____ Address _____

Slippery Rock Watershed Coalition c/o Stream Restoration Incorporated
A PA Non-Profit Organization
3016 Unionville Road
Cranberry Twp., PA 16066

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. May Distribution: 1210 copies

John Dawes, Western Pennsylvania Watershed Program Accepts 2004 SRWC Appreciation Award

The WPWP continues to mean so much to so many!!! Thousands of people have been able to implement efforts that restore and sustain the quality of our water resources through support from this program!!! Thank you!!!

SRWC Annual Get-Together

We hope you will join us on May 13 for our annual get-together! Anyone is welcome to take part in the fun! The festivities will be from 6PM to 8PM at the Boyers Sportsman Club in Boyers, PA. We'll be enjoying delicious food and deserts, fabulous door prizes, good company, and there will be lots to do for the children (including the always-popular piñata!) We will also have displays about our restoration projects and a presentation updating the status of the watershed assessment - learn something about the water problems and solutions happening in your own back-yard! So don't miss out! Bring the whole family for FREE food, door prizes, and much more! For additional information on this event, call Shaun Busler of Stream Restoration Inc. at 724-776-0161.

SRWC Adopt-a-Highway Clean-up

Aaaaah, springtime! The birds are singing, the flowers are blooming, the sun is shining… and trash has been piling up along I-79! The SRWC will hold their first trash pick-up day of 2004 on Friday, May 21 beginning at noon. Come help us in our effort to keep the 1-mile stretch of interstate between mile markers 100 and 101 clean and green. Who knows what interesting artifacts of garbage have accumulated during those long winter months? If you'd like to help us take up a collection for Oscar the Grouch, meet us at the unofficial Park-n-Ride at the intersection near I-79 and US-422 (off exit 99). We'll provide gloves, safety vests, bags, and a free lunch! Call Cliff Denholm at 724-776-0161 if you have any questions. We would appreciate your help. Anyone is welcome!

De Sale Phase III 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)
10A	1/11/95	Measured	1		3.1				0	400	143.0		117.0		22.6		1424	
10A	2/16/95	Measured	12		3.7				0	194	46.3		40.1		1.8		495	
10A	3/21/95	Measured	3		3.1				0	348	50.4		49.4		0.7		716	
10A	4/11/95	Measured	3		3.2				0	248	40.0		45.8		0.8		627	
10A	5/9/95	Measured	2		2.9				0	482	80.7		98.8		1.2		1113	
10A	6/21/95	Measured	1		2.8				0	338	39.8		66.1		0.9		798	
10A	7/25/95	Measured	2		2.7				0	388	36.6		57.5		1.1		1050	
10A	8/17/95	Measured	1		2.7				0	468	34.7		70.0		1.6		1013	
10A	9/14/95	Measured	2		2.7				0	572	56.8		89.0		2.1		1138	
10A	10/24/95	Measured	1		2.7				0	570	62.7		236.0		2.5		1380	
10A	1/17/96	Measured	3		3.2				0	504	121.0		76.4		0.8		260	
10A	2/27/96	Measured	3		3.4				0	322	102.0		65.5		1.0		925	
10A	3/26/96	Measured	4		3.4				0	300	66.8		47.3		1.0		949	
10A	5/21/96	Measured	6		3.0				0	332	50.6		62.7		3.5		1040	
10A	6/20/96	Measured	3		2.9				0	396	53.3		82.5		1.3		1020	
10A	9/12/96	Measured	2		2.7				0	558	54.0		106.0		2.7		1520	
10A	12/18/96	Measured	3		3.3				0	282	54.0		50.1		1.6		636	
10A	1/30/97	Measured	3		3.5				0	324	109.0		88.9		2.3		844	
10A	2/27/97	Measured	18		3.7				0	120	21.6		23.1		1.6		304	
10A	3/25/97	Measured	5		3.4				0	404	85.2		77.3		2.2		909	
10A	4/22/97	Measured	4		3.2				0	428	76.1		76.9		3.2		691	
10A	6/10/97	Measured	2		3.0				0	532	111.0		109.0		1.4		976	
10A	7/23/97	Measured	5		2.7				0	620	85.4		121.0		2.0		1500	
10A	8/27/97	Measured	1		2.7				0	678	80.5		133.0		2.9		1300	
10A	2/9/99	Measured	3		3.2				0	318	115.0		91.3		1.4		1410	
10A	10/23/06	Measured	2		3.0				0	436	118.0		88.1		2.2		1010	

De Sale Phase III 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)
Min			1		2.7				0	120	21.6		23.1		0.7		260	
Max			18		3.7				0	678	143.0		236.0		22.6		1520	
Avg			4		3.1				0	406	72.9		83.4		2.6		963	
Range			17		1.0				0	558	121.4		212.9		21.9		1260	

Description: PA DEP sampling point; Seep at toe of spoil which flowed into pre-existing treatment pond #1

De Sale Phase III 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)
10B	1/11/95	Measured	4		3.8				0	552	232.0		171.0		33.6		2081	
10B	2/16/95	Measured	3		4.3				0	728	210.0		149.5		29.7		2494	
10B	3/21/95				4.3				0	784	204.0		117.0		22.6		2124	
10B	4/11/95	Measured	4		3.7				0	542	142.0		105.0		16.8		1680	
10B	5/9/95	Measured	3		3.8				0	636	168.0		122.3		19.3		1605	
10B	6/21/95	Measured	5		3.5				0	668	180.0		119.0		17.6		1480	
10B	7/25/95	Measured	3		3.7				0	638	156.0		100.0		15.5		1607	
10B	8/17/95	Measured	2		4.1				0	728	180.0		113.0		14.6		1980	
10B	9/14/95	Measured	1		4.6				0	820	218.0		132.0		18.5		2194	
10B	10/24/95	Measured	2		4.5				0	842	265.0		174.0		21.3		2469	
10B	1/17/96	Measured	2		4.4				0	776	182.0		123.0		26.4		2101	
10B	2/27/96	Measured	3		4.1				0	738	214.0		137.0		28.2		2450	
10B	3/26/96	Measured	2		4.2				0	798	19.3		98.4		21.1		451	
10B	5/21/96	Measured	3		4.3				0	824	204.0		132.0		28.7		2120	
10B	6/20/96	Measured	2		4.4				0	810	218.0		140.0		21.6		2215	
10B	9/12/96	Measured	2		4.1				0	876	211.0		150.0		18.0		2370	
10B	10/23/96	Measured	2		4.4				0	804	222.0		153.0		20.8		2090	
10B	12/18/96	Measured	3		4.4				0	744	199.0		114.0		18.6		1920	
10B	1/30/97	Measured	2		4.6				0	636	22.6		148.0		22.8		1500	
10B	2/27/97	Measured	2		4.6				0	814	242.0		153.0		21.1		1700	
10B	3/25/97	Measured	2		4.6				0	886	241.0		154.0		21.5		886	
10B	4/22/97	Measured	2		4.5				0	806	212.0		129.0		19.1		2000	
10B	6/10/97	Measured	2		4.5				0	830	279.0		176.5		11.9		2520	
10B	7/23/97	Measured	2		4.4				0	802	245.0		153.0		15.0		2200	
10B	8/27/97	Measured	3		4.5				0	902	258.0		165.0		16.8		2100	
10B	2/9/99	Measured	1		3.7				0	356							1510	

De Sale Phase III 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)
Min			1		3.5				0	356	19.3		98.4		11.9		451	
Max			5		4.6				0	902	279.0		176.5		33.6		2520	
Avg			2		4.2				0	744	197.0		137.1		20.8		1917	
Range			4		1.1				0	546	259.7		78.1		21.7		2069	

Description: PA DEP sampling point; Previously a piped discharge that entered pre-existing treatment pond #2 but is now collected by the collection ditch

De Sale Phase III 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)
10C	1/11/95	Measured	6		3.5				0	208	18.1		95.3		11.5		1438	
10C	2/16/95	Measured	60		3.5				0	322	48.9		77.4		10.0		889	
10C	3/21/95	Measured	20		3.4				0	328	29.3		68.3		9.9		995	
10C	4/11/95	Measured	18		3.3				0	278	29.2		64.5		9.2		957	
10C	5/9/95	Measured	8		3.1				0	398	28.4		96.4		14.5		1200	
10C	6/21/95	Measured	8		3.2				0	208	5.6		58.3		8.0		798	
10C	7/25/95	Measured	8		3.5				0	160	2.0		50.7		4.5		1295	
10C	8/17/95	Measured	2		3.4				0	238	2.7		62.2		5.6		1401	
10C	9/14/95	Measured	6		3.7				0	250	2.1		72.3		5.8		1296	
10C	10/24/95	Measured	3		3.5				0	304	4.7		112.0		7.9		1633	
10C	2/27/96	Measured	12		3.9				0	178	30.3		38.5		6.6		676	
10C	3/26/96	Measured	12		3.6				0	244	26.9		51.8		7.6		174	
10C	5/21/96	Measured	15		3.1				0	286	16.4		60.2		8.9		943	
10C	6/20/96	Measured	17		3.1				0	346	21.1		74.8		10.9		1090	
10C	9/12/96	Measured	4		3.0				0	400	18.2		95.9		11.7		1530	
10C	10/23/96	Measured	11		3.3				0	292	17.5		74.0		7.4		887	
10C	12/18/96	Measured	12		3.6				0	200	25.7		43.3		4.3		609	
10C	1/30/97	Measured	12		3.7				0	146	44.0		55.0		5.1		665	
10C	2/27/97	Measured	12		3.9				0	220	46.4		48.7		6.2		501	
10C	3/25/97	Measured	24		3.5				0	326	53.0		66.9		6.4		902	
10C	4/22/97	Measured	15		3.2				0	404	43.4		71.8		8.4		978	
10C	6/10/97	Measured	8		3.0				0	494	48.6		108.0		7.9		1350	
10C	7/23/97	Measured	3		2.8				0	544	27.0		121.0		16.1		1600	
10C	8/27/97	Measured	4		3.0				0	532	22.9		130.0		17.3		1500	
10C	2/9/99	Measured	10		3.8				0	82	16.0		30.4		2.4		448	
10C	4/30/02	Estimated	10		3.4				0	242	7.2		51.1		9.1		1286	30
10C	10/8/02		0															
10C	3/14/03	Measured	40		6.9				67	0	0.0		37.1		0.0		651	4
10C	6/17/03	Measured	12		6.2				60	116	0.4		58.1		0.0		1204	14

De Sale Phase III 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)
10C	9/11/03	Measured	10		7.0				82	0			34.5		0.0		929	4
10C	10/30/03	Measured	12		7.0				57	0	0.0		79.1		0.0		1236	20
10C	3/30/04	Measured	20		6.2				37	113	1.3		66.7		1.7		1171	6
Min			0		2.8				0	0	0.0		30.4		0.0		174	4
Max			60		7.0				82	544	53.0		130.0		17.3		1633	30
Avg			13		3.9				10	254	21.2		69.5		7.2		1040	13
Range			60		4.2				82	544	53.0		99.6		17.3		1459	26

Description: PA DEP sampling point; Originally sampled at the effluent of the of the pre-existing treatment pond #3, which is the same as the passive treatment pond SP2; Since construction of the passive system it is now sampled at the final effluent of the HFLB

De Sale Phase III 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)
10D	3/21/95				3.7				0	118	4.8		22.8		4.1		442	
10D	4/11/95				3.9				0	82	0.5		17.7		3.4		274	
10D	5/9/95				3.3				0	228	12.4		48.2		8.5		922	
10D	6/21/95				3.2				0	194	9.3		45.6		8.2		713	
10D	7/25/95				3.1				0	212	9.3		43.4		7.3		1118	
10D	8/17/95				3.0				0	334	11.2		62.7		9.2		1194	
10D	9/14/95				3.0				0	382	16.4		70.1		10.4		1202	
10D	10/24/95				3.0				0	358	13.1		67.6		10.6		1238	
10D	1/17/96				3.5				0	190	13.3		35.3		5.7		635	
10D	2/27/96				3.7				0	98	5.0		24.8		5.3		472	
10D	3/26/96				3.7				0	126	6.0		26.4		5.5		520	
10D	5/21/96				3.4				0	166	7.3		33.1		5.5		709	
10D	6/20/96				3.8				0	78	4.5		20.9		3.2		348	
10D	9/12/96				3.2				0	216	10.5		44.7		7.7		740	
10D	10/23/96				3.8				0	92	4.6		22.8		3.8		307	
10D	12/18/96				3.7				0	118	7.0		24.5		5.5		368	
10D	1/30/97				3.8				0	66	6.9		27.1		4.4		347	
10D	2/27/97				4.0				0	70	4.7		17.9		3.1		272	
10D	3/25/97				3.7				0	174	9.3		39.3		6.4		631	
10D	4/22/97				3.5				0	180	9.9		36.2		6.8		581	
10D	6/10/97				3.3				0	220	13.3		47.7		8.0		882	
10D	7/23/97				3.0				0	368	20.0		77.8		11.6		1600	
10D	8/27/97				3.1				0	318	17.6		67.7		10.1		1100	
10D	2/9/99				4.0				0	34	3.6		16.0		3.0		309	

De Sale Phase III 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)
Min					3.0				0	34	0.5		16.0		3.0		272	
Max					4.0				0	382	20.0		77.8		11.6		1600	
Avg					3.5				0	184	9.2		39.2		6.6		705	
Range					1.0				0	348	19.5		61.8		8.7		1328	

Description: PA DEP sampling point; Unnamed tributary to Seaton Creek upstream of AMD discharges

De Sale Phase III 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)
10E	3/21/95				3.7				0	124	3.9		24.8		4.6		475	
10E	4/11/95				3.9				0	88	4.5		18.4		3.6		373	
10E	5/9/95				3.3				0	220	10.5		46.8		8.6		852	
10E	6/21/95				3.2				0	180	7.9		44.7		7.9		720	
10E	7/25/95				3.1				0	195	7.6		43.0		7.3		1016	
10E	8/17/95				2.9				0	350	13.5		65.4		9.5		1215	
10E	9/14/95				3.0				0	346	15.2		67.3		10.1		1225	
10E	10/24/95				3.1				0	332	10.9		61.5		9.8		1188	
10E	1/17/96				3.5				0	190	11.9		37.6		6.3		664	
10E	2/27/96				3.7				0	96	4.4		26.9		5.3		512	
10E	3/26/96				3.7				0	122	5.5		26.7		5.8		533	
10E	5/21/96				3.5				0	158	6.3		33.0		6.4		680	
10E	6/20/96				3.8				0	84	3.3		24.3		3.9		384	
10E	9/12/96				3.3				0	204	9.6		46.4		7.7		781	
10E	10/23/96				3.9				0	96	2.9		24.8		4.3		309	
10E	12/18/96				3.8				0	116	7.8		24.4		5.3		413	
10E	1/30/97				3.8				0	70	6.2		28.6		5.0		341	
10E	2/27/97				4.0				0	84	5.4		21.2		3.6		295	
10E	3/25/97				3.7				0	172	8.7		39.0		7.3		662	
10E	4/22/97				3.6				0	182	8.5		35.9		7.2		610	
10E	6/10/97				3.3				0	208	9.1		49.0		8.6		903	
10E	7/23/97				3.0				0	362	17.8		75.5		11.8		1300	
10E	8/27/97				3.2				0	298	15.0		66.5		10.0		1100	
10E	2/9/99				4.0				0	36	3.4		17.0		3.2		337	
10E	4/30/02				4.7				8	112	2.4		25.2		6.2		762	24
10E	10/8/02				6.7				36	0	1.1		27.0		1.3		1208	18
10E	3/14/03				6.5				16	0	0.7		9.3		0.9		283	4
10E	6/17/03				6.3				39	0	0.0		6.6		0.0		498	4
10E	9/11/03				6.8				26	0	0.0		14.2		0.0		575	16

De Sale Phase III 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)
10E	10/30/03				6.5				22	0	0.5		17.3		0.9		552	12
10E	3/30/04				4.7				9	56	2.2		18.2		4.1		511	0
10E	6/8/04			7.3	6.9	1436		44	40	-21	0.4	0.1	16.0	15.1	0.5	0.1	910	3
Min				7.3	2.9	1436		44	0	-21	0.0	0.1	6.6	15.1	0.0	0.1	283	0
Max				7.3	6.9	1436		44	40	362	17.8	0.1	75.5	15.1	11.8	0.1	1300	24
Avg				7.3	4.2	1436		44	6	139	6.5	0.1	33.8	15.1	5.5	0.1	693	10
Range				0.0	4.0	0		0	40	383	17.8	0.0	68.9	0.0	11.8	0.0	1017	24

Description: PA DEP sampling point; Unnamed westerly tributary of Seaton Creek downstream of AMD discharges and Sampling point #23; Collected above confluence with easterly tributary

De Sale Phase III 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)
Collection Pond	10/14/02			4.0	2.9	3082	15		0	422	81.8	78.3	110.6	109.1	1.9	1.8	1910	10
Collection Pond	12/12/02			3.0	3.0	3160	0		0	497	144.6	140.8	119.8	117.2	1.5	1.1	2144	13
Collection Pond	3/10/03			3.2	3.6	2227	1		0	411	136.0	132.9	78.6	78.0	0.6	0.4	1443	12
Collection Pond	4/24/03			4.0	3.1	2742	11		0	412	115.0	114.6	96.4	95.3	0.8	0.6	1942	9
Collection Pond	6/30/03			2.6	2.8	2656	25		0	330	41.4	39.0	83.7	82.4	1.1	0.9	2145	2
Collection Pond	8/28/03			2.5	2.8	2800	28		0	410	39.4	38.1	83.9	82.7	1.5	1.4	1900	5
Collection Pond	10/29/03			2.9	3.0	2284			0	325	62.4	61.8	82.1	79.4	0.9	0.9	1510	8
Collection Pond	3/25/04			3.0	3.1	2452			0	340	121.9	117.9	74.9	73.2	0.4	0.3	1083	15
Min				2.5	2.8	2227	0		0	325	39.4	38.1	74.9	73.2	0.4	0.3	1083	2
Max				4.0	3.6	3160	28		0	497	144.6	140.8	119.8	117.2	1.9	1.8	2145	15
Avg				3.1	3.0	2675	13		0	393	92.8	90.4	91.2	89.7	1.1	0.9	1760	9
Range				1.5	0.8	933	28		0	172	105.2	102.7	44.9	44.0	1.5	1.5	1062	13

Description: Sampled at effluent of pre-existing collection pond for discharge 10A

De Sale Phase III 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 RAW	10/8/02				3.0				0	842	128.0		143.0		28.7		2244	52
DEP RAW	3/14/03				3.4				0	355	70.0		62.7		6.0		1173	24
DEP RAW	6/17/03				3.0				0	552	95.4		108.0		25.8		1439	24
DEP RAW	9/11/03				3.0				0	641	107.0		115.0		25.2		2229	20
DEP RAW	10/30/03				3.2				0	672	111.0		101.0		20.2		1409	22
DEP RAW	3/30/04				3.3				0	439	98.8		90.1		15.0		1390	
Min					3.0				0	355	70.0		62.7		6.0		1173	20
Max					3.4				0	842	128.0		143.0		28.7		2244	52
Avg					3.2				0	583	101.7		103.3		20.2		1647	28
Range					0.4				0	487	58.0		80.3		22.7		1072	32

Description: PA DEP sample point; Sampled at collection ditch before Forebay

De Sale Phase III 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)
FOREBAY	12/12/02	Estimated	5	3.3	3.4	3411	1		0	600	167.8	148.7	145.5	141.1	29.7	25.9	2605	23
FOREBAY	3/10/03	Assumed	16	3.4	3.5	2737	1		0	506	124.7	116.3	105.8	102.9	21.6	19.9	2269	11
FOREBAY	4/24/03	Assumed	12	4.0	3.1	3380	10		0	534	109.7	107.2	123.5	121.6	30.8	28.8	3433	10
FOREBAY	6/30/03	Assumed	11	2.9	3.0	3378	25		0	542	84.6	73.4	123.3	118.7	28.4	23.5	2749	6
FOREBAY	8/28/03	Assumed	5	2.9	3.0	3347	28		0	602	84.0	82.4	122.0	116.9	25.2	22.9	3272	8
FOREBAY	10/29/03	Assumed	16	3.1	3.2	3389	10		0	619	134.3	134.2	142.1	131.8	23.6	23.4	3432	8
FOREBAY	3/25/04	Assumed	30	3.2	3.3	3156			0	506	141.8	128.3	105.9	102.7	22.2	21.3	1999	12
Min			5	2.9	3.0	2737	1		0	506	84.0	73.4	105.8	102.7	21.6	19.9	1999	6
Max			30	4.0	3.5	3411	28		0	619	167.8	148.7	145.5	141.1	30.8	28.8	3433	23
Avg			14	3.3	3.2	3257	13		0	558	121.0	112.9	124.0	119.4	25.9	23.7	2823	11
Range			25	1.2	0.6	674	27		0	113	83.9	75.2	39.7	38.4	9.2	9.0	1434	17

Description: Sampled at the effluent spillway of the Forebay, which includes discharges 10A and 10B

De Sale Phase III 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)
VFP1	12/12/02	Bucket	5	6.4	6.4	3820	3	139	115	164	36.0	33.0	151.9	149.8	1.5	0.5	2720	20
VFP1	3/10/03	Measured	16	5.8	5.8	1245		20	12	52	4.9	1.9	35.9	35.9	3.5	1.9	775	16
VFP1	4/24/03	Measured	12	6.2	5.8	3113	12	79	29	166	25.3	21.6	108.6	106.5	4.1	1.0	2166	13
VFP1	6/30/03	Bucket	11	6.0	5.9	3162	22	81	40	196	69.7	68.3	116.5	113.6	4.8	0.5	3190	19
VFP1	8/28/03	Bucket	5	5.0	3.4	2953	25	8	0	258	51.7	51.4	109.4	106.3	12.4	10.3	2871	49
VFP1	10/29/03	Bucket	16	3.4	3.3	2845	10	0	0	358	45.7	45.3	120.7	114.0	17.6	13.8	2033	31
VFP1	3/25/04	Bucket	30	3.4	3.2	2803			0	284	53.6	48.2	87.5	86.8	11.8	11.6	1732	26
Min			5	3.4	3.2	1245	3	0	0	52	4.9	1.9	35.9	35.9	1.5	0.5	775	13
Max			30	6.4	6.4	3820	25	139	115	358	69.7	68.3	151.9	149.8	17.6	13.8	3190	49
Avg			14	5.2	4.8	2849	14	55	28	211	41.0	38.5	104.4	101.8	8.0	5.7	2212	25
Range			25	3.0	3.1	2575	22	139	115	306	64.8	66.4	116.0	113.8	16.1	13.4	2415	36

Description: Vertical Flow Pond 1; Composite sample of all 8 effluent pipes of the Vertical Flow Pond 1

De Sale Phase III 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)
SP1	12/12/02	Assumed	5	6.5	6.5	2287	1		44	49	0.9	0.4	53.5	48.8	0.2	0.2	1092	5
SP1	3/10/03	Assumed	29	5.6	5.3	1445	1		5	83	9.3	7.3	42.7	42.0	3.2	2.0	870	8
SP1	4/24/03	Assumed	16	6.5	6.3	2865	10		22	164	5.5	4.0	93.6	85.4	0.5	0.4	2643	7
SP1	6/30/03	Assumed	8	4.7	4.8	2715	24	0	2	141	1.0	0.4	96.3	94.6	1.7	1.4	2390	8
SP1	8/28/03	Assumed	6	3.7	3.7	2650	30	0	0	207	2.0	1.2	93.6	91.3	8.3	8.1	2402	14
SP1	10/29/03	Assumed	17	3.4	3.4	2681	10	0	0	280	10.9	10.5	103.3	97.0	13.8	13.8	2437	16
SP1	3/25/04	Assumed	38	3.4	3.3	2467			0	238	37.8	36.0	71.7	69.3	10.3	9.5	1289	24
Min			5	3.4	3.3	1445	1	0	0	49	0.9	0.4	42.7	42.0	0.2	0.2	870	5
Max			38	6.5	6.5	2865	30	0	44	280	37.8	36.0	103.3	97.0	13.8	13.8	2643	24
Avg			17	4.8	4.8	2444	13	0	10	166	9.6	8.5	79.2	75.5	5.4	5.1	1875	12
Range			33	3.2	3.2	1420	29	0	44	231	36.9	35.6	60.6	55.0	13.7	13.6	1774	19

Description: Settling Pond 1; Pre-existing treatment pond #2; Sampled at effluent spillway

De Sale Phase III 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)
VFP2	12/12/02	Not Flowing	0															
VFP2	3/10/03	Measured	29	6.7	6.9	1450	0	60	64	-18	0.6	0.3	38.7	38.1	0.4	0.3	885	9
VFP2	4/24/03	Measured	16	6.8	6.5	2610	12	71	52	100	13.6	12.8	80.4	76.5	0.1	0.1	2613	30
VFP2	6/30/03	Bucket	8	6.6	6.8	2577	22	102	91	41	2.7	1.8	80.6	80.3	0.1	0.1	1949	16
VFP2	8/28/03	Bucket	6	6.7	6.9	2280	23	84	72	66	1.3	0.6	74.6	73.2	0.3	0.2	1984	12
VFP2	10/29/03	Bucket	17	6.6	6.3	2566	10	50	43	90	1.6	1.4	97.0	96.6	2.4	0.6	2033	15
VFP2	3/25/04	Bucket	38	5.1	4.6	2289		2	1	150	8.1	4.9	71.7	71.0	6.8	6.0	1442	12
Min			0	5.1	4.6	1450	0	2	1	-18	0.6	0.3	38.7	38.1	0.1	0.1	885	9
Max			38	6.8	6.9	2610	23	102	91	150	13.6	12.8	97.0	96.6	6.8	6.0	2613	30
Avg			16	6.4	6.4	2295	13	62	54	72	4.6	3.6	73.8	72.6	1.7	1.2	1818	16
Range			38	1.7	2.4	1160	23	100	90	168	13.1	12.5	58.3	58.5	6.7	6.0	1728	21

Description: Vertical Flow Pond 2; Composite sample of all 6 effluent pipes

De Sale Phase III 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)
SP2	12/12/02	Not Flowing	0															
SP2	3/10/03	Assumed	29	6.6	7.0	1463	1		59	-2	0.9	0.6	38.9	38.1	0.5	0.2	893	7
SP2	4/24/03	Assumed	16	6.8	6.7	2611	9		53	98	6.3	0.5	76.3	71.1	0.2	0.1	3701	16
SP2	6/30/03	Assumed	8	7.5	8.1	2475	25		38	52	2.2	0.1	68.6	54.6	0.2	0.1	1688	28
SP2	8/28/03	Assumed	6	8.3	7.8	2225	29	90	80	22	1.1	0.1	73.7	73.1	0.2	0.1	1883	14
SP2	10/29/03	Assumed	17	6.9	6.6	2542	10	32	37	101	0.5	0.1	96.1	95.7	0.4	0.2	1948	9
SP2	3/25/04	Assumed	38	5.0	4.6	2340			1	150	5.0	2.5	73.4	72.8	6.8	5.8	1503	4
Min			0	5.0	4.6	1463	1	32	1	-2	0.5	0.1	38.9	38.1	0.2	0.1	893	4
Max			38	8.3	8.1	2611	29	90	80	150	6.3	2.5	96.1	95.7	6.8	5.8	3701	28
Avg			16	6.8	6.8	2276	15	61	45	70	2.6	0.7	71.2	67.5	1.4	1.1	1936	13
Range			38	3.3	3.5	1148	28	58	79	152	5.8	2.5	57.2	57.7	6.7	5.7	2808	24

Description: Settling Pond 2: Pre-existing treatment pond #3; Sampled at spillway; The effluent of this pond was previously sample point 10C which had been moved after the construction of the passive system to effluent of the HFLB

De Sale Phase III 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)
HFLB	12/12/02	Not Flowing	0	7.2				65										
HFLB	3/10/03	Measured	30	6.9	7.1	1525	0	63	70	8	0.2	0.1	38.5	38.0	0.3	0.1	885	9
HFLB	4/24/03	Measured	10	7.0	7.0	2555	12	70	66	81	1.1	0.1	73.9	72.9	0.1	0.0	1838	12
HFLB	6/30/03	Bucket	8	7.1	7.1	2518	20	67	64	42	2.6	2.1	69.3	65.5	0.1	0.1	1851	9
HFLB	8/28/03	Bucket	5	7.2	7.4	2212	18	74	77	21	0.7	0.7	70.0	68.2	0.2	0.1	1783	10
HFLB	10/29/03	Bucket	13	7.0	6.7	754	10		50	85	0.1	0.1	91.9	90.4	0.1	0.1	369	5
HFLB	3/25/04	Assumed	38	6.1	6.2	2413		35	34	85	0.2	0.1	65.6	65.0	0.9	0.5	1304	8
HFLB	4/9/04	Bucket	30	6.4														
Min			0	6.1	6.2	754	0	35	34	8	0.1	0.1	38.5	38.0	0.1	0.0	369	5
Max			38	7.2	7.4	2555	20	74	77	85	2.6	2.1	91.9	90.4	0.9	0.5	1851	12
Avg			17	6.8	6.9	1996	12	62	60	54	0.8	0.5	68.2	66.7	0.3	0.1	1338	9
Range			38	1.1	1.2	1801	20	39	43	77	2.5	2.0	53.4	52.4	0.8	0.5	1483	7

Description: Horizontal Flow Limestone Bed; Sampled at effluent pipe; Final effluent of the pasive treatment system; Current location of PA DEP sampling point 10C

De Sale Phase II 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)
410	1/6/69		236		4.2				0	85	0.4						336	
410	2/5/69		193		4.7				4	102	0.7						259	
410	3/10/69		70		4.3				0	124	0.4						442	
410	4/7/69		310		4.9				8	32	0.2						154	
410	5/5/69		123		4.1				0	84	0.1						288	
410	6/2/69		70		4.0				0	128	0.4						403	
410	7/8/69		94		4.0				0	74	0.3						259	
410	8/4/69		34		3.1				0	152	0.7						422	
410	9/8/69		50		3.6				0	120	1.0						413	
410	10/6/69		22		3.9				0	112	1.5						422	
410	11/3/69		70		4.1				0	68	0.3						250	
410	12/8/69		338		4.6				6	30	0.1						154	
410	5/16/95				3.4				0	162	8.4		32.8		5.8		598	6
410	6/29/95				3.6				0	116	5.1		35.6		7.0		571	14
410	7/27/95				3.1				0	242	9.8		51.9		8.0		1089	3
410	9/12/95		19		3.0				0	420	19.5		81.1		14.3		1812	6
410	11/20/95				3.7				0	58	4.9		16.8		3.0		350	3
410	2/22/96				4.0				3	32	2.9		11.5		2.5		266	3
410	3/27/96				3.4				0	150	8.0		30.6		6.9		837	3
410	4/18/96				3.5				0	130	6.9		28.2		5.5		681	3
410	5/30/96				3.3				0	224	12.6		49.6		9.5		1154	3
410	6/27/96				3.4				0	140	6.7		31.3		5.7		636	5
410	7/31/96				3.1				0	262	9.8		50.8		8.6		1132	0
410	8/29/96				3.1				0	334	13.0		63.2		11.0		1418	0
410	9/18/96				3.6				0	86	3.7		16.3		2.8		399	0
410	10/24/96				3.7				0	80	3.6		19.4		3.7		535	4
410	11/26/96				4.3				6	46	2.3		9.9		2.0		198	8

De Sale Phase II 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)
410	3/21/97				3.6				0	144	7.4		28.3		6.2		696	0
410	6/10/97				3.2				0	216	9.8		39.6		7.4		898	0
410	7/10/97				3.1				0	342	17.4		61.2		11.0		1203	0
410	8/12/97				3.0				0	410	18.2		69.8		12.4		1577	6
410	10/9/97				3.3				0	220	10.5		40.9		7.1		900	0
410	11/18/97				3.7				0	118	8.7		23.0		4.5		597	0
410	12/23/97		150		3.8				0	70	4.8		15.7		3.3		373	0
410	1/7/98				3.6				0	112	5.9		23.0		4.7		550	4
410	2/10/98	Estimate	60		3.5				0	166	11.3		34.2		6.8		733	
410	3/5/98	Measured	450		3.6				0	128	8.2		26.0		5.1		650	
410	3/19/98				3.6				0	96	6.2		19.9		4.0		471	
410	4/9/98				3.8				0	110	9.1		24.3		6.8		568	60
410	5/19/98				3.4				0	182	9.5		35.3		15.0		857	4
410	7/7/98				3.2				0	230	12.8		54.0		9.3		1097	
410	9/24/98				2.9				0	306	20.9		69.2		12.6		1659	6
410	10/14/98				3.2				0	294	16.3		59.1		10.6		1304	
410	1/26/99	Estimate	50		4.1				3	28	3.5		10.0		2.3		240	
410	3/23/99				3.6				0	102	5.9		26.6		5.7		418	
410	5/18/99				3.3				0	204	8.6		47.2		8.8		973	
410	6/24/99				3.2				0	240	9.3		51.6		9.2		1185	
410	7/8/99				3.1				0	324	11.7		58.2		10.4		1432	
410	8/20/99				3.0				0	224	11.5		60.9		11.1		1526	
410	9/9/99				3.1				0	278	12.5		64.9		11.7		1648	
410	11/12/99				3.2				0	320	12.0		51.3		9.3		1153	12
410	12/14/99		200		3.8	612			0	44	2.7		10.6		2.2		241	6
410	1/20/00				3.5				0	154	15.9		36.0		6.8		1027	
410	1/24/00	Bucket	48	4.3	3.4	1445			0	170	11.1		35.2		7.7		884	8

De Sale Phase II 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)
410	2/10/00				3.4				0	230	14.6		42.0		8.2		1153	
410	3/8/00				3.4				0	128	4.7		25.6		5.2		573	
410	4/25/00				3.5				0	148	6.1		32.8		7.3		770	
410	5/16/00				3.4				0	192	8.4		34.7		7.2		934	
410	5/25/00				3.4				0	156	5.9		28.7		5.8		634	
410	6/15/00				3.6				0	92	4.1		16.5		3.4		568	
410	7/13/00				3.1				0	288	13.7		61.5		11.3		936	
410	8/9/00				3.2				0	160	10.1		42.0		7.9		929	
410	9/28/00				7.0				178	0	8.5		8.8		1.4		1243	32
410	10/18/00				7.0				112	0	4.6		11.0				1398	18
410	11/14/00				6.8				80	0	1.4		17.4		0.5		923	10
410	12/19/00				6.5				40	0	0.5		27.1		0.5		815	
410	1/17/01				6.6				60	0	0.3		31.8		0.6		881	14
410	2/22/01				6.5				38	0	1.1		12.2		0.8		300	6
410	3/29/01				6.1				30	0	0.9		15.7		1.0		471	8
410	4/5/01	Measured	135		6.7				46	0	0.4		12.4		0.7		529	8
410	5/4/01				6.1				24	5	1.9		32.2		2.1		725	18
410	5/8/01	Measured	120		6.4				38	9	2.3		33.0		2.1		722	24
410	6/19/01				6.7				60	0	2.4		28.6				990	6
410	7/11/01				6.5				50	0	2.2		41.5				1093	16
410	8/30/01				6.5				54	0	1.4		38.3				1444	14
410	10/18/01				6.6				54	0	0.4		33.1				1675	12
410	11/8/01	Cross-section	55	6.8	6.9	1944	11		52	0	0.4	0.3	24.3	23.8	0.3	0.2	1253	10
410	2/14/02				4.9				12	85	1.5		18.1		4.9			8
410	3/13/02				6.5				62	0			4.0		0.6			
410	4/30/02				4.8				8	96	4.6		18.2		4.0			10
410	6/10/02				4.5	1472			0	84	3.0	1.0	22.1	21.9	8.9	6.7	741	9

De Sale Phase II 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)
410	7/25/02				6.7				40	0	0.6		39.4		0.0		1238	14
410	10/8/02				6.8				44	0	0.7		25.3		0.0		1298	10
410	3/14/03				6.2				14	25	1.0		9.7		1.0		293	
410	6/17/03				6.2				39	3	0.0		4.6		0.0		537	6
410	9/16/03				6.5				26	0	0.0		17.5		0.0		709	
410	10/29/03				3.9				0	84	2.6		22.5		4.2		723	6
410	3/30/04				4.0				3	67	3.6		18.3		5.4		510	
410	6/8/04			7.0	6.8	1346		45	47	-20	0.3	0.1	14.3	13.4	0.5	0.2	893	4
Min			19	4.3	2.9	612	11	45	0	-20	0.0	0.1	4.0	13.4	0.0	0.2	154	0
Max			450	7.0	7.0	1944	11	45	178	420	20.9	1.0	81.1	23.8	15.0	6.7	1812	60
Avg			132	6.0	4.4	1364	11	45	14	120	5.9	0.5	32.1	19.7	5.6	2.4	793	8
Range			431	2.7	4.1	1332	0	0	178	440	20.9	0.9	77.1	10.4	15.0	6.5	1658	60

Description: Westerly unnamed tributary to Seaton Creek sampled @ State Rt. 58 500' downstream of DeSale II passive treatment system; Also known as PA DEP point 23.

De Sale Phase III 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)
DS DN	4/24/03			5.0	5.2	1390	9		3	18	0.9	0.9	15.9	15.6	4.3	1.8	927	9
DS DN	6/30/03			5.3	5.2	1508	18	2	3	11	0.9	0.4	19.9	18.9	3.1	1.1	1048	8
DS DN	8/28/03			5.2	4.9	1396		3	2	44	0.7	0.4	27.8	26.7	3.2	2.4	958	7
DS DN	10/29/03			4.3	4.3	1294	9		0	68	1.3	0.8	28.9	28.0	4.6	4.4	780	5
DS DN	3/25/04			4.4	4.2	1080			0	49	2.5	1.9	18.9	18.8	5.4	5.0	600	4
DS DN	6/8/04			6.0	6.3	1468		16	14	17	1.2	0.5	15.1	13.6	2.9	0.2	1032	10
Min				4.3	4.2	1080	9	2	0	11	0.7	0.4	15.1	13.6	2.9	0.2	600	4
Max				6.0	6.3	1508	18	16	14	68	2.5	1.9	28.9	28.0	5.4	5.0	1048	10
Avg				5.0	5.0	1356	12	7	4	35	1.2	0.8	21.1	20.3	3.9	2.5	891	7
Range				1.7	2.1	428	9	14	14	57	1.8	1.5	13.8	14.4	2.4	4.8	448	6

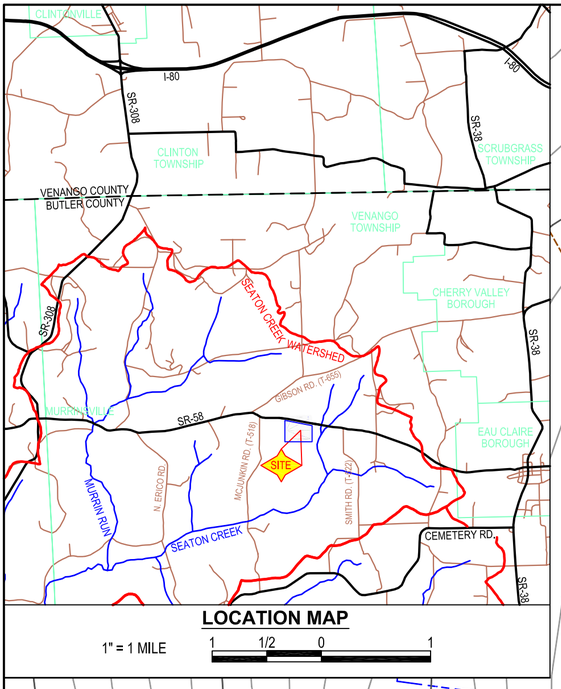
Description: Unnamed tributary to Seaton Creek; Upstream Sample; Located downstream of confluence of De Sale I and De Sale II unnamed tributaries

Erico Bridge 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)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
48	9/8/94				4.6				10	124	1.3		26.6		8.2		571	3
48	3/22/95				4.8				10	36	0.4		12.8		3.5		422	3
48	6/29/95				4.7				10	46	0.5		14.6		4.3		385	6
48	8/22/95				4.4				7	110	0.7		29.8		8.1		852	16
48	9/12/95				4.6				11	118	1.0		33.2		8.4		888	8
48	10/12/95				4.6				10	102	2.4		33.8		9.6		832	8
48	11/15/95				6.0				22	0	0.6		2.7		0.5		93	6
48	2/22/96				4.7				7	14	0.9		8.3		3.3		158	3
48	3/13/96				4.6				8	76	1.4		13.0		4.7		332	12
48	4/30/96				4.6				7	24	3.0		7.3		1.8		205	3
48	5/9/96				4.8				10	48	0.6		12.2		3.9		359	3
48	6/18/96				4.5				9	122	1.0		22.8		7.7		941	3
48	7/9/96				4.6				9	76	0.7		21.6		7.1		627	6
48	8/15/96				4.6				9	102	0.5		20.0		5.8		733	0
48	9/10/96				5.8				15	24	0.7		8.0		0.9		110	4
48	11/20/96				5.6				7	14	0.0		4.6		1.3		132	0
48	1/23/97				4.6				9	58	0.9		11.0		3.6		300	20
48	2/27/97				4.6				8	22	0.6		7.9		2.2		207	4
48	3/19/97				4.6				10	54	0.6		11.7		4.3		402	0
48	5/20/97				4.6				9	70	0.3		14.5		4.1		417	0
48	8/6/97				4.4				7	94	4.7		26.6		8.0		703	12
48	10/9/97				4.7				10	72	0.5		18.3		4.1		576	0
48	1/7/98				4.7				10	24	0.0		12.0		3.6		331	0
48	5/14/98				4.7				9	48			11.7		3.7		332	
48	3/30/00	Measured	1270		5.0				9	5			8.9		0.9		296	
48	5/10/00	Measured	1050		4.9				10	15	0.6		14.5		1.7		366	
48	11/20/00			6.5	6.5	1173	2		27	0	1.8		13.2		0.0		644	13
48	2/22/01				6.3				20	0	0.4		6.4				251	
48	3/29/01				6.0				18	0			6.4				261	

Erico Bridge 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)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
48	4/5/01	Measured	1000		6.4				22	0			6.2				288	
48	4/20/01			6.3	6.3	462	8		10	0	0.1	0.1	4.4	4.2	0.1	0.0	234	5
48	5/8/01				6.3				22	0	0.3		7.8				309	
48	6/22/01				6.4				28	41	0.9		11.2				404	
48	7/11/01				6.5				32	0	1.0		13.3				528	6
48	8/6/01				6.6	1068			50	0	0.9		11.5		0.0		739	6
48	8/30/01				6.5				58	0	1.1		10.7				642	8
48	10/18/01				6.5				42	0	1.7		11.8				669	8
48	11/8/01			6.8	6.6	1177	10		24	0	1.1	0.7	11.8	11.7	0.5	0.2	770	9
48	3/7/02			6.8	6.6	622			12	0	0.3	0.2	4.9	4.9	0.1	0.0	296	1
48	3/13/02				6.2				24	23	0.4		5.2					
48	4/30/02				5.9				13	45			6.6					
48	7/25/02				6.7				34	0	0.8		16.9		0.0		696	10
48	10/8/02				6.8				42	0	1.5		12.2		0.0		804	10
48	10/14/02			7.0	6.7	1335	10	30	28	1	1.1	0.7	12.8	12.5	0.1	0.1	933	9
48	3/14/03				6.3				11	32	0.0		4.4		0.0		167	0
48	4/24/03			6.5	6.4	827	10		11	-4	0.3	0.2	6.5	6.5	0.1	0.1	436	3
48	6/17/03				6.0				18	16	0.0		4.0		0.0		267	0
48	6/30/03			6.7	6.6	857	22	22	15	-8	0.4	0.1	6.3	6.2	0.1	0.0	528	1
48	7/23/03			6.7	6.4	853	24	13	15	-5	0.4	0.1	10.3	10.2	0.1	0.1	475	4
48	8/28/03			6.8	6.9	840	25	19	18	-8	0.4	0.1	11.4	11.2	0.1	0.1	555	6
48	10/29/03			6.8	6.2	1294	8	8	7	2	0.3	0.2	9.6	9.4	0.2	0.1	369	2
48	3/25/04			5.7	5.5	550		5	3	8	0.4	0.3	6.5	6.4	1.1	0.7	225	5
48	6/8/04			6.7	6.4	857		13	12	-1	0.2	0.1	6.1	5.9	0.1	0.1	492	2
Min			1000	5.7	4.4	462	2	5	3	-8	0.0	0.1	2.7	4.2	0.0	0.0	93	0
Max			1270	7.0	6.9	1335	25	30	58	124	4.7	0.7	33.8	12.5	9.6	0.7	941	20
Avg			1107	6.6	5.6	917	13	16	16	31	0.8	0.3	12.2	8.1	2.7	0.1	462	5
Range			270	1.3	2.5	873	23	25	55	132	4.7	0.6	31.1	8.3	9.6	0.7	848	20
Total Loading (lb/day)								209	218	411	10.9	3.4	162.0	107.6	36.4	1.8		



LOCATION MAP

1" = 1 MILE (1 1/2 0 1)

n/f REARICK, H.J.

S.R. 0058

12" RCP

INV IN 1403.55

15" RCP

INV OUT 1403.14

OIL WELL

SIGN

A

A'

1430

1440

1410

1420

VFP2

C

B

A

HFLB

ANTI-SEEP COLLARS

ANTI-SEEP COLLAR

SP1

SP2

VFP2

HFLB

300' STEEL

B

B'

COLL. POND

COLLECTION POND

UNNAMED TRIBUTARY TO SEATON CREEK

North

VFP2

4" DRAW DOWN DEVICE

ANTI-SEEP COLLAR

C

D

VFP1

FP

ANTI-SEEP COLLARS

COLL. DITCH

FOREBAY

D'

n/f STALKER, K. J.

n/f MEYER, H.E.

H/T #3 1462.7

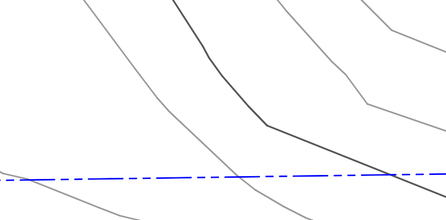
RECLAIMED SLUDGE DRYING POND

n/f TERWILLIGER, M. B.

PASSIVE TREATMENT SYSTEM SUMMARY CHART

COMPONENT	DESCRIPTION	COMMENTS
COLL. POND	3,700 SF COLLECTION POND	EXISTING POND COLLECTING DISCHARGE 10A
COLL. DITCH	300 FT COLLECTION DITCH	COLLECT DIFFUSE SEEPS ALONG TOE OF SPOIL (DISCHARGE 10B) AND CONVEY TO FOREBAY
FOREBAY	1,900 SF FOREBAY	COLLECTS COMBINED DISCHARGES AND PARTICULATE SETTLING FACILITY
VFP1	900 T VERTICAL FLOW POND	2 TIERED UNDERDRAIN/FLUSH SYSTEM INCL. 4 INVID. OUTLET CELLS PER TIER; 90% CCE LS CELLS
FP	15,000 CF FLUSH POND	NON-DISCHARGING FLUSH POND FOR VFP1 INCL. DRAW-DOWN DEVICE AND EMERGENCY SPILLWAY
SP1	11,300 SF SETTLING POND	PARTICULATE SETTLING FACILITY
VFP2	800 T VERTICAL FLOW POND	2 TIERED UNDERDRAIN/FLUSH SYSTEM INCL. 3 INVID. OUTLET CELLS PER TIER; 90% CCE LS CELLS
SP2	4,300 SF SETTLING POND	PARTICULATE SETTLING FACILITY WITH DIRECTIONAL BAFFLE
HFLB	800 T HORIZONTAL FLOW LIMESTONE BED	MANGANESE REMOVAL AND ALKALINITY GENERATOR

VFP1 PIPE SCHEMATIC



NOTE:
Pipe schematic for Discharge Pipes drawn as if standing in the VFP1 spillway looking easterly towards the Discharge Pipes. Flush Pipes drawn as if standing in the FP looking south-westerly towards the Flush Pipes.

Layer: L - Lower Tier, U - Upper Tier
Cell: Corresponds to VFP labels
Type: V - Vertical Flow Discharge Pipe; F - Flush Pipe

VFP2 PIPE SCHEMATIC

NOTE:
Pipe schematic for Discharge Pipes drawn as if standing in the VFP2 spillway looking easterly towards the Discharge Pipes. Flush Pipes drawn as if standing in the bottom of SP2 looking north-westerly towards the Flush Pipes.

Layer: L - Lower Tier, U - Upper Tier
Quadrant: Corresponds to VFP labels
Type: V - Vertical Flow Discharge Pipe; F - Flush Pipe

LEGEND

- CONTOUR - INDEX
- CONTOUR - INTERMEDIATE
- PASSIVE SYSTEM STRUCTURE
- WATER
- PENNDOT RIGHT-OF-WAY
- PROPERTY LINE (APPX.)
- DIRT/UNIMPROVED ROAD
- DIRECTIONAL BAFFLE (CURTAIN-TYPE)
- STRUCTURE (SOLID IF DWELLING)
- RIP RAP SPILLWAY
- SURVEY MARKER (WITH ELEVATION)
- 4" SCH 40 PVC PERFORATED LATERAL - LOWER TIER
- 4" SCH 40 PVC PERFORATED LATERAL - UPPER TIER
- 4" SCH 40 PVC SOLID PIPE - LOWER TIER
- 4" SCH 40 PVC SOLID PIPE - UPPER TIER
- 6" SCH 40 PVC SOLID PIPE - LOWER TIER
- 6" SCH 40 PVC SOLID PIPE - UPPER TIER
- 6" SCH 40 PVC PERFORATED PIPE
- 6" SCH 40 PVC SOLID PIPE
- 4" SCH 40 PVC SOLID PIPE
- DIVERSION DITCH
- WATER SAMPLE POINT (RAW)
- AS-BUILT CROSS SECTION (A A')

Notes:

As-Built EDM survey by Earthtech, Inc., Johnstown, PA with additional information from site inspections provided by BioMost, Inc.

This as-built is a reasonbale representation of actual field conditons.

Location of anti-seep collars is approximate.

Base map provided by PA DEP, BAMR, as prepared by Gwin Engineers, Altoona, PA. Aerial photography dated 03-14-95. Contract No. CN 94-48.

Property lines shown are approximate only. Locations based on Butler County Tax Assessment Maps: 2F-36 & 3F-16.

Location and size of oil well are approximate.

Water surface areas and elevations subject to change based on passive component permeability and/or spillway outlet conditions, and/or other factors.

All pipe perforations are 5/8" unless otherwise noted.

All pipe is Schedule 40, solid core, pressure-rated PVC unless otherwise noted.

30 15 0 15 30

SHEET 1 OF 2 - PLAN VIEW

AS-BUILT PLANS

DE SALE RESTORATION AREA PHASE III

Venango Township
Butler County, PA

Slippery Rock Watershed Coalition
in cooperation with
Stream Restoration Incorporated

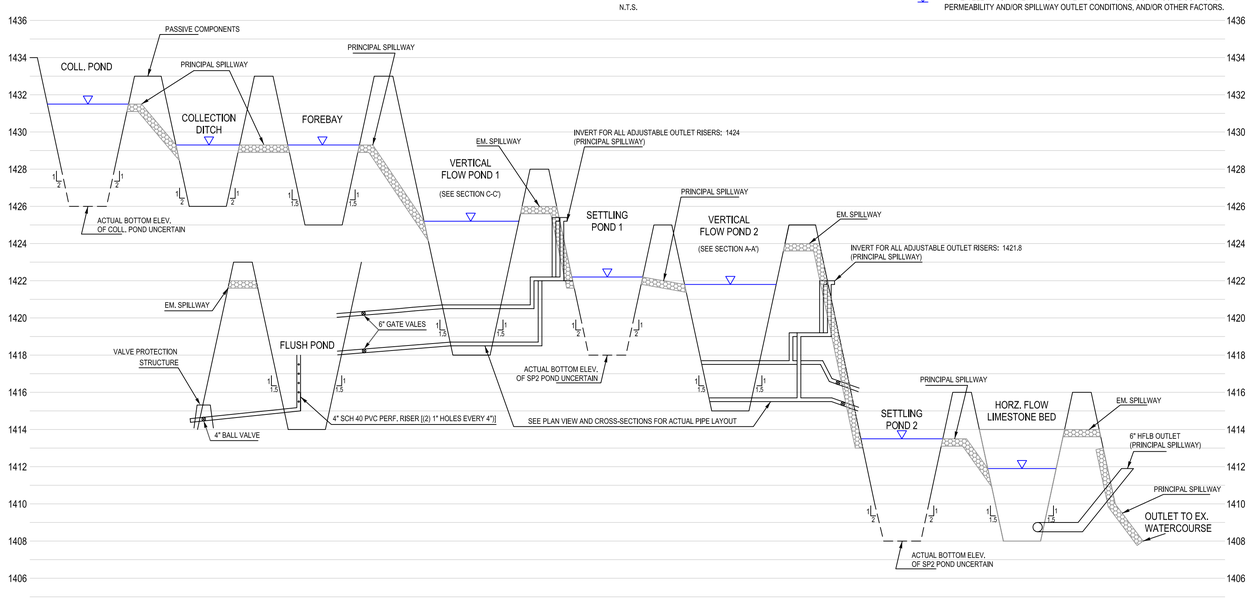
Scale: 1" = 30' Date: 6/2004
BioMost, Inc., Cranberry Twp., PA

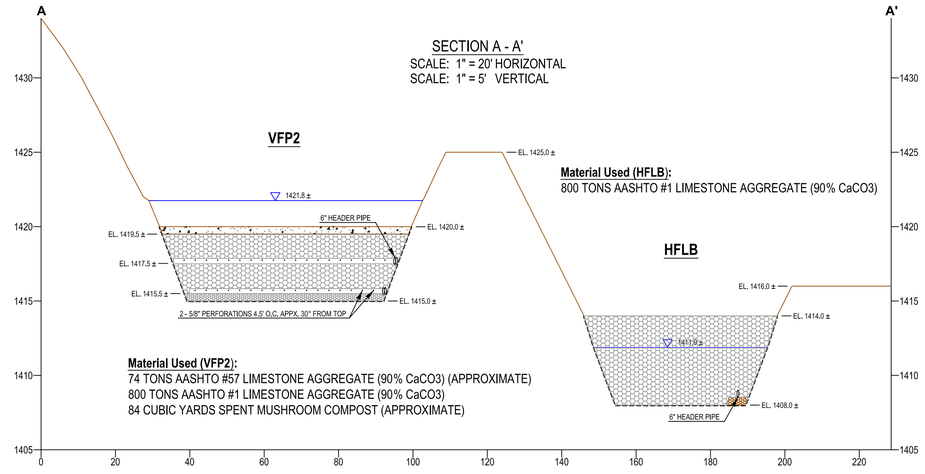
630102AB/Plan View

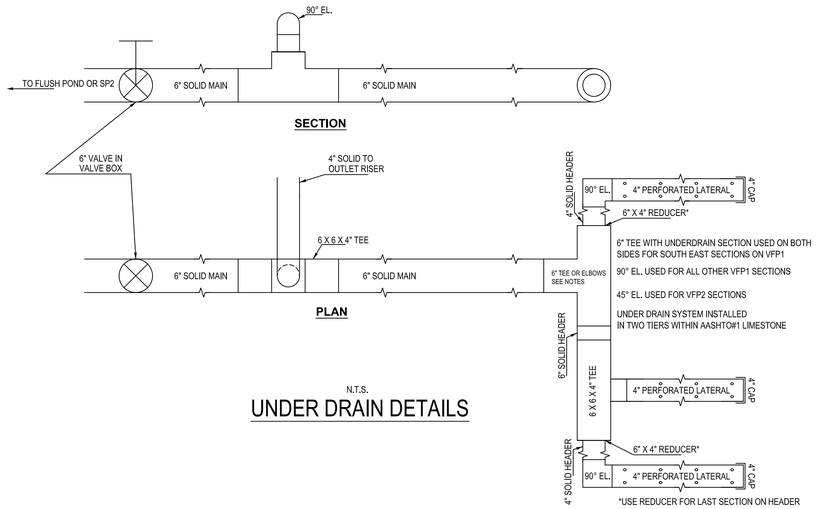
ELEVATION SCHEMATIC

N.T.S.

WATER ELEVATION ARE APPROXIMATE AND VARY BASED ON PASSIVE COMPONENT PERMEABILITY AND/OR SPILLWAY OUTLET CONDITIONS, AND/OR OTHER FACTORS.

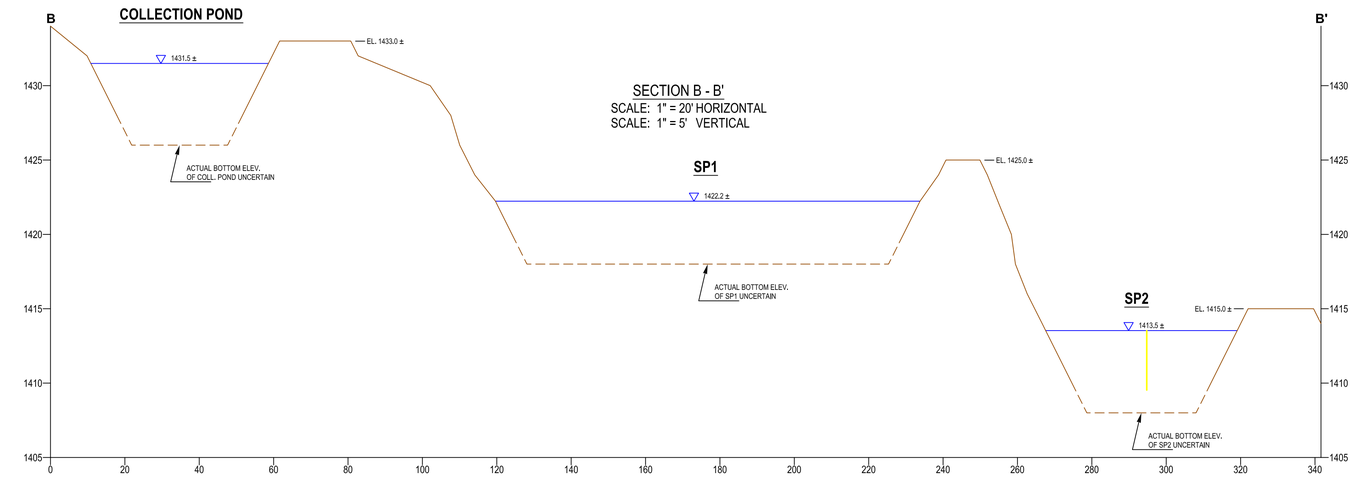






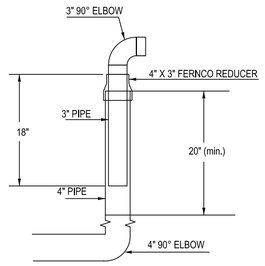
N.T.S.

UNDER DRAIN DETAILS



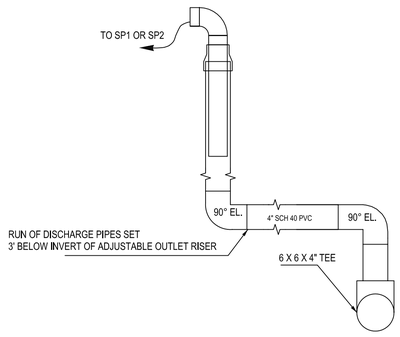
LEGEND

- GROUND SURFACE
- GEOTEXTILE
- DIRECTIONAL BAFFLE (CURTAIN-TYPE)
- RIVER GRAVEL (2B)
- LIMESTONE (AASHTO #57)
- LIMESTONE (AASHTO #1)
- RIP RAP (R-4)
- SPENT MUSHROOM COMPOST



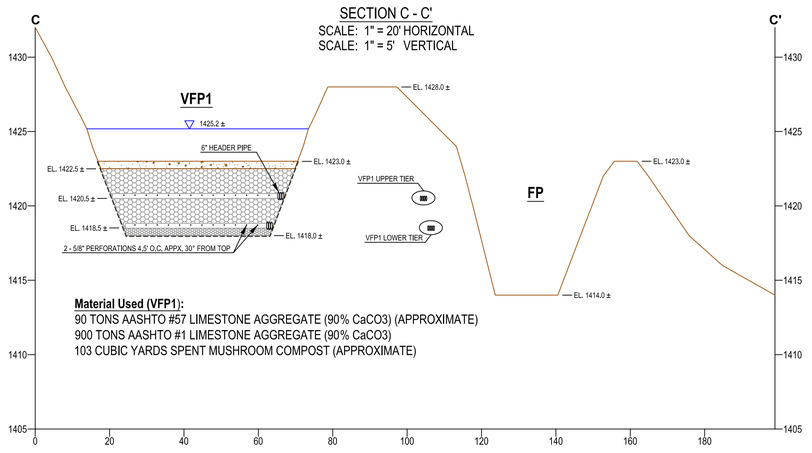
SCALE: 1" = 1'

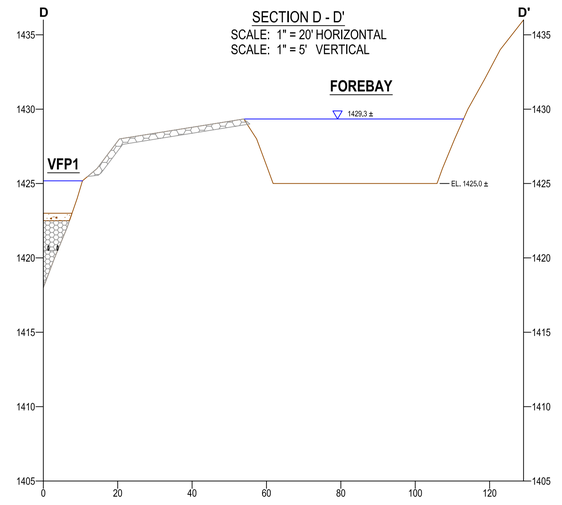
OUTLET RISER DETAIL



N.T.S.

DISCHARGE PIPE DETAIL





Notes:

Compost volume calculated from As-Built Plans (Approximate).

AASHTO #57 limestone tonnage calculated from As-Built Plans (Approximate).

Water surface areas and elevations subject to change based on passive component permeability and/or spillway outlet conditions, and/or other factors.

All pipe perforations are 5/8" unless otherwise noted.

All pipe is Schedule 40, solid core, pressure-rated PVC unless otherwise noted.

SHEET 2 OF 2 - DETAILS

AS-BUILT PLANS

DE SALE RESTORATION AREA
PHASE III

Venango Township
Butler County, PA

Slippery Rock Watershed Coalition
in cooperation with
Stream Restoration Incorporated

Scale: As-Shown Date: 6/2004

BioMost, Inc., Cranberry Twp., PA

630102AB\X-S