SCHUYLKILL CONSERVATION DISTRICT
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POTTSVILLE, PA 17901

REMEDIATION OF THE TRACY AIRHOLE AMD DISCHARGE PROJECT

NOVEMBER 12, 2008

FINAL REPORT
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Table of Contents

1. Project Overview

The Tracy Airhole Discharge is located 3 miles west of Donaldson, Schuylkill County, Pennsylvania in the Good Spring Creek Watershed a sub-watershed of Swatara Creek. Located in the headwaters, the Tracy Airhole Discharge is one of the largest abandoned mine drainage (AMD) discharges within the Upper Swatara Creek Watershed in southeastern PA. Average flow from the discharge is 1,210 gpm and water quality monitoring has shown discharge water to be net alkaline with a near-neutral pH, containing 14.8mg/L iron, negligible amounts of aluminum and 2.53mg/L manganese. Metal loading from the Tracy Airhole and other discharges, resulted in Good Spring Creek's and Upper Swatara Creek's designations as "impaired" on the 303(d) list with approved TMDLs.

In 2005, the Schuylkill Conservation District was awarded a Pennsylvania DEP Nonpoint Source Management Program grant to engineer and construct a treatment system for the Tracy Airhole Discharge. After DEP awarded the grant, site surveys were completed, permits were submitted, final engineering was completed, and the construction contract was competitively bid and awarded. Due to unforeseen problems, the Schuylkill Conservation District requested a time extension until September 30, 2008. Construction of the treatment system commenced in January 2008 and was completed in April 2008.

The treatment system was designed to remediate the Tracy Airhole Discharge and improve water quality of Good Spring Creek and the entire Swatara Creek Watershed. Reductions in pollution coincide with recommendations outlined in the Upper Swatara Creek Watershed TMDL. This treatment system is another step toward restoration of the Upper Swatara Creek Watershed and its eventual removal from DEP's 303(d) List of Impaired Waterways.

2. What was the project supposed to accomplish?

Specific goals of the Tracy Airhole Discharge remedation project were to:

1. Treat and improve water quality of the Tracy Airhole Discharge.
2. Implement and evaluate a passive treatment system to treat the Tracy Airhole Discharge, and relate that knowledge to other mine drainage treatment projects.

3. Eliminate or reduce iron, and manganese loadings from the Tracy Airhole Discharge into Good Spring Creek and ultimately Swatara Creek.
4. Produce water quality improvement in Good Spring Creek downstream of the Tracy Airhole discharge

The primary goal of the project was to eliminate or significantly decrease AMD loadings from the Tracy Airhole Discharge to Good Spring Creek. Success of the project was measured by reductions in iron concentrations of the treated water and iron load to Good Spring Creek.

Long term, the goal of the project was to eventually remove Good Spring Creek and Swatara Creek from the 303(d) List of Impaired Waters. The Tracy Airhole discharge was listed as the most significant source of pollution to Good Spring Creek and listed as a high priority project in the TMDL Upper Swatara Creek Implementation Plan. Remediation of other AMD discharges; restoration of stream channels destroyed by mining activities; reclamation of mine land; culm bank removal to reduce sedimentation, erosion, and improve water quality may be needed before restoration of Good Spring Creek can be accomplished.

3. What you actually did and how it differs from your plan?

The Tracy Airhole discharge treatment system was modeled after similar passive treatment systems designed to treat net alkaline discharges with high concentrations of iron and low concentrations of aluminum. Two elements were included in the primary settling basin design to increase iron removal efficiency. First, the primary setting basin was constructed with a conveyance channel (level spreader) across the basin's front to sheet flow water evenly over the entire basin and the second was to actively aerate the basin. This project involved the diversion of discharge water into a large primary settling basin, then water would flow overland through a wooded area to a polishing wetland before entering Good Spring Creek. A second, slightly smaller, overflow settling basin was constructed to treat water bypassing the primary settling basin during periods of high flow. Some of the water exiting the primary settling basin was unintentionally diverted into the overflow basin due to variations in topography of the wooded area between the two basins.

System's operation

The treatment system utilizes an ability to be operated passively or actively using aeration. An Inline Water Level Control Structure (IWLCS) placed in the discharge channel diverts water through an 18" pipe to the primary settling basin's level spreader. During periods of high flows, water is diverted through and around the IWLCS down the existing channel to a second IWLCS that diverts water into the overflow settling basin.

Water is conveyed through the 18" pipe to the level spreader that distributes water across the entire basin's front. This level spreader was designed to passively increase carbon dioxide (CO_2), and oxygen (O_2) transfer between the atmosphere and water to increase iron oxidation and slow water velocities to maximize settling. An aeration system was placed in the primary settling basin to actively increase diffusion of CO_2 and O_2 between the atmosphere and water to maximize iron oxidation.

After water has left the primary settling basin, it flows through an undisturbed wooded area where it creates a shallow wetland. Originally all water leaving the primary settling basin was to flow through the wooded area into a constructed polishing wetland; however, this did not occur due to variations in land topography about one third of the flow is diverted further into the wooded area where it flows into the overflow basin. Although not originally designed, the splitting of flow between the constructed polishing wetland appears to be beneficial to the treatment system's overall treatment effectiveness. The remaining two thirds of flow continues as intended to the polishing wetland. Treated water leaving the overflow basin and polishing wetland enters Good Spring Creek.

Scope of work

Scope of work for this project included detailed surveying, site mapping (both land and geotechnical), final engineering, competitive bidding, system as-built plans, and completion of an operation and maintenance manual. The final product of the plan is very much in-line with the original proposal and scope-of-work. Since this project involved final engineering, some project elements of the conceptual design were modified or added, but this was an expected outcome of the project.

Project Deliverables

- Final engineering and design complete with specifications of the AMD treatment system.
- Operation & maintenance manual
- Completed AMD passive treatment system with water quality monitoring information to effectively evaluate the treatment system and its functionality
- Final Report

4. What were your successes and reasons for your success?

The project has been successfully completed, and resulted in the construction of a treatment system for a high priority AMD discharge in the Swatara Creek Watershed. Completing this project required innovative thinking that would overcome design challenges posed by both the site characteristics and overall discharge size. This treatment system is unique in the Swatara Watershed because it marries together both passive and active treatment technologies.

5. Water Quality Improvement Data

Five sample locations were selected for the Tracy Airhole discharge treatment system and are shown in Table 1. These five sample locations were selected to provide a representation of treatment effectiveness at various points within the treatment system. Sample point TAHWEIR is located next to a weir five yards from the discharge origin. Sample points OVRPDOUT and PND3DISC are where water leaves the treatment system and is discharged into Good Spring Creek.

Sample ID	Sample Location Description
TAHWEIR	Tracy Air Hole discharge @ weir
PND1DISC	Water exiting primary settling basin
PND3IN	Water flowing into polishing wetland
PND3DISC	Water exiting polishing wetland
OVRPDIN	Water flowing into overflow pond
OVRPDOUT	Water exiting overflow pond

Table 1. Sample point identification and location descriptions.

Water quality samples collected after construction of the Tracy Airhole discharge treatment system are shown in Table 2. Water quality sample results suggest the treatment system is working efficiently to reduce iron and manganese concentrations present in the Tracy Airhole discharge water. Although sample size is to small to draw statistical conclusions, there

appears to be a greater reduction of iron in the primary settling basin when the aeration system is in operation (8/19/08) when compared with data collected when the aeration system was not operated (5/8/08 and 10/16/08). Collection of additional samples is required to determine if statistical differences in treatment system efficiency exist when operated with and without the aeration system.

Date	Location	Flow	Fe Total	Alk	Sulfate	H Acidity	Al	pH (lab)	Mn
		GPM	mg/l	mg/l	mg/l	mg/l	mg/l	units	mg/l
5/8/2008	TAHWEIR	1061	13.50	51.8	215.8	-31.8	<0.2	6.2	2.07
5/8/2008	PND1DISC		8.04	39.6	222.4	-23.4	<0.2	6.4	2.04
5/8/2008	PND3IN		9.16	33.6	232.4	-28.4	<0.2	6.6	1.55
5/8/2008	PND3DISC		2.29	37.2	248.0	-26.6	<0.2	6.8	1.37
5/8/2008	OVRPDIN		0.40	29.0	248.5	-21.0	<0.2	6.8	1.09
5/8/2008	OVRPDOUT		0.33	26.2	237.1	-13.8	<0.2	6.8	1.01
8/19/2008	TAHWEIR	601	17.55	72.2	211.5	-35.2	<0.5	6.2	2.27
8/19/2008	PND1DISC		0.44	47.0	217.8	-35.2	<0.5	6.7	2.23
8/19/2008	PND3IN		0.76	42.2	220.0	-31.2	<0.5	6.8	1.99
8/19/2008	PND3DISC		<0.3	49.2	217.2	-35.2	<0.5	7.2	1.88
8/19/2008	OVRPDIN		1.01	39.6	218.2	-27.2	<0.5	6.9	1.57
8/19/2008	OVRPDOUT		<0.3	38.0	213.5	-25.0	<0.5	6.9	1.41
10/16/2008	TAHWEIR	497	20.04	84.2	188.7	-36.8	<0.5	6.3	2.37
10/16/2008	PND1DISC		1.01	51.4	202.8	-35.0	<0.5	6.4	2.23
10/16/2008	PND3IN		1.39	42.6	207.4	-24.4	<0.5	6.6	1.71
10/16/2008	PND3DISC		<0.3	49.8	204.7	-33.8	<0.5	7	1.68
10/16/2008	OVRPDIN		1.13	43.8	207.8	-28.4	<0.5	6.8	1.51
10/16/2008	OVRPDOUT		<0.3	40.2	209.7	-24.6	<0.5	6.9	1.29

Table 2. Lab water quality data for the Tracy Airhole discharge treatment system. Sample dates 5/8/08 and 10/16/08 were collected while the aeration system was not in operation while sample date 8/19/08 was collected while the aeration system was operational.

Averages calculated for flow, iron concentration, alkalinity, sulfate concentration, acidity, pH, and manganese concentration are shown in Table 3. The average values in Table 3 were calculated with samples collected both with and without active aeration. The treatment system as a whole appears to be effectively removing iron from the Tracy Airhole discharge water.

Date	Location	Flow	Fe Total	Alk	Sulfate	H Acidity	pH (lab)	Mn
		GPM	mg/l	mg/l	mg/l	mg/l	units	mg/l
10/16/2008	TAHWEIR	720	17.03	69.40	205.33	-34.60	6.23	2.24
10/16/2008	PND1DISC		3.16	46.00	214.33	-31.20	6.50	2.17
10/16/2008	PND3IN		3.77	39.47	219.93	-28.00	6.67	1.75
10/16/2008	PND3DISC		0.96	45.40	223.30	-31.87	7.00	1.64
10/16/2008	OVRPDIN		0.85	37.47	224.83	-25.53	6.83	1.39
10/16/2008	OVRPDOUT		0.31	34.80	220.10	-21.13	6.87	1.23

Table 3. Combined active aeration and passive aeration average values for flow, total iron, alkalinity, sulfate, hot acidity, pH and manganese for the Tracy Airhole discharge and treatment system based on two samples collected without mechanical aeration and one sample with mechanical aeration.

6. Project Partners

Project success was largely made possible through the coordinated efforts of project partners. The project was overseen by a group of representatives from the Northern Swatara Creek Watershed Association, Schuylkill Conservation District, DEP/Pottsville District Mining Office, DEP/Bureau of Watershed Conservation, DEP/Bureau of Abandoned Mine Reclamation, EPCAMR-Eastern PA Coalition for Abandoned Mine Reclamation, Land Studies (engineering contractor) and United States Geological Survey. This group, which served as the technical steering committee, assisted with the review of professional services, design oversight, and construction oversight.

Some of the individual partner actions that led to the project's success include the following. Northern Swatara Creek Watershed Association provided volunteers for water quality monitoring. The OSM/VISTA volunteer assisted with project construction oversight and coordinated a monitoring program. The U.S. Geological Survey provided a projection of parameters for design, monitoring, and technical expertise. The PA DEP Bureau of Abandoned Mine Reclamation (BAMR) provided engineering assistance, flow, and water quality data and maps of reclaimed land in the watershed. PA DEP Bureau of Dams & Waterways Engineering provided technical assistance on permitting and wetlands identification and delineation. The PA DEP Bureau of Watershed Management assisted in providing EPA Section 319 and other funding for mine drainage abatement projects. PA DEP Bureau of Mining and Reclamation contributed historical mining data and Scarlift Reports. PA DEP District Mining Operations Pottsville Office coordinated and assisted with data collection, acquiring funding for abatement

projects and working with the local community, encouraged re-mining, provided technical assistance and project design. The Schuylkill County Conservation District (SCCD) provided technical assistance in project design, coordinating water quality improvement efforts, data collection, and in acquiring funding. Municipalities and agencies in Schuylkill County assisted with identification of landowners seeking funding for stream improvement projects and in project design. Watershed restoration efforts have received strong endorsements from U.S. Congressmen Tim Holden and Pennsylvania Representative Tim Seip. Additional support and assistance were provided by many local groups or businesses including the Northern Swatara Creek Watershed Association, Natural Soil Products Inc, Fraily Township, Borough of Tremont, Arthur "Pat" Aungst Inc, Pine Crest Tree Farms, Ringtown Boy Scouts and Rausch Creek Lands LP for approval to construct the treatment system.

7. What problems were encountered and how you dealt with them?

Design, construction, and start-up of the treatment system provided little problems to the overall completion of the project. Both design and construction challenges were expected when completing the project, but all issues encountered were minimal and were resolved by the project's technical steering committee.

A limited footprint available for the treatment system was something that posed a challenge from the start. A culm bank was required to be removed before construction of the treatment system could commence; however, with an exploration permit issued by the DEP Pottsville District Mining Office, the landowner was able to remove the culm bank and increase land available for the project.

Another challenge to the completion of this project was the high cost of fuel associated with moving materials. The two settling basins required a large volume of material to be excavated and then hauled off site. A local business located across the road from the treatment system site agreed to take the excavated material saving a great deal on hauling costs.

Other problems encountered were the result of weather related conditions. Snowfall and heavy rains resulted in conditions that impaired the contractor's ability to work with heavy equipment.

Construction of corduroy access roads and the use of smaller equipment helped to alleviate these problems. Cold weather during the start up of the project resulted in equipment problems related to fuel issues.

8. How your work contributed to solution of original problems?

Water quality of the Tracy Airhole discharge has shown an average flow of 1,210 gpm, pH 5.98, alkalinity 36.7 mg/l, acidity -31.1 mg/l, iron 15.9 mg/l, aluminum < 0.2 mg/l, manganese 2.54mg/l and sulfates 227 mg/l. The treatment system produced improvements in water quality (Table 1, 2 and 3) that coincided with the reduction recommendations published in the Upper Swatara Creek TMDL. Additionally, the Tracy Airhole discharge will contribute to the eventual removal of Good Spring Creek and Swatara Creek from DEP's 303(d) List of Impaired Waterways.

If the Tracy Airhole discharge treatment system continues to work at the current efficiency, it is expected to meet the TMDL for Good Spring Creek by reducing at least 92% of the iron, and 66% of the manganese from the Tracy Airhole discharge. Work completed through this grant has made it possible to engage a high priority discharge in the Swatara Creek Watershed. Ongoing water quality data analysis will help to determine the effect that the treatment system has had on water quality in Good Spring Creek.

9. What else needs to be done?

Initial sample results shown in Tables 1, 2 and 3 imply significant reductions in iron discharged to Good Spring Creek from the Tracy Airhole discharge as a result of the treatment system. It is important to note that the system was completed in April 2008 and has been in operation for only a few months; therefore, long-term monitoring is necessary to assess overall effectiveness of the treatment system.

Long term system maintenance will be required, because iron precipitation in the primary settling basin will cause a build-up of iron sludge to occur; therefore, removal and disposal will be necessary to maintain basin volume and treatment effectiveness. Removal of iron sludge from the wooded area, overflow basin and polishing wetland will be required in the future to maintain treatment effectiveness. Build-up of iron sludge should occur at a much slower rate in

these areas compared to the primary settling basin. Cleaning of the aeration system will be necessary to ensure proper function and longevity.

10. What are your plans for disseminating results of your work?

Knowledge gained from this effort will be distributed through the World Wide Web, PowerPoint presentations, the PA DEP Water Management Nonpoint Source Liaison Work Group, and presentations at the Annual Statewide Conferences on AMD/AMR.

Information about the project will also be available on project partner web sites. These web sites include:

- www.dep.state.pa.us
- www.amrclearninghouse.org
- www.epcamr.org

Northern Swatara Creek Watershed Association, PA DEP, and the Conservation District will continue to coordinate watershed field tours for public officials, community members, and school students. EPCAMR has a statewide e-mail address book capable of reaching 57 Conservation District Watershed Specialists and nearly one hundred groups, individuals, and watershed associations throughout the region. Members of the public, local community organizations and the media were also invited to meetings and press releases for important events such as review of final designs and contract bidding. A formal dedication of the treatment system will be held in the future.

11. How well did your spending align with your budget request?

Spending of this grant aligned very closely with the projected budget. There was, a shortfall in funding for construction at the time of contract award due to escalating energy costs associated with equipment operation and materials. The Schuylkill Conservation District received violation settlement money from DEP for projects within the Swatara Creek Watershed. This money was used to fund the construction shortfall of the Tracy Airhole Treatment System Project. Five thousand dollars was transferred from line item Contractual to line item Construction in order to help cover the increased cost of project construction.

12. Brief Summary

The SCD and project partners completed construction of the Tracy Airhole Discharge Treatment System located in the Good Spring Creek Watershed, a sub-watershed of the Swatara Creek Watershed. The system removes over ninety percent of the AMD's iron and significantly improves Good Spring Creek and Swatara Creek. Completion of the Tracy Airhole Discharge treatment system and other projects will lead to Good Spring Creek and Upper Swatara Creek's eventual removal from DEP's 303(d) List of Impaired Waterways.

13. Photographs

Additional photographs available on attached CD.

Picture1. Clearing and grubbing of the overflow settling basin site.

Picture 2. Excavation of the overflow settling basin

Picture 4. Inline water control level control structure to be placed in discharge channel.

Picture 5. Placement of water level control structure in discharge channel.

Picture 6. Placement of overflow settling basin intake pipe.

Picture 7. Completed overflow settling basin before being filled with water.

Picture 8. Overflow settling basin receiving water from the primary settling basin.

Picture 9. Clearing and grubbing of the polishing wetland site.

Picture 10. Excavation of the polishing wetland.

Picture 11. Completed polishing wetland, before being filled with water

Picture 12. Polishing Wetland receiving water from the primary settling basin.

Picture 13. Clearing and grubbing of the primary settling basin site.

Picture 14. Excavation of the primary settling basin.

Picture 15. Placement of primary settling basin intake pipe under highway.

Picture 16. Completed primary settling basin before being filled with water.

Picture 17. Primary settling basin receiving discharge water and operating aeration system.

14. Financial Report

The project was originally funded for $250,000 under the FY 2005 Nonpoint Source Implementation Program. One line item transfer of $5,000 was requested from Contractual to Construction in 2008. See the attached sheet for line item, transfer of funding, and breakdown of funding for project.

Matching Funds

This project was completed with funding provided to the Schuylkill Conservation District by DEP through a violation settlement to be used for projects within the Swatara Creek Watershed.

	Salaries and Benefits	Admin	Contractual Services	Construction	Equipment	Other	Total
Grant Amount	500.00	2,500.00	50,000.00	197,000.00	0.00	0.00	250,000.00
SCD In-kind	0.00	32.40	0.00	97,638.01	1,436.40	129.74	99,236.55
Total	500.00	2,532.40	50,000.00	294,638.01	1,436.40	129.74	**349,236.55**

Table 4. Total funding for each line item provided by the grant and in-kind.

15. Appendix A (Accomplishment Worksheets)

16. Detailed Technical Reports where applicable

Copy of detailed technical report is included in the Operation, Maintenance and Replacement Plan manual.

17. Operation, Maintenance and Replacement Plan

See attached booklet.