CAMP LUTHERLYN PROJECT

U.S. Department of the Interior
Office of Surface Mining

in cooperation with

Stream Restoration Incorporated

FINAL REPORT
NOVEMBER 2005

Cooperative Agreement Number: CA 470326
OSM Account Number: 4 2W 4530 281

The following report was taken from the 06/2005 Final Report as prepared by Heath S. Gamaché, Assistant Director, Lutherlyn Environmental Education Program, for the PA DEP funded "Abandoned Mine Drainage Mitigation Project at Camp Lutherlyn", Project # NW20253, Grant ME# 3521000 and revised by Stream Restoration Incorporated.

NARRATIVE

PROJECT GOALS

Main goals:

- Construct a passive treatment wetland system to mitigate AMD drainage to Semiconon Run
- Help restore 2.4 miles of the Semiconon Run to conditions suitable for human and wildlife usage
- Increase diversity of wildlife and habitat
- Provide educational and environmental stewardship opportunities for 8,000+ visitors annually
- Encourage on-going protection of natural resources in the Connoquenessing Creek watershed

This project was funded in order to help restore 2.4 miles of the Semiconon Run to a condition that provides habitat for wildlife and recreational opportunities for people. Targeted improvements in water chemistry of the Semiconon Run downstream from the treatment system include raising the dissolved oxygen concentration of the mine discharge to at least 6 mg/L, while concentrations of dissolved iron in the discharge, averaging 20-25mg/L, are expected to drop below 3 mg/L. Based on an average flow from the mine of 40 gallons per minute, this mitigation project would remove more than a ton of pollution from the stream each year.

More importantly, this project provides opportunities for the public to learn about and take part in efforts to clean up AMD in their own watershed and region. The Lutherlyn Environmental Education Program (LEEP) offers these educational and environmental stewardship opportunities to the 8,000+ students, teachers and visitors that attend LEEP programs each year. The partnerships developed between the public and private sector, citizen volunteers, landowners, government agencies, and other restoration-focused action groups will lead to a stronger community and on-going protection of natural resources in the Connoquenessing Creek watershed.

PROJECT SUCCESSES

This project has been very successful for several reasons. First, the treatment system is functioning very well, and in its second full season of growth the wetland is exceeding treatment expectations for Iron reduction. Based on available monitoring information (see attached), the system that was expected to remove about 1 ton of iron per year is actually preventing close to 4 tons of iron from entering Semiconon Run per year. Secondly, hundreds of students from southwestern Pennsylvania have already participated in environmental education programs at the treatment site, learning about the legacy of coal mining operations in our state and ongoing efforts to clean up the associated damage. Educational efforts have included history lessons, water chemistry assessments, and biological monitoring, as well as revegetation and tree planting projects. Third, the partnership building efforts during this project have paid dividends in continuing collaboration on watershed monitoring, community awareness of watershed issues, and state and national-level interest in the success of the project.

PROJECT ACCOMPLISHMENTS

A conceptual plan was developed for the passive system, which consisted of a collection system, holding pond, and treatment wetland. Permitting requirements were addressed by conducting a secondary data review of the Butler County Soil Survey, NWI map, topographic map, site map, and historical analytical data of discharges, and the Semiconon Run.

An environmental assessment of the project area, including a delineation of wetland areas, was conducted and submitted to the Northwest Regional Office of the PA Department of Environmental Protection along with a request for a Restoration Waiver for the construction of the passive treatment system. Additional notification requirements, plan approvals, and permitting for township, county, state,

and federal agencies were obtained as necessary. Native, non-invasive plant species identified during the environmental assessment of the project area were referred to during the design of the wetland component of the passive treatment system to ensure the appropriate hydrologic regimes and appropriate species selection for the establishment of locally native wetland/riparian vegetation.

The final design of the passive treatment system incorporated existing topographic survey information supplemented by additional field survey. Additionally, specific, to-scale drawings of the collection system, holding pond, wetland area, riparian buffer, and access path were prepared. Information obtained from the secondary data review and environmental assessment of the project area was used in determining the most appropriate locations and dimensions of the components of the passive treatment system.

Project design and planning was coordinated with Lutherlyn Environmental Education Program personnel to promote environmental education opportunities and site access. A complete set of drawings and project narrative of the passive treatment system design was provided to Lutherlyn for use during the preparation of the educational component of this project.

Construction, project management, and quality control/assurance was provided by Quality Aggregates, Inc., Aquascape (now known as Beran Environmental), and BioMost, Inc. Prior to clearing and earthmoving activities, the limits of disturbance necessary for construction of the passive treatment system were marked in the field and reviewed with construction personnel so that unnecessary disturbance to the surrounding area could be avoided. The work area was then cleared, followed by excavation and construction of the conveyance channels for the redirection of surface water away from the passive treatment system. The abandoned mine drainage was temporarily redirected, to provide improved work conditions for earthmoving activities associated with the construction/excavation of the collection system, holding pond, and treatment wetland.

The collection system was located uphill from the treatment system and utilized buried collection systems installed above and below the trail to collect the two main seeps. A 6” diameter outflow pipe at the bottom of the collection drains extended down-slope and below grade into the holding pond. The from the upper collection system was fitted with a flow restricting perforated “nozzle” where it emerges into and above the surface of the holding pond to provide additional aeration. A level spreader was built from pre-cast concrete blocks and an adjustable steel weir was attached to the upstream side of the blocks. This level spreader was installed across the elevated berm between the holding pond and the wetland to prevent the development of preferential flow patterns, facilitate sheet flows, and provide another source of aeration.

Following excavation of the basins for the holding pond and wetland area, sub-basin material was hauled to the site, placed and compacted. Completion of the wetland and pond sub-basins was followed by placement of organic substrate. The final grading of upland areas that were disturbed during construction, the replacement of walking trails to and around the site, and the regrading of the access path and the parking area completed the earth-moving phase of construction.

Volunteer work-days were planned for the planting of the treatment wetland, the riparian area and the disturbed uplands. Disturbed upland areas were immediately seeded and mulched to ensure stabilization of the project area following construction. Plant harvesting and placement was performed by personnel from Beran Environmental, Lutherlyn staff, and volunteers in a manner that provided dense and diverse vegetative cover. Following wetland planting and initial establishment of vegetation, a monitoring and maintenance plan for the passive treatment system was developed and implemented.

A site survey was conducted for the preparation of as-built drawings of the treatment system to be filed with the DEP and copies kept at Lutherlyn and Beran Environmental. The Lutherlyn staff designed interpretive signage regarding the treatment of abandoned mine drainage.

Due to historically unprecedented rainfall during the summers of 2003 and 2004 and suspected changes in the mine pool, three important changes from the original plan occurred during the course of the project. First, the mine discharge migrated to a new location further uphill from the original location. Second, the volume of the AMD discharge increased dramatically. Third, significant, shallow, subsurface water caused slumping above the treatment system.

To maintain the integrity of the treatment system, while still capturing the mine discharge, an additional settling pond with a small check dam and intake weir was installed. The anoxic drains were

left in place, and still capture some of the discharge. This modification allows the collection of all surface water from the mine discharge, plus rainfall during runoff events. The weir and check dam control the level of water input into the system, preventing excessive flows from entering the treatment system during major storm events. At this point in time, the new collection system is working very well and directing the mine discharge into the treatment wetland as intended.

To address the slumping, a French drain was installed along the upgradient side of the cut slope above the settling pond to intercept shallow subsurface water. The slump was repaired and stabilized with limestone gabion baskets, then re-graded. The entire area was re-seeded and mulched. There has been no further slumping and the vegetation is growing nicely.

OBSTACLES OVERCOME

The primary problems associated with accomplishing this project were weather related. Heavy rainfall delayed earthmoving activities for several months as the ground was to soft for the excavating equipment to maneuver. Fortunately, we had some flexibility in scheduling and were able to stay on track in the long run. The planting of the wetlands was delayed somewhat, but a mild autumn encouraged planted vegetation to establish itself well before the winter. Slumping of graded slopes and shifting discharge points were very discouraging for a while, but with help from the U.S. Department of Interior Office of Surface Mining, we were able to address those problems and repair the damage. The treatment system is functioning very well now.

MAJOR ISSUE ADDRESSED

The original problem was serious environmental degradation of the Semiconon Run due to high levels of Iron deposition. By constructing the treatment wetland, we have greatly decreased this problem (approximate 85% reduction in iron loads). Water chemistry in the Semiconon Run has improved, and staining has decreased. Some populations of stream life have started to recover, and new communities of wetland plants and animals are developing.

FUTURE WORK

We will continue to re-establish riparian buffer zones, re-plant disturbed upland forested areas and adjust water retention times in the wetland to achieve maximum treatment. I hope that other AMD seeps in the watershed and surrounding area will receive attention as downstream neighbors and communities see how effective our efforts have been. More monitoring is necessary to keep track of continuing improvements in water quality and wildlife habitat.

EDUCATION AND OUTREACH OPPORTUNITIES

There are several outlets for sharing the information we have gained from this project. Website databases at the local (Connoquenessing Watershed Alliance), state (Department of Environmental Protection), and national (Office of Surface Mining) levels will receive data about the wetland and the Semiconon Run. Regional symposiums on watershed issues have invited us to present papers or posters about the project. Local and regional news media continue to express interest in doing stories on Lutherlyn's environmental projects. Most importantly, visitors, teachers and students will learn about AMD treatment through hands-on experience with monitoring and maintaining the treatment wetland.

Before construction, the abandoned mine discharge issued from the streambed of an ephemeral channel that flowed directly into Semiconon Run.

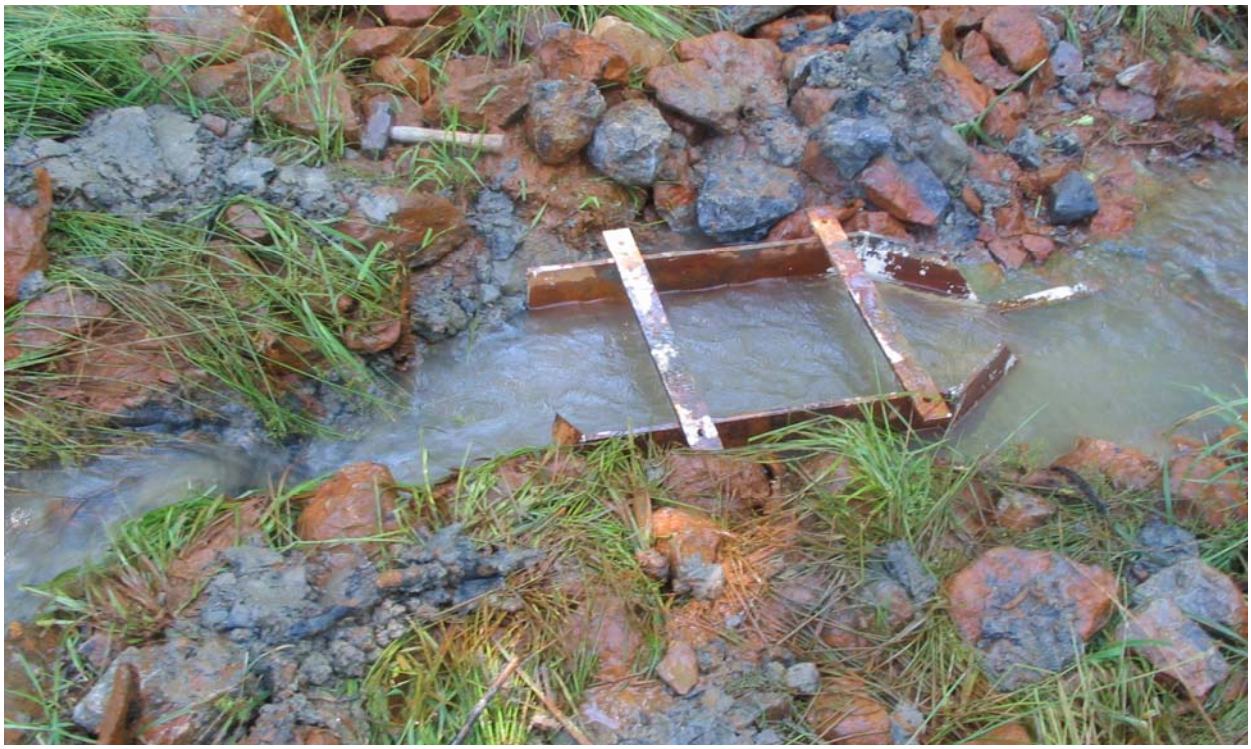
After the initial buried collection systems were installed, the discharge was successfully collected and directed into the passive system. Vigorous agitation and aeration was achieved using the available hydraulic gradient. The system functioned very well through the fall of 2003.

In the winter of 2003-2004, the discharge previously collected by the buried collection systems, “moved” approximately 120’ horizontally and 5’ vertically upstream to the other side of the ephemeral channel.

OSM funding was used to install a stream intake-type collection system that directs the abandoned mine drainage into the passive system. (10/20/04)

Slumping occurred above the settling pond due to significant shallow subsurface flows that were likely exasperated by heavy precipitation. (11/13/03)

OSM Funding was used to install a French drain upgradient of the cut slope to intercept the subsurface flow, install buried limestone riprap reinforcement and successfully stabilize the slope. (10/20/04)



A flume was installed in order to measure the flow leaving the aerobic wetland. (06/22/05)

Settling pond (to left of photograph) outlets via an aeration spillway (top left) into a drop pond area (left and foreground), flows into the aerobic wetland and outlets to Semiconon Run near the top center of the photograph. System currently reduces iron concentrations from 22 mg/l to less than 3 mg/l.

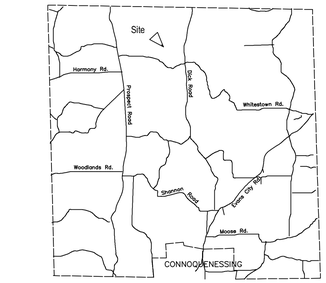
WATER MONITORING INFORMATION - AUGUST 2005

SAMPLE ID	SAMPLE DATE	TAKEN BY	FLOW	FIELD PH	LAB PH	COND. umhos	TEMP DEG C	ALK. mg/L (LAB)	ALK. mg/L (FIELD)	ACIDITY mg/L	IRON mg/L	DISS IRON mg/L	MANG. mg/L	DISS MANG mg/L	ALUM. mg/L	DISS ALUM mg/L	SO4 mg/L	TSS mg/L
COLLECTION POINT (Raw)	08/09/05	DURRETT	83	6.20	6.37	704	12.5	70	100	-41	22.39	22.23	5.76	5.64	<0.04	<0.04	243.7	5
WETLAND EFFLUENT (Treated)	08/09/05	DURRETT		6.90	7.02	682	19.5	44	60	-29	2.68	0.86	3.53	3.49	<0.04	<0.04	250.9	2
SEMI COMMON RUN UP	08/09/05	DURRETT		7.3	7.04	310	20.2	44	34	-28	0.21	0.03	0.06	0.05	<0.04	<0.04	21.5	1
SEMI COMMON RUN DOWN	08/09/05	DURRETT		7.20	6.81	616	21.0	73	56	-50	1.11	0.90	2.38	2.32	0.59	0.24	187.4	4

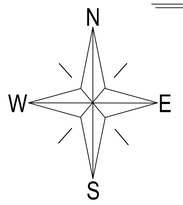
N.D. - Not Detectable

PLAN VIEW

Scale: 1" = 40'



Vicinity Map



INTERCEPTOR DRAIN DETAILS

Scale: 1" = 4'

Species Planted in Semiconon Passive Treatment Wetland

Scientific Name	Common Name	Indicator Status	Stratum
Asclepias incarnata	Milkweed, Swamp	OBL	H
Carex crinita	Sedge, Fringed	OBL	H
Carex stricta	Sedge, Tussock	OBL	H
Carex spp.	Sedge	---	H
Eleocharis spp.	Spikerush	---	H
Juncus effusus	Rush, Soft	FACW+	H
Leersia oryzoides	Cutgrass, Rice	OBL	H
Ludwigia palustris	Water-purslane	OBL	H
Polygonum sagittatum	Tearthumb, Arrowleaf	OBL	H
Polygonum spp.	Smartweed	---	H
Pontederia cordata	Pickerel Weed	OBL	H
Scirpus validus	Bulrush, Soft-stemmed	OBL	H
Sparganium americanum	Burreed, American	OBL	H
Symplocarpus foetidus	Skunk-cabbage	OBL	H
Cephalanthus occidentalis	Buttonbush	OBL	S
Cornus stolonifera	Dogwood, Red-osier	FACW+	S
Salix sericea	Willow, Silky	OBL	S
Acer rubrum	Maple, Red	FAC	T

Legend

- Contour - Index
- Contour - Intermediate
- Stream
- Edge of Water
- Anoxic Collection System (buried)
- @486.53 Survey Bench Mark w/elevation
- Trail
- Paved/Improved Road
- A A' As Built Cross Section
- Rip Rap (R-4)
- Rip Rap (R-5)
- Weir (Concrete Level Spreader 2 x 2 x 6)
- Gravel Parking Area
- Treatment Wetland Area
- CP Water Monitoring Location

NOTES:
AS-BUILT EDM SURVEY (OCTOBER 2003) BY S.D. GRAFF, PROFESSIONAL SURVEYING SAXONBURG, PA. THE SURVEY HAS AN ASSUMED DATUM.
WATER SURFACE AREAS CALCULATED AT APPROXIMATE WATER ELEVATION.
WATER SURFACE AREAS AND ELEVATIONS SUBJECT TO CHANGE BASED ON PASSIVE COMPONENT AND/OR SPILLWAY OUTLET CONDITIONS.

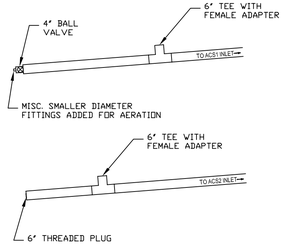
STREAM INTAKE COMPONENTS, FLUME AND INTERCEPTOR DRAIN LOCATED BY VISUAL APPROXIMATION FROM 10/04 AND 06/05 FIELD INVESTIGATION BY BIOMOST, INC.

SURFACE AREA OF SETTLING POND = 4,500 +/- SF
SURFACE AREA OF TREATMENT WETLAND = 13,000 +/- SF
SURFACE AREA OF SPILLWAYS = 2,700 +/- SF
TOTAL SURFACE AREA = 20,200 +/- SF

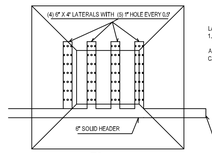
ANOXIC COLLECTION SYSTEM DETAILS

Scale: 1" = 4'

OUTLET DETAILS

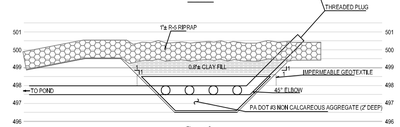


INLET DETAILS



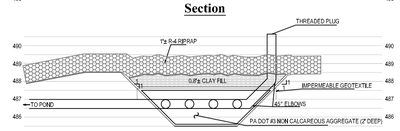
Plan

ACS1



Section

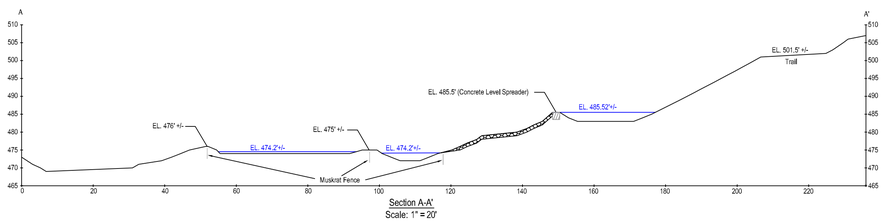
ACS2



Section

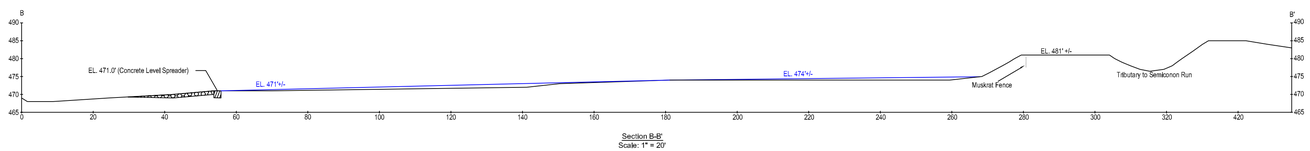
NOTE: ALL ANOXIC COLLECTION SYSTEM PIPE IS 6" SCH 40 PVC

CROSS SECTIONS



Section A-A'
Scale: 1" = 20'

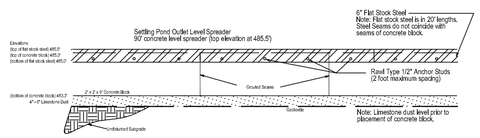
CROSS SECTION NOTES:
WATER ELEVATIONS APPROXIMATE.
MICROTOPOGRAPHIC RELIEF INCORPORATED INTO TREATMENT WETLAND FOR INCREASED FUNCTION.
36" CHAIN LINK FENCE BUILT INTO BERMS TO PREVENT MUSKRAT DAMAGE.
DEPTH OF R-4 RIP-RAP IS APPROXIMATELY 1'.



Section B-B'
Scale: 1" = 20'

LEVEL SPREADER DETAILS

Not to Scale



As-Built Plans -- Semiconon Run Passive Treatment System

Camp Lutherlyn

PADEP Growing Greener Project

Connoquenessing Township,
Butler County, PA

Beran Environmental Services, Inc., Boyers, PA
& BioMost, Inc., Cranberry Twp., PA

Scale: As Shown

Date: 6/2005

As-built EDM survey (October 2003) by
S.D. Graff, Professional Surveying
Saxonburg, PA