



6th West Branch Susquehanna Restoration Symposium



April 27 & 28, 2012

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6th West Branch Susquehanna Restoration Symposium

AGENDA

Friday, April 27

- 7:30 - 9:00 **Registration & Exhibit Setup, Refreshments**
- 9:00 - 9:15 **Welcome**
 Amy Wolfe, Trout Unlimited
- 9:15 - 10:00 **Keynote Address**
 John Arway, Pennsylvania Fish and Boat Commission
- 10:00 - 10:30 **Break with Refreshments**
- 10:30 - 11:00 **Utilization of AMD in Well Development for Natural Gas Extraction**
 Kelly Heffner, DEP Office of Water Management
 John Stefanko, DEP Office of Active and Abandoned Mine Operations
- 11:00 - 11:30 **Using Treated AMD for Frack Water– The Antrim Experience**
 Michael Smith, DEP Moshannon District Mining Office
- 11:30 - 1:00 **Lunch & Awards Ceremony**
- 1:00 - 1:30 **Controlling Phosphorus in Animal Waste Management Systems with Mine Drainage Residuals**
 Amy Wolfe, Trout Unlimited
- 1:30 - 2:00 **A Comparison of Long-Term AMD Treatment Costs Using Different Technologies at Tangascootack Site #1**
 Dr. Robert Hedin, Hedin Environmental
- 2:00 - 2:30 **Update of DEP's Proposed Cresson Mine Drainage Treatment Plant and Other Active AMD Plants**
 Pam Milavec, DEP Bureau of Conservation and Restoration

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AGENDA

Friday (continued)

- 2:30 - 3:00 **Break with Refreshments**
- 3:00 - 3:30 **Remediation of High-Strength Mine Impacted Water at the Klondike-1 Discharge using Crab Shell Substrate Mixtures: Laboratory Column and Field Pilot Tests**
Dr. Rachel Brennan, Penn State University
- 3:30 - 4:00 **Educational Outreach and Its Role in Abandoned Mine Drainage Restoration**
Rebecca Holler, Trout Unlimited
- 4:00 - 4:30 **DEP's Reorganization: Where Do We Go From Here?**
Glenn Rider, DEP Bureau of Conservation and Restoration
- 4:30 - 6:00 **Social Reception and Student Poster Session**
- 5:15 - 5:30 **Student Poster Awards Ceremony**
John Dawes, Foundation for PA Watersheds

Saturday, April 28

- 7:30 - 8:30 **Breakfast for Tour Participants**
- 8:30 - 4:00 **Lancashire #15 Treatment Facility and Clearfield Creek Watershed AMD Project Tour**
Those who are registered should meet at the registration desk by 8:15 to load the bus. The bus will leave at 8:30 am.

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Keynote Speaker

John Arway

Pennsylvania Fish and Boat Commission



John Arway is the Executive Director of the PA Fish & Boat Commission and an avid angler, boater and hunter. He is a fisheries ecologist by training and has a B.S. in Biology from the University of Pittsburgh and an M.S. in Aquatic Biology from Tennessee Technological University. John has worked for over 30 years for the Commission primarily in the prediction and assessment of threats to aquatic resources living in Commonwealth waters. He has been in the Director position for two years and is currently working on alternative funding ideas as a way to reduce the cost of a fishing license. John has lived in the West Branch Watershed for 32 years.



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Presentation Summaries & Speaker Biographies

Utilization of AMD in Well Development for Natural Gas Extraction

Kelly Heffner, DEP Office of Water Management

John Stefanko, DEP Office of Active and Abandoned Mine Operations

In November 2011, the PA Department of Environmental Protection (DEP) released a draft white paper on the utilization of abandoned mine drainage (AMD) in well development for natural gas extraction. The intent of the DEP's white paper was to provide solutions to address the use of AMD for natural gas extraction including: [1] AMD storage at AMD sites and at sites regulated by DEP's Office of Oil and Gas Management, [2] draft preliminary storage standards for AMD to be stored in nonjurisdictional impoundments, [3] a process of DEP review of proposals to utilize AMD, and [4] solutions to address long-term liability issues. DEP held several stakeholder meetings and invited public comments on the white paper. This presentation provides an overview of the DEP's white paper and its finalization based on the feedback received from the public comments

Kelly Heffner has served most recently as Acting Deputy Secretary for Field Operations from March 2010 to March 2011. Prior to that, she served as Policy Director for DEP and has served as the DEP's American Reinvestment and Recovery Act (ARRA) Coordinator. Other previous positions held by Kelly include Executive Policy Specialist in the DEP Policy Office; Chief of the Permitting Section in the Division of Waterways, Wetlands and Storm Water Management; and as a Water Pollution Biologist. Before joining DEP, Kelly also worked for five years in the private sector as a Project Manager and Biologist for RMC Environmental Services in Pottstown. Kelly holds a Bachelor of Science degree in Environmental Science from East Stroudsburg University.

Deputy Secretary Stefanko oversees the bureaus of Mining Programs, Abandoned Mine Reclamation, Mine Safety, and the District Mining Operations. Mr. Stefanko has been with the Department since 1987. Prior to his recent appointment John was the Executive Assistant and served as the senior advisor to the previous Deputy Secretary until his retirement in December 2010. He has also served as the Chief of DEP's Division of Contracts, Procurement and Bonding within the Bureau of Office Services and as a Project Designer for the Department's Bureau of Abandoned Mine Reclamation, Division of Acid Mine Drainage Abatement. Mr. Stefanko holds an Associate Degree in Mechanical Engineering from Pennsylvania State University and a Bachelor's Degree in Civil Engineering Technology from the University of Pittsburgh at Johnstown.

Using Treated AMD for Frack Water– The Antrim Experience

Mike Smith, DEP Moshannon District Mining Office

In 1999, Antrim Mining Company established a mine drainage treatment trust fund to provide for the long-term treatment of two acid mine discharges near the village of Antrim in Tioga County, PA. The Antrim Number 1 and Backswitch discharges were from abandoned mines that were affected in the course of Antrim's surface mining operations in the 1980's. They comprise approximately 50% of the total pollution load, before treatment, entering Wilson Run, the major AMD-impaired tributary to Babb Creek. The discharges are currently treated at a chemical treatment plant operated by the Babb Creek Watershed Association funded by the Antrim Treatment Trust. Treatment of these discharges was the

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catalyst for a successful effort to restore the entire Babb Creek watershed. Continued operation of the Antrim Treatment facility is crucial for sustained restoration of Babb Creek; however due to flow rates higher than anticipated and other additional costs as well as poor market returns during the 2008 economic downturn, the Antrim Treatment Trust appeared to be underfunded. The use of the Antrim discharges to provide water for natural gas well development was explored as a possible source of revenue for the treatment trust. The Antrim Trust obtained a water withdrawal approval “docket” from the Susquehanna River Basin Commission and solicited proposals from companies interested in using the large and steady flow of water from the discharges. Although the discharge was geographically well positioned for use with Marcellus shale development, severe water chemistry, particularly high sulfate concentrations, limited its appeal for hydrofracking. In 2011, the Trustee entered into a lease agreement with Hydrorecovery Inc. to build a frack water treatment facility on a portion of the Trust property. Hydrorecovery’s treatment process will remove sulfates to make the water useable to the gas industry. The lease provides for annual payments for use of Treatment Trust land and a water use fee for access to the Antrim and Backswitch discharges. Lease payments should be sufficient to assure long-term financing of AMD treatment operations and may also generate additional revenue for other treatment operations in Tioga and Lycoming Counties.

Michael W. Smith, P.G. is the District Mining Manager at DEP’s Moshannon District Office, which covers most of northcentral Pennsylvania and the West Branch watershed. He has held that position for over 20 years. Before that, he worked for the Bureau of Mining and Reclamation and the Pennsylvania Geologic Survey as a hydrogeologist. Mr. Smith has a B.A. in Geology and Environmental Science from Susquehanna University and a M.S. in Geology from Penn State. He has authored numerous articles on remining, acid mine drainage, and mine hydrology.

Controlling Phosphorus in Animal Waste Management Systems with Mine Drainage Residuals

Amy Wolfe, Trout Unlimited

Land-applied animal manure from dairy and swine farms is a significant source of phosphorus to the Chesapeake Bay watershed because many farms do not have a sufficient area to land-apply manure. Although no-till practices have proven to be effective for lessening the runoff of solids and nitrogen from fields, no-till manure applications can actually result in higher losses of phosphorus, specifically soluble phosphorus – known as water extractable phosphorus (WEP) – during runoff events than is observed in conventional till fields. No economically viable best management practice (BMP) currently exists that allows small farms to substantially decrease WEP in the dairy manure before it is land-applied. To address this, TU worked with Iron Oxide Recovery and agricultural experts from Oklahoma State University, Penn State University, and the USDA Agricultural Research Service to establish an innovative method using mine drainage residuals (MDR) obtained from mine drainage treatment systems to significantly reduce WEP in dairy and swine manure. The project is ongoing, with recent funding from the Growing Greener Program, to develop the use of MDR into a cost-effective BMP that will provide farmers with a means to continue land application of manure while decreasing the risk of phosphorus pollution to receiving streams and ultimately the Chesapeake Bay. TU is especially interested in this project because the use of MDR will ultimately help to reduce or eliminate the costs of MDR removal for

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watershed organizations and others who are responsible for the operation and maintenance of mine drainage treatment systems.

Amy joined Trout Unlimited in 1999 as the coordinator for the Kettle Creek Home Rivers Initiative where she was responsible for the completion of numerous fish habitat and abandoned mine drainage remediation projects, restoration plans, and landowner stewardship and educational trainings and projects. In 2004, Amy led TU into launching the West Branch Susquehanna Restoration Initiative. Now as Director of TU's Eastern Abandoned Mine Program, Amy continues to expand TU's efforts to restore trout and their watersheds that are impacted as a result of abandoned coal mines. Amy received a Bachelor of Science in Environmental Biology and Ecology from Lock Haven University in 1996. Before coming to TU, her experience included seasonal work with the Maryland Biological Stream Survey through the University of Maryland Center for Environmental Science Appalachian Laboratory, PA Fish and Boat Commission, DCNR Bureau of State Parks, and DEP Bureau of Water Quality.

A Comparison of Long-Term AMD Treatment Costs Using Different Technologies at Tangascootack Site #1

Dr. Robert Hedin, Hedin Environmental

The Tangascootack#1 site contains an AMD discharge that flows 40-200 gpm and contains pH 4, 96 mg/L acidity, 27 mg/L Mn, 12 mg/L Al, and <1 mg/L Fe. In 2010 an existing passive treatment system was rehabilitated and expanded to better treat the AMD. The renovated system includes two alkalinity-generating units: a vertical flow pond (VFP) and a drainable limestone bed (DLB). The treatment effectiveness of the VFP and DLB have been monitored monthly for 18 months. Both units discharge a net alkaline effluent with pH 7-8 and Al concentrations < 1 mg/L. The VFP does not remove Mn, while the DLB lowers Mn to <1 mg/L. The system provides a unique opportunity to reliably compare passive treatment technologies for low pH AMD at remote locations where regular attention by an operator is not feasible. An economic analysis is presented that compares construction and anticipated long-term operation and maintenance costs for both treatment units. These results are also compared to costs developed using AMDTreat for lime treatment and NaOH treatment. The analysis shows the large economic advantage of effective passive treatment over chemical options at remote sites.

Robert Hedin has a Ph.D in Ecology and was a Research Scientist with the U.S. Bureau of Mines for six years in the 1990s where he studied mine drainage and passive treatment. Since 1994 he has owned and operated Hedin Environmental, a small Pennsylvania consulting firm specializing in mine water assessments and remediation. Hedin Environmental has designed 40 passive treatment system, including the Marchand System which received a Governor's Environmental Excellence Award, the Middle Branch system which restored a native trout fishery, and the Anna S Treatment Complex which contributed to removal of 14 miles of Babb Creek from the 303(d) list. Hedin Environmental has an active research program which has produced the limestone bed, improvements in the design of anoxic limestone drains and vertical flow ponds, and the Nation's most successful resource recovery program. Dr. Hedin maintains a strong emphasis on the scientific basis of mine water remediation and has published over two dozen papers in peer reviewed proceedings and journals.

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Update of DEP's Proposed Cresson Mine Drainage Treatment Plant and Other Active AMD Plants

Pam Milavec, DEP Bureau of Conservation and Restoration

The Department of Environmental Protection (DEP) has entered into an agreement with the Susquehanna River Basin Commission to provide treated abandoned mine drainage (AMD) to the West Branch Susquehanna River. The DEP will provide 15.7 MGD of treated AMD to the West Branch Susquehanna River under low-flow stream conditions in order to mitigate for agricultural consumptive use. The recently completed Lancashire #15 treatment plant, constructed in the headwaters of the West Branch Susquehanna River, will provide 10 MGD. An AMD treatment facility is being proposed in the headwaters of Clearfield Creek, a major tributary of the West Branch Susquehanna River, to provide 5.7 MGD of the needed water during low-flow stream conditions (Q7/10). That facility will be constructed near Cresson Borough and is the primary subject of this presentation.

Construction and operation of this treatment plant in the headwaters of Clearfield Creek is also expected to restore water quality in the main stem of Clearfield Creek to a level that will support a fishery from the headwaters downstream to at least the confluence with Brubaker Run. This facility will also collect and treat the most significant source of mine drainage to Sugar Run, a tributary of the Juniata River. This will allow for biological restoration of Sugar Run, with the completion of other priority projects in the watershed. These goals coincide with the Lower Tier Restoration Goals of DEP's AMD Set Aside Guidelines.

The Cresson project is currently in the pre-design, feasibility analysis phase. This phase will determine how best to direct AMD from 3 different mine pools to the treatment plant and where to locate the plant. It also includes a treatability analysis to determine how best to treat the combined mine pools, as well as an analysis of the environmental impacts of the project. A mine pool management plan will be developed to assure that 5.7 MGD of treated water can be provided under low-flow conditions.

The presentation will also provide updates of other active treatment plants in various phases of development, construction and completion. They include Lancashire #15, the Hollywood treatment plant on Bennett Branch Sinnemahoning Creek, and the Wehrum plant in Blacklick Creek.

Pam Milavec is employed by the PA Department of Environmental Protection, Bureau of Conservation and Restoration. She works in the Cambria District Office, where she is Environmental Services Section Chief. This Section is responsible for watershed planning and project development of AMD treatment and abatement projects under the AMD Set Aside program in the bituminous portion of the state.

Pam has been with DEP for 28 years, working also as a Water Pollution Biologist and a Water Quality Specialist. She has worked in several other programs within DEP, including Water Quality Management, Oil and Gas Management and Abandoned Mine Reclamation. She has a B.S. in Biology from the University of Pittsburgh at Johnstown.

Remediation of High-Strength Mine Impacted Water at the Klondike-1 Discharge using Crab Shell Substrate Mixtures: Laboratory Column and Field Pilot Tests **Dr. Rachel Brennan, Penn State University**

Anaerobic passive treatment systems remediating high-strength mine impacted water (MIW) have not displayed consistent success. For example, the high iron (140 mg/L) and acidity (380 mg/L as CaCO₃) of the Klondike-1 discharge near Ashville, PA, caused premature clogging of a vertical flow pond which was filled with a traditional spent mushroom compost (SMC) and limestone substrate. In this study, continuous-flow columns and pilot-scale field reactors were used to evaluate if treatment of high-strength MIW can be improved using crab shell as a substrate amendment.

For the lab study, columns were wet-packed with substrate mixtures ranging from 0 – 100% crab shell (with the balance SMC), and fed Klondike-1 water to produce a 16 hr hydraulic residence time. After determining the best performing substrate mixtures in the column test, a pilot-scale field study was initiated at the Klondike-1 site in August 2010, in which 1000-gallon tanks were filled with a limestone under-drain and an upper substrate layer of: 1) 100% crab shell; 2) 70% crab shell + 30% SMC; or 3) 90% SMC + 10% limestone. Aqueous samples were collected from the effluent of the columns/tanks as well as after aeration/settling, and analyzed for pH, ORP, ammonia, acidity, alkalinity, DOC, anions, and metals.

In the column study, an optimum ratio of 70% crab shell + 30% SMC sustained complete Fe and Al removal, pH above 6.0, and excess alkalinity generation for twice as long as the traditional SMC and limestone substrate, without clogging. To date, the field study results mirror the laboratory findings, which could impact how high-strength AMD is managed in the future.

Dr. Rachel Brennan is an Associate Professor in Civil and Environmental Engineering at Penn State. Her area of expertise is in the development and application of enhanced bioremediation technologies for the treatment of wastewater, surface water, groundwater, and soil, including those contaminated with endocrine disruptors, chlorinated solvents, hydrocarbons, nitrate, perchlorate, and acid mine drainage (AMD). In 2007, Dr. Brennan was awarded the Faculty Early Career Development (CAREER) Award from the National Science Foundation to expand her research on the simultaneous biological, chemical, and physical treatment of AMD using multifunctional substrates. Her work in AMD treatment resulted in a patent on the technology and a consulting appointment to the U.S. Environmental Protection Agency. In 2011, Dr. Brennan received the McKee Groundwater Protection, Restoration, or Sustainable Use Award from the Water Environment Federation (WEF). She currently serves the local government as a member of the State College Borough Water Authority Advisory Board, the state as a Research Committee member of the Pennsylvania Water Environment Association, and the international community as a Technical Advisor to the Penn State chapter of Engineers Without Borders. In addition, she has been recognized by several awards for teaching excellence, including the 2011 Penn State Engineering Alumni Society Outstanding Teaching Award.

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Educational Outreach and Its Role in Abandoned Mine Drainage Restoration **Rebecca Holler, Trout Unlimited**

Education is often times overlooked by groups and individuals focused on “on-the-ground” AMD restoration. However, the education of current and future generations is key to gaining public support for any project. Trout Unlimited has begun an intensive multi-generation education program to increase public awareness and involvement in AMD restoration projects. In just over four years, this effort has educated more than 4,000 adults and youth from various backgrounds. These programs have included “mini-symposiums” that targeted specific sub-watersheds in the West Branch Susquehanna River basin. Additional education efforts have included classroom education that exposes students to AMD concepts, field trips that allow for hands-on learning, watershed festivals which allow for contact with many people at one time, and teacher education to expand the program. With approximately 448,000 residents within the West Branch watershed, the need for education exceeds these efforts. Learn about the upcoming education programs TU is working on and how you can partner with TU and the WBSRC on new and innovative ways to educate, inform, and motivate citizens locally and statewide to tackle the issue of AMD in our waterways.

Rebecca has been with TU since 2009 and currently serves as the Education Coordinator for the Eastern Abandoned Mine Program. Rebecca works to educate youth and adults about the impact of historic coal mining. Her work is primarily focused in the West Branch of the Susquehanna River watershed where TU is working as a catalyst for restoration of coldwater streams and the ultimate recovery of the West Branch. She has her B.S in biology from Elizabethtown College.

DEP’s Reorganization: Where Do We Go From Here? **Glenn Rider, DEP Bureau of Conservation and Restoration**

The watershed community has been in a buzz since the announcement last fall that Pennsylvania’s Department of Environmental Protection would be undergoing a major reorganization. Now that the reorganization has taken place, many are wondering what implications this will have towards the cleanup of AMD and other pressing water pollution concerns. This presentation will briefly highlight the reorganized structure of DEP’s water programs, as well as, explain how the new Bureau of Conservation and Restoration will be moving forward to meet the overarching goal of “getting dirty streams off the dirty water list”.

Glenn Rider currently serves as the Director of DEP’s Bureau of Conservation and Restoration. He holds a degree in Biology and General Science and is also certified to teach science at the secondary level. He began his environmental career in 1980 as a field inspector for the Pennsylvania DER and has held a variety of positions in water related programs including Water Pollution Biologist, Program Specialist, Chief, Division of Storage Tanks, Chief, Division of Watershed Protection, and Director of Bureau of Watershed Management. Mr. Rider lives in the beautiful Yellow Breeches Watershed in southcentral Pennsylvania.

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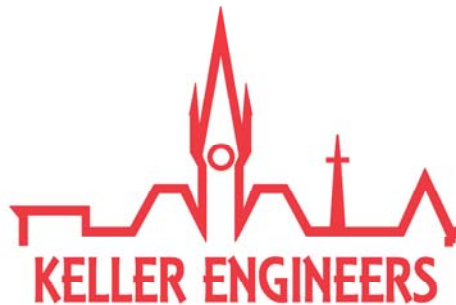
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