Abandoned Mine Drainage Mitigation Project

at

Camp Lutherlyn

Operation and Maintenance Plan

Connoquenessing Township
Butler County, Pennsylvania

June 2005

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At
Camp Lutherlyn

"A Pennsylvania Growing Greener Initiative"

OPERATION AND MAINTENANCE PLAN

June 2005

Connoquenessing Township, Butler County, PA

"A Public-Private Partnership Effort"

Aquascape; Beran Environmental Services, Inc.; BioMost, Inc.; Butler County; Camp Lutherlyn; Connoquenessing Watershed Alliance; Environmentally Concerned of Zelienople; Hedin Environmental; Lutherlyn Brotherhood Affinity Group; Lutherlyn Environmental Education Program; PA DEP Knox DMO; PADEP BMR; Quality Aggregates Inc.; S.D. Graff Professional Surveying; Stream Restoration Incorporated; US Office of Surface Mining; Volunteers;

OPERATION AND MAINTENANCE PLAN

This is the operation and maintenance plan for the Abandoned Mine Drainage Mitigation Project at Camp Lutherlyn located in Connoquenessing Township, Butler County, Pennsylvania. This project is located along Semiconon Run. Semiconon Run flows into the Little Connonquenessing Creek (a Cold Water Fishery), which is a tributary to the Connonquenessing Creek (a Warm Water Fishery). This passive treatment system consists of two anoxic collection systems, a channel collection and intake system, a settling pond, and an aerobic wetland.

Camp Lutherlyn will be responsible for the maintenance of all structures in order for the passive treatment system to continue to function properly. This AMD treatment system was designed, based on the best available knowledge and technology at the time and implemented through a public-private partnership effort coordinated by Camp Lutherlyn. It must be recognized that the technology of passively treating AMD is relatively new. All structures were designed focusing on minimal operation and maintenance compared to conventional treatment systems. In order, however, for these facilities to effectively treat the mine drainage, periodic inspections and maintenance activities are required.

CONTENTS

PASSIVE TREATMENT SYSTEM PROJECT OVERVIEW

Passive systems use no electricity, require limited maintenance, and use environmentally-friendly materials for treatment, such as limestone aggregate and spent mushroom compost, that provide a cost-effective alternative to the harsh chemicals typically used for conventional treatment of mine drainage. These passive systems neutralize the acidity and add alkalinity, if necessary, in addition to providing an environment that facilitates beneficial chemical reactions and biological activity for the removal of contaminants. Alkalinity helps to encourage metals dissolved in the mine drainage to form particulates, which are then retained in the channels, settling ponds and/or constructed, naturally-functioning, wetlands. In some cases, such as the Camp Lutherlyn site, there is sufficient alkalinity present within the discharge such that only channels, settling ponds and wetlands are required.

There are several principal types of passive treatment components that can be used, often in series, to treat degraded mine drainage. These components are chosen based on the drainage characteristics (quality and flow rate), desired chemical or biological reactions, and available construction space. The following is a brief description of the passive treatment components at Camp Lutherlyn.

Collection Systems serve to collect, intercept, and/or combine discharges and seeps as well as to convey water. There are two distinctly different collection systems at the Camp Lutherlyn project. The original system, which is still in place and collects a relatively small amount of mine drainage, consists of two Anoxic Collection Systems (ACS). Due to the dynamic conditions of the mine pool, a supplemental collection system had to be installed that consists of a small check-dam, pool, and intake structure placed within the channel that previously conveyed the mine drainage to Semiconon Run.

Settling Ponds and Wetlands are typically used in passive treatment systems to allow for the oxidation, precipitation, and accumulation of metal solids that occur when alkaline drainage issues from a minesite or after acidic drainage has passed through an alkalinity-generating treatment component. Although many treatment wetlands are angular-shaped, shallow ponds supporting predominantly cattails, they can be designed, built, and planted to look and function as a natural wetland with high species diversity that provides not only treatment but also exceptional wildlife habitat. The latter approach was employed at Camp Lutherlyn. There is one settling pond and one aerobic wetland at the Camp Lutherlyn passive treatment system.

SITE SPECIFIC INSTRUCTIONS

Everyone who will be involved in the operation of the site should have an understanding of, and the ability to perform, basic routine duties, such as site inspections that include evaluating channels, spillways and passive treatment components as well as water sampling and measuring flows.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

To maintain the integrity of the passive treatment facility, the site should be inspected at regular intervals and after major precipitation events or other natural/manmade occurrences that may affect the performance or integrity of the structure. Regular site inspections should be conducted on a monthly basis. A qualified person should perform the inspection and complete the appropriate report(s). (See attached inspection report forms.) The inspector should keep the paper copy of the report in permanent files in chronological order at Camp Lutherlyn. If desired, arrangements can be made with Stream Restoration Incorporated to report/store data on the GIS enabled database online via the website www.datashed.org.

The report should include the inspection date, the inspector's name, the organization with which the inspector is affiliated, and the start and end time of the actual inspection. The following sections correspond with the attached Passive Treatment System O&M Inspection Report.

A. Site Vegetation (Uplands and Associated Slopes)

Vegetation (i.e. groundcover) is extremely important to provide wildlife habitat and to prevent erosion. Erosion can carry sediment into streams resulting in turbidity and siltation. Sediment entering the Settling Pond and Wetland can cause loss of capacity. During the inspection, overall condition of the site vegetation **(Section A)** should be observed and numerically rated from 0 to 5. If significant areas are barren, describe the action needed as well as the location. Normal husbandry practices (such as fertilizing, seeding, mulching, removing unwanted species, etc.) should be implemented, as necessary, to maintain a stable non-erosive ground cover and viable wildlife habitat on the site.

Rating	Description	Recommended Action
0	Site barren	Revegetate as soon as practicable; temporary seeding, installation of staked straw/haybales, filter fabric, etc. may be necessary until stabilization with permanent approved seed mix
1	Site mostly barren. Only small isolated areas of vegetation present	(Same as for "0" rating)
2	Large area(s) barren	Outline approximate area(s) on Site Schematic; revegetate as described for "0" rating
3	Revegetation spotty; erosion gullies present	Outline approximate area(s) on Site Schematic; on poorly vegetated areas, seed, mulch, apply soil amendments, as necessary; install staked straw/haybales, rip-rap, etc. in gullies to control erosion
4	Successful vegetation >70% groundcover; few, isolated, minor erosion features or areas with <70% groundcover	Identify potential problem areas; note changes on future Inspection Reports
5	Successful vegetation >70% groundcover	No remedial action required

B. Access Road and Parking Area

A stabilized access road and parking area helps to facilitate maintenance, monitoring, and educational/outreach programs. The entrance gate should be secured to control unauthorized vehicular traffic.

On the inspection sheet **(Section B)**:

- Access road and parking area accessible (Yes or No): Are there fallen trees or debris blocking access? Are there significant erosion gullies present?
- Maintenance required: Do portions need to be stabilized with aggregate? If so, identify area on Site Schematic. Is machinery required to remove debris?

C. Diversion Ditch and Spillways

The diversion ditch as well as the spillways should be inspected and maintained to minimize erosion and insure proper water handling. The channels should be kept free of obstructions/debris that would restrict water flow. Any debris/obstructions should be removed. Vegetation should also be removed from spillways if it is causing significant water level increase in the component that it drains. If disturbed or eroded areas are present, these areas should be stabilized as soon as possible with rip-rap or plant species. Channels or ditches that carry mine drainage should be cleaned out when precipitate reduces the capacity by one half. Particular attention should be paid to the stability of rock-lined channels and spillways to assure that the rock lining is intact.

On the inspection sheet **(Section C)**, for each identified channel or spillway note:

- Significant erosion present (Yes or No): Is the rip-rap or vegetative lining impaired or absent? Has the berm been overtopped and/or breached?
- Significant debris present (Yes or No): Are there tree limbs, leaves, trash, etc. that would "dam" the water in the diversion ditches and spillway channels? Is there vegetation and/or debris in the rip-rap lined spillways that would cause the water level to rise in the passive components?
- Maintenance performed (Yes or No): Have the plants been removed from the rip-rap lined spillways? (Removal of plants from rip-rap lined spillways on a regular basis as part of "general housekeeping" prevents overtopping of berms and loss of function of the facility.) Have tree limbs, leaves, trash, etc. been removed? Has the erosion been addressed (rocks placed in erosion features; sediment cleaned from ditches, dirt placed and compacted on berms of ditches and channels, etc.)?
- Maintenance remaining: Describe additional maintenance needed. Indicate areas for additional maintenance on the Site Schematic.

D. Culverts

Culverts should be maintained and kept free of any obstructions. The culverts should be inspected to make sure that no damage has occurred to the pipe and that they have not become

plugged. If plugged or if the capacity is substantially decreased, the debris and sediment should be removed and any damage repaired.

On the inspection sheet **(Section D)**:

- Culvert functioning (Yes or No): Is there evidence of flows over or around the culvert?
- Culvert in need of maintenance (Yes or No): Has the culvert been crushed or damaged? Is the culvert significantly blocked with debris?
- What is the condition of the culvert:
- Maintenance required: Should culvert be replaced? Is machinery needed for cleaning?

E. Passive Treatment System Components

All passive treatment components such as the settling pond, wetland, and collection systems that intercept and convey water need to be inspected for erosion, berm (slope) stability, vegetation, siltation, leaks, etc. Any problem should be noted and corrected as soon as practicable. During inspections, the condition of the vegetation and the presence of any disturbed or eroded areas should be noted. Disturbed or eroded areas will need to be stabilized as soon as possible with staked straw/haybales, rip-rap, plantings with accepted species, etc., whichever is appropriate.

Water inlet areas for all structures should be observed during each site inspection and kept free from sediment, leaves, and any other foreign objects. This is very important for the efficient operation of the system. Any debris present, including accumulated iron precipiatates, in the water inlet areas should be removed. All flow control structures including pipes should be maintained to assure that they are free flowing and not restricted.

The collection pool will be subjected to significant influence from stormwater events that may cause rapid accumulation of sediment. This sediment will need to be cleaned out when the level reaches about 1' from crest the inlet control structure weir. Either manual or mechanical methods may be used. The pool should be restored to the approximate original dimensions (15' X 15' X 4' Deep). These are approximate dimensions and may be adjusted based on actual field conditions. Over-excavation (more than 4' deep) of the pond could be used to reduce clean-out frequency.

All valves should be monitored and maintained so that the free flow of water continues during normal operation. Valves also need to be monitored to insure full operation (are able to be completely opened & closed) and that no leakage is occurring.

If erosion of the lower wetland berm occurs from flooding of Semiconon Run, it may be necessary in the future to place riprap along the bank.

On the inspection sheet, for each identified passive treatment component note:

- Significant erosion present (Yes or No): Are there erosion gullies on the inside and outside berms?
- Features relating to berm instability present (Yes or No): Is there any slumping noted? Are there tension cracks on top of the berms?
- Successful vegetation (Yes or No): Are there significant areas on the inside and outside berms that need to be revegetated? Overall does the vegetation appear healthy?

- Significant siltation/sedimentation present (Yes or No): Is there significant sediment from erosion of berms or upland areas accumulating in the passive component? (This does not include accumulated metal precipitates, see Section I.)
- Significant change in water level (Yes or No): Is the water level rising or lowering in the passive component? Is there a discharge from other than the primary spillway? Is the water level appropriate (not too high or too low) for the plants in the wetlands?
- Valves operable (Yes or No): Are all valves able to be opened and closed by hand? Are the valves in good condition? (All valves should be fully operated during each inspection in order to maintain proper functionality.)
- Maintenance required: Do portions of the berms need to be stabilized with rip-rap and/or reconstructed? Does supplemental reseeding and mulching need to be completed? Do any passive components need to be cleaned of sediment? Do valves need to be replaced? Is there any vandalism to the valves?

F. Wildlife Utilization

One of the functions of a constructed wetland is to provide wildlife habitat for desired species. If, however, during inspections, signs of damage are noted, such as from muskrats in wetlands, appropriate steps should be taken to continue the function of the passive system and general site restoration. Significant damage needs to be corrected by repairing berms, removing invasive species, replanting, and trapping (contact PA Game Commission).

On the inspection sheet **(section F)**:

- Animals observed: Although not an inventory, please record whether there were tracks or visual observations of wildlife utilizing the site. Describe any damage observed.
- Invasive plants observed: If invasive or undesirable plants are observed, please note and remove as soon as practicable.

G. Flow Measurements:

There are three different methods of conducting flow measurements at this site.

Bucket and Stopwatch

Flow measurements from pipes such as the upper and lower drains can be made using the bucket and stopwatch method or other acceptable method. The bucket and stopwatch method consists of timing (in seconds) the filling of a bucket of known volume (preferably calibrated in gallons). The flow rate in gallons per minute can then be calculated utilizing the following formula:

$$\text{Flow (gal/min)} = \left(\frac{\text{Gallons}}{\text{Seconds}} \right) \text{X } 60$$

Weir

Flow measurements can be taken at the collection intake by using the flow intake as a weir and using the Francis Formula below:

$$\text{Cu ft/sec} = 3.33 (W - 0.2 H) H^{1.5}$$

A flow in cubic feet/second is calculated where H = height of water flowing through weir in feet and W = width of weir in feet (2.64' for Agri-drain Inlet Control Structure)

Gallons/minute (GPM) can then be calculated:

GPM = Cu ft/sec X 448.83

Ideally a staff gauge should be set several feet away from the weir. It is important to note that while commonly done, measuring the height of the water at the weir will typically produce a lower flow rate than the actual.

Iron precipitates, leaves, and other debris will need to be periodically cleaned out of the intake.

Flume

Flow measurements may be taken at the effluent of the wetland by utilizing the installed 9" H-flume. A miniature "staff gauge" ruler is connected to the flume to measure the flow. The ruler is placed on the bottom and gallons/minute can be read off. Flow measurements can also be calculated by measuring the water depth and then using the below tables to determine the flow rate. It is important that the flume be cleaned out and the bottom essentially level before taking a measurement as flow is determined by depth of water.

Depth (Feet)	Depth (Inches)	Flow (GPM)
0.01	0.12	0
0.02	0.24	0
0.03	0.36	1
0.04	0.48	1
0.05	0.6	1
0.06	0.72	2
0.07	0.84	3
0.08	0.96	4
0.09	1.08	5
0.10	1.2	6
0.11	1.32	7
0.12	1.44	8
0.13	1.56	9
0.14	1.68	11
0.15	1.8	12
0.16	1.92	14
0.17	2.04	16
0.18	2.16	18
0.19	2.28	20
0.20	2.4	22
0.21	2.52	25
0.22	2.64	27
0.23	2.76	30
0.24	2.88	33
0.25	3	36

Depth (Feet)	Depth (Inches)	Flow (GPM)
0.26	3.12	39
0.27	3.24	42
0.28	3.36	46
0.29	3.48	50
0.30	3.6	53
0.31	3.72	57
0.32	3.84	61
0.33	3.96	66
0.34	4.08	70
0.35	4.2	75
0.36	4.32	79
0.37	4.44	84
0.38	4.56	89
0.39	4.68	95
0.40	4.8	101
0.41	4.92	106
0.42	5.04	112
0.43	5.16	118
0.44	5.28	124
0.45	5.4	131
0.46	5.52	137
0.47	5.64	144
0.48	5.76	151
0.49	5.88	158
0.50	6	166

Depth (Feet)	Depth (Inches)	Flow (GPM)
0.51	6.12	174
0.52	6.24	182
0.53	6.36	190
0.54	6.48	199
0.55	6.6	207
0.56	6.72	216
0.57	6.84	225
0.58	6.96	235
0.59	7.08	244
0.60	7.2	254
0.61	7.32	264
0.62	7.44	274
0.63	7.56	285
0.64	7.68	296
0.65	7.8	307
0.66	7.92	318
0.67	8.04	329
0.68	8.16	341
0.69	8.28	353
0.70	8.4	365
0.71	8.52	377
0.72	8.64	390
0.73	8.76	403
0.74	8.88	416
0.75	9	430

H. Field Water Monitoring and Sample Collection

In order to assess the efficiency and performance of this system, water quality monitoring of each component of the system should be completed according to the schedule below. If possible, water samples should be taken and analyzed by the PA State Lab or other approved laboratory using standard chemical testing procedures for the following water quality parameters.

Laboratory Water Quality Parameters

pH	**Total Iron**	**Total Aluminum**
Alkalinity	**Dissolved Iron**	**Dissolved Aluminum**
Acidity	**Total Manganese**	**Sulfates**
Specific Conductance	**Dissolved Manganese**	**Total Suspended Solids**

Total calcium and dissolved oxygen are also valuable. In addition to the laboratory analyses, field tests should be completed including flow (as feasible), pH, temperature, and alkalinity. If water samples cannot be taken for laboratory analysis then, at a minimum, the following field tests should be completed: pH, temperature, alkalinity, and dissolved iron.

Water sampling and field testing at the following locations will enable evaluation of the degree of success of the passive components, individually and combined, in treating the mine drainage:

1. **Raw (RAW)**
2. **Collection Pool (CP)**
3. **Settling Pond (SP)**
4. **Wetland (WL)**
5. **Semiconon Run Up (UP)**
6. **Semiconon Run Down (DN)**

The monitoring program should include points other than the final effluent from the wetland in order to provide a complete description of the water quality through the passive treatment system at the time of sampling. For instance, the untreated raw mine discharge (as close to the source as possible), each component (at the effluent), and the stream (above and below the system) should be monitored. These monitoring point locations are identified on the O&M Inspection Sheet, site schematic, and “As-Built” plans.

In order to conduct laboratory analyses for pH, alkalinity, acidity, sulfates, conductivity, and total suspended solids, a 500-ml (or other specified volume), unfiltered sample should be collected, stored in a cooler, and transported to the laboratory. In order to differentiate between dissolved and total iron, manganese, and aluminum concentrations, the laboratory requires two, 125-ml (or other specified volume) samples that are preserved with trace metal-grade nitric acid to ensure that the pH is <2. The sample for total metals is not filtered. The sample for dissolved metals is filtered using a 0.45-μm filter in the field prior to placing the sample in the bottle. The filtering device should be rinsed with distilled or de-ionized water between each sample. Each bottle should be labeled with its own unique number.

A record of every sample taken should be made directly on the inspection sheet. Information such as sampler’s name, sample location, sample date, flow rate, field tests, and sample bottle identification will be written on the inspection sheet. Pertinent information is then transferred from the inspection sheets to the laboratory’s Record of Sample form or Chain of Custody form.

On the inspection sheet **(Section H)** for each Sampling Point:

- Monitoring point field measurements recorded:

Parameter	Method
Flow	Bucket & Stopwatch (where pipe discharge), etc.
pH	HACH pH kit, pH meter, etc.
Temperature	Field thermometer, pH meter, etc.
Total Alkalinity	HACH Digital Titrator, etc.
Iron	HACH iron, etc.
Dissolved oxygen (optional)	HACH DO kit, DO meter, etc.

Record readings to nearest whole number, except pH (record to nearest tenth). If the discharge is not piped and the is no weir or flume present at the monitoring point, no flow is measured.

- Sample bottle data: If water samples are collected, assign and record bottle numbers on the inspection sheet. You will need to transfer this information to the laboratory's Record of Sample or Chain of Custody form.
- Comments: Observations such as color of the sample or other information may be recorded in the "Comments" column.

I. Sludge Accumulation Assessment

Long-term iron precipitate sludge accumulation should be monitored.

On the inspection sheet for each component listed **(Section I)**:

- Sludge Accumulation: Has the sludge filled the component to within about 1-2' of the primary spillway or top of berm in the Wetland?
- Sludge Condition: Note the color and depth (estimated) of the sludge. Typically, white, red, and black colors indicate precipitate rich in aluminum, iron, and black, respectively.
- Comments: For example: Is there significant organic debris in the sludge? Is there evidence of wildlife utilizing the component? Depth of water?

WETLAND PLANT DIVERSITY REPORT

It is also recommended that a Wetland Plant Diversity Report be completed at least once per year. The primary purpose of this report is to assess the diversity of plant species within the constructed treatment wetland in order to determine if species diversity is increasing or decreasing. Species diversity is believed to increase the health, productivity, and treatment capability of the wetland. In addition, increased plant species diversity should result in an increase in wildlife diversity. A secondary purpose is to identify if unwanted invasive plants have become established. These plants should be removed from the wetlands. On the report provide the common name and/or scientific name for each plant, the plot number, the location of the plot, and the population within that plot.

MISCELLANEOUS MAINTENANCE CONSIDERATIONS

All materials used in repairs should be of equal or better quality and have the same capacity and function as shown on the "As-Built" plans.

Removal and disposal of accumulated precipitate or sediment

Precipitates from chemical reactions and other solids will be retained within the settling pond and wetland. This sludge should be removed when the volume of the component is reduced by about one half or reaches a level about 1-2' below the primary spillway or top of berm as noted in Section I. Inlet and outlets as well as the flume should be kept clear of debris and obstructions. Sludge removal is planned for every fifteen to twenty-five years or as needed. Opportunities may be available to utilize the sludge for metal recovery or the sludge may be allowed to drain/dewater for disposal. (An Erosion and Sediment Pollution Control Plan should be completed for the placement area.)

Miscellaneous Piping

This passive treatment system contains buried piping that is critical to the proper functioning of the system. Piping is used to collect and convey the discharge to the settling pond. This piping as well as the culverts at the site will need to be cleaned out when the capacity is reduced by 25 percent. Cleanouts for the anoxic collection systems may need to be periodically used to keep the pipes clear. Cleaning pipes can be carried out by using pipe clean-out rods, industrial snake clean-out tools, backflushing, or other reasonable methods.

REPLACEMENT

All passive treatment systems are unique. The sludge storage capacity for a projected design life of 25 years was based upon background monitoring data and published references. Higher flow rates and poorer water quality can substantially affect the design life. When the storage capacity of the system has been diminished by approximately one half, the sludge should be removed. Prior to removal the system and water quality should be evaluated to determine if reconstruction of the system will be necessary. Advances in technology and changes in raw drainage quality and quantity should be considered to determine if revisions to the size and/or design of the system would be advantageous. Replacement considerations include:

- Estimating Best Management Practice (BMP) design life;
- Determining replacement responsibility, including a successor, as necessary;
- Determining approximate costs for the following possible needs:
    - removing accumulated sediments;
    - replacing defective valves, water control structures, etc.;
    - re-sizing the system to accommodate changed water quality or quantity;
    - recharging organic matter in wetlands;
    - replanting wetlands.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

6/2005

Inspection Date:		Project Name:	**Abandoned Mine Drainage Mitigation Project At Camp Lutherlyn**
Inspected by:		Municipality:	**Connoquenessing Township**
Organization:		County:	**Butler** State: **PA**
Time Start:	End:	Project Coordinates:	**41° 09' 20"** Lat **79° 54' 10"** Long
Receiving Stream:	**Semiconon Run**	Subwatershed:	**Little Connoquenessing Creek** Watershed: **Connoquenessing Creek**

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. Site Vegetation (Uplands and Associated Slopes)

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. Access Road and Parking Area

Is the access road and parking area accessible for operation and monitoring? Yes/No?
Does the access road and parking area need maintenance? Yes/No?
Describe maintenance performed and remaining (Identify location on Site Schematic.):

C. Diversion Ditch and Spillways

Channel Identification	Significant Erosion (Y/N)	Debris Present (Y/N)	Maintenance Performed (Y/N)	Maintenance Performed and Remaining (Indicate ditch by number i.e. 2b = Settling Pond Outlet)
1. Upland Diversion Ditch				
2. Rock-Lined Spillways				
a. Settling Pond Inlet				
b. Settling Pond Outlet				
c. Wetland Outlet				

D. Culverts Functioning (Y/N) Maintenance Required (Y/N) Describe Condition

Culvert 1: _____ _____ _____
Culvert 2: _____ _____ _____

Describe maintenance performed and remaining:

E. Passive Treatment System Components

Component	Significant Erosion (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. Settling Pond)
Settling Pond							
Wetland						***NA***	

F. Wildlife Utilization

Animal sighted or tracks observed _____
Invasive plants observed _____

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

G. Flow Measurements – Use Bucket and Stopwatch method (Indicate no flow by entering "0" in Gallons Measured – Record in Section H) Identify any broken, plugged, or leaking pipes.

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

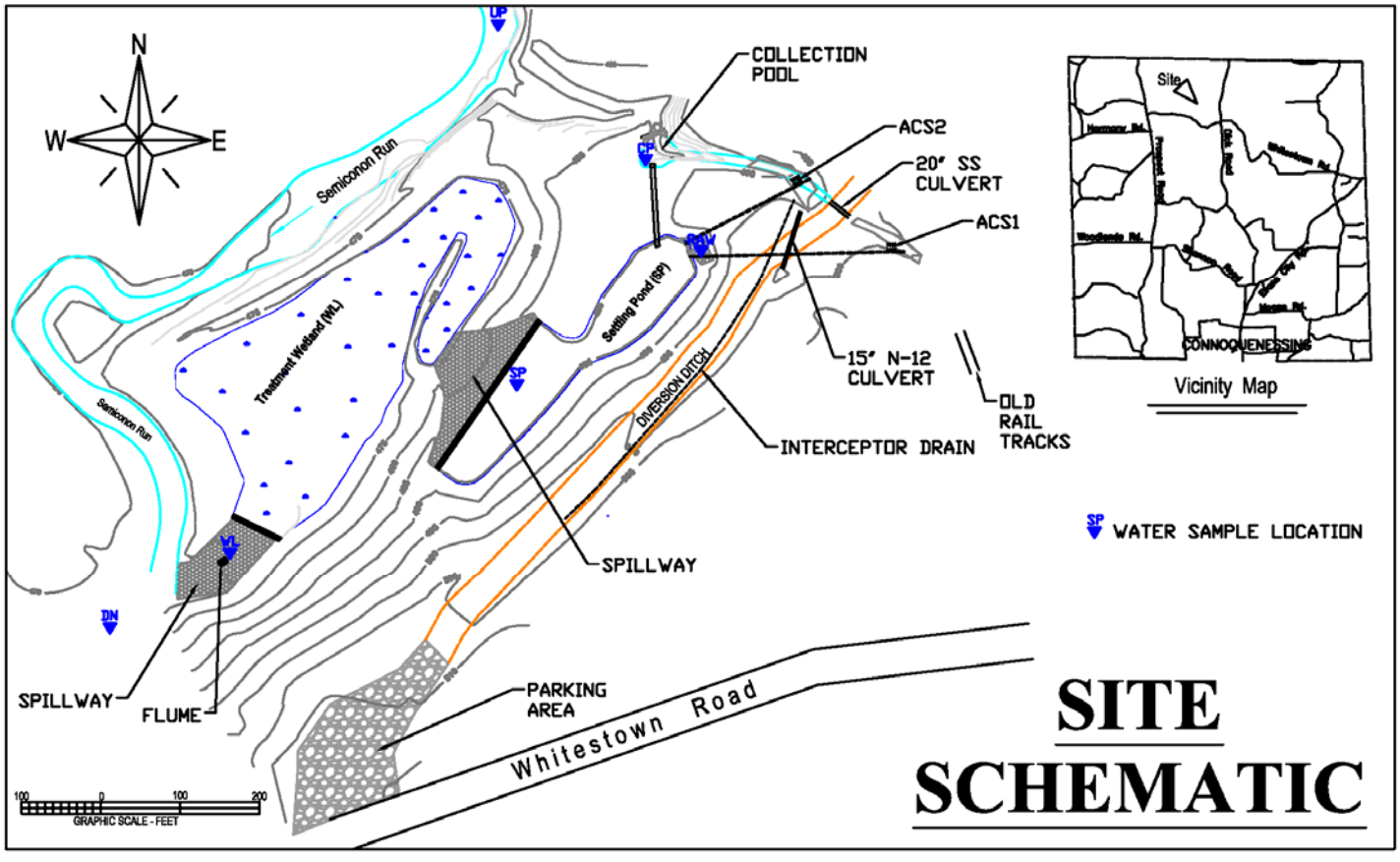
Sampling Point	Flow*		pH	Temp (°C)	Total Alkalinity (mg/L)	DO (mg/L)	Iron (mg/L)	Comments	Bottle #	Bottle # (total metals)	Bottle # (diss. metals)
	gals	sec.									
Raw											
Collection Pool*											
Settling Pond											
Wetland (Effluent)*											
Semiconon Run Up											
Semiconon Run Dn											

*Note: For Weir (Collection Pool) and Flume (Wetland Effluent) measurements, enter the depth of water in feet in the "gals" column.

I. Sludge Accumulation

	Sludge Accumulation (within 1-2' of Spillway Y/N*)	Sludge Description	Comments
Collection Pool:			
Settling Pond:			
Wetland*:			

*Note: The sludge accumulation in the Wetland may exceed the crest of the spillway as vegetation continues to grow in accumulated precipitates and helps to stabilize the sludge. In this case the sludge may continue to accumulate to within about 2' of the total berm height.



WETLAND PLANT DIVERSITY REPORT

Inspection Date:	______________	Project Name:	**Abandoned Mine Drainage Mitigation Project At Camp Lutherlyn**		
Inspected by:	______________	Municipality:	**Connoquenessing Township**		
Organization:	______________	County:	**Butler**	State:	**PA**
Time Start: ________	End: ________	Project Coordinates:	**40° 52' 38''** Lat	**80° 01' 18''** Long	
Receiving Stream:	**Semiconon Run**	Subwatershed:	**Little Connoquenessing Creek**	Watershed:	**Connoquenessing Creek**

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

Common Name	Scientific Name	Plot #	Plot Location	Number