2018 NAAMLP ABSTRACTS

Cassandra Forte
Title: **Systematic Review of Mining Effects on Human and Environmental Health**
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Abstract:
Mining scars Earth's topography. In doing so, many species are displaced from their natural habitats. There are requirements and restrictions with respect to where and when certain mining can take place; what happens post-mining differs. Coal mining is federally regulated, and land must be reclaimed, or returned to its approximate original environmental state, post-mining. I conducted a systematic review of literature to better understand which strategies best promote species comeback on federally regulated mine sites. For non-federally regulated mine sites, environmental hazards were examined to determine if all, or at least more than one, type of mining should be required to be reclaimed.
A systematic review was conducted to answer the question: does increasing habitat and fragmentation post-mining encourage displaced species to return to the area? Several reclamation approaches were found to encourage species comeback to the fragmented areas where significant habitat has been lost. One study found that amphibians returned to a post-mining area by means of spontaneous succession reclamation. Other methods, like the forestry reclamation approach, are relatively new methods and do not provide any solid species comeback studies.
Keywords: remediation, reclamation, mining

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SNOW HILL 2

Abstract:
The Snow Hill project was selected for the Mid-Continent Region Award as it addressed public safety concerns and environmental damage caused by two large coarse coal refuse piles, with a total area of 49 acres, on each side of North Coal Creek, Vigo County, Indiana. Acid mine drainage (AMD) and eroding coal refuse from the two refuse piles clogged the channel of North Coal Creek and substantially degraded its water quality. In addition, the steep, eroding coal refuse on either side of North Coal Creek was unstable and posed a danger to visitors. Utilizing techniques currently used by the municipal landfill industry, impermeable liners and subsurface drainage structures were emplaced on the tops of the two refuse piles and covered by three feet of fill in order to attenuate infiltration of rain water through the piles and limit the migration of AMD from the refuse piles to North Coal Creek. A three-stage aerobic wetland and settling pond complex was constructed downstream of the refuse piles to encourage oxidation of dissolved iron and remove suspended iron oxides from the water column. The coal refuse embankments were regraded and stabilized to eliminate the public safety hazard.

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RESTORING WATER QUALITY AND BROOK TROUT POPULATIONS IN THE CASSELMAN RIVER

Abstract:

The Casselman River (Casselman) covers 91 square miles in the Youghiogheny River Sub-Basin of which 20 miles are in Maryland. The Casselman is a high quality stream noted for its native brook trout populations. In 1996 the Casselman was listed on Maryland's 303(d) list for low pH impairment due to acid mine drainage (AMD) from mine lands either abandoned or reclaimed before the Surface Mining Control and Reclamation Act of 1977 and episodic acid rain deposition. Low pH values (less than 6.5) in many tributaries negatively affected the benthic invertebrate and brook trout populations.

The Maryland Abandoned Mine Lands Division (AMLD) received EPA 319 (h) funding of $1.1 million to restore water quality and improve native brook trout and other fish populations. Eighteen limestone sand application and four leach bed treatment sites were constructed on public and private property sites between 2013 and 2017.

These mitigation measures have brought the receiving streams into compliance with Maryland's water quality standard for pH. Biological assessments have shown remarkable benthic invertebrate recovery. Brook trout populations have responded favorably by increasing in total numbers of adult trout, standing crops, and reproductive success. Improvements in the brook trout population will create additional recreational opportunities for anglers to enjoy.

This presentation will describe project goals, data results, photographs of limestone sands dump sites and leach beds, and report on the comparative results of pre-construction and post-construction water quality and biological monitoring. The project has been extremely successful and offers a low cost, low maintenance technology for watershed groups to address acidic impairments and improve brook trout populations.

Daniel Werner
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Abstract:
N. 16th St. Subsidence, Pottsville PA
The Southern Anthracite Coal Field's Top Split Mammoth Vein was mined in the late 1890s and early 1900s near its outcrop in the City of Pottsville, PA. At that location now is the John S. Clarke Elementary Center. A mine subsidence opened in a section of street near the school itself and the neighboring baseball field. Despite the unique geology and expansive abandoned underground mines complicating reclamation, the Wilkes-Barre DEP BAMR coordinated with school, city, and utility personnel while still meeting its own OSMRE requirements to get this feature reclaimed in less than 48 hours, without disruption to bus transportation, the school schedule, or local traffic. The presentation will describe the investigation, coordination among parties, and reclamation of the N. 16th St. Subsidence. The presentation may be beneficial to state, tribal and federal reclamation specialists, regulatory agency personnel, mine reclamation professionals, land management and policy decision makers, consultants, university researchers, environmental interest groups, suppliers and reclamation contractors. The information provided during this presentation can be used for comparison of similar situations as well as to highlight the unique conditions in Pennsylvania's Anthracite region.

David Hallman
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Abstract:

Foamed Sand Backfilling for Subsidence Mitigation at Glenrock, Wyoming

This presentation will describe the efficacy of using foam for placing sand backfill to mitigate mine subsidence as demonstrated in a recent pilot project conducted in Glenrock, Wyoming. The foamed sand backfilling approach consists of mixing foam with sand to create a slurry-like mixture which is then injected into the mine openings, rubble zones, and fractures remotely through boreholes to effect backfilling. The foamed backfill contains no cementitious material and does not 'set'. Thus injection from a single borehole may last for days and encompass large backfill volumes, improving the efficiency. Following injection of the foamed sand material, the foam gradually dissipates and allows the sand to settle from suspension. The sand then consolidates under self-weight as the foam decays and more material is injected. This allows more and more material to be injected into the opening until it is ultimately filled with the backfill material. The foam serves only as the transport medium for placement of the backfill and provides no long term presence. For the pilot study over 4,000 tons of ASTM C-33 concrete sand were injected into mine workings located beneath an area of less than an acre. Subsequent verification drilling revealed that the sand backfill completely filled large openings tight to the roof, exhibiting an average SPT (N1)60 blow count value of 5.9. The SPT samples also showed that the sand backfill material effectively penetrated and filled void spaces within blocks of caved and rubblized overburden material, including openings as narrow as ¼-inch wide. The project serves to demonstrate the effectiveness of using foam to place underground backfill. Economic advantages of the foamed sand backfilling approach include the ability to use a wide range of low-cost backfill materials derived from near- or on-site sources or wastes from other industries, wider borehole spacing and low water consumption.

Elizabeth Meredith
Title: **Isotopic identification of AMD – groundwater interaction**
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Abstract:
Not part of the NASLR technical session.
Historic coal mines in the Great Falls, Montana, area have been discharging highly acidic, metalladen water for more than 50 years. The acid mine drainage (AMD) infiltrates into the alluvial and bedrock aquifers, including the Madison Group limestone, an important aquifer in central Montana. The limestone is faulted, fractured, and karstified; these qualities have greatly increased aquifer storage and transmissivity–but in an anisotropic, highly irregular fashion. The faulted and karstic limestone surface allows quick infiltration and direct pathways for AMD to travel down gradient, potentially impacting domestic wells. Preliminary findings of Gammons and others (2013) illustrated the potential for using sulfur and oxygen isotopes of sulfate to fingerprint the acid mine water entering the local groundwater flow system.
The Montana Bureau of Mines and Geology has expanded the isotopic investigation under an OSMRE funded study. An isotopic-tracing tool is especially important in situations where dilution and limestone buffering increases the pH of the infiltrating AMD water to near neutral and masks other geochemical indicators, such as high metal concentrations. Additionally, investigators are testing the potential to use isotopic fingerprinting to determine the source of acidity in the groundwater of a subdivision outside of the known extent of contamination.
This 2-year investigation, concluding in 2018, expands the scope of isotopic fingerprinting to characterize the baseline endmembers, including a regional sampling of the limestone aquifer and the overlying sandstone aquifers. Investigators found a wider range in the isotopic ratios of sulfur and oxygen of sulfate in natural environments than was previously understood. Additionally, the baseline isotope ratios of the limestone aquifer varied significantly between neighboring drainages. Sulfur and oxygen isotopes are strong indicators of AMD interactions in the groundwater but regional variations must be considered.

Don Newton
Abstract Topics: **Partnerships in Reclamation; Innovative/Unique Reclamation Techniques;** AML Pilot Projects
Abstract Title: **Seeding the Future: Wyoming AML Native Plants Project**
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Abstract:
Wyoming is part of the vast sagebrush steppe ecosystem that at one time extended over 131 million acres. Today only about half of that acreage remains split between 11 western states. There are over 350 sagebrush obligate species that live, feed, and breed within this shrinking ecosystem. The Wyoming AML Native Plants Project (AML NP2) is a creative collaboration between federal and state entities, local government groups, and non-governmental organizations intent on improving wildlife habitat by re-establishing sagebrush and native plant communities at previously reclaimed mine sites through our creative educational planting projects to cooperatively developing innovative seeding technologies.
This presentation will cover the breadth of our projects objectives including our educational planting project where we planted 900 sagebrush seedlings with the help of 45 middle school science students, the partnership we are developing to grow sagebrush seedlings for reclamation and restoration with the Wyoming Department of Corrections at the Wyoming Honor Farm and the Institute of Applied Ecology's Sagebrush in Prisons Project, and the innovative research and design project we are constructing with The Nature Conservancy on seed pillow technology. We hope that our work in seed pillow technology can be adapted for many reclamation projects from AML to oil and gas and beyond. In summation we hope to show you how the Wyoming AML Native Plants Project is an inclusive project that is not solely limited to re-establishing sagebrush and native plant communities but is about thinking beyond regulation into innovation through unique partnerships and educational outreach with the intention of sharing the information and technology with other states and reclamation programs.

Harold Hutson

TITLE**: An Analysis of Cost Factors in Geomorphic Mine Reclamation**

PRESENTER: Harold J. Hutson, PE, PG
COMPANY: BRS, Inc.

Abstract:

BRS, Inc. has completed over 20 large scale geomorphic mine reclamation projects or construction phases for the Wyoming Abandoned Mine Land program starting in 2007. The Wyoming AML has been a leader in geomorphic reclamation, which has yielded projects which are more stable and require less maintenance, provide for increased vegetation diversity and habitat values, and are more aesthetically pleasing than traditional reclamation employed in the past.

The construction cost total for the projects included in this presentation is approximately $50 million, with over 27 million cubic yards of earthwork moved in the reclamation efforts which reclaimed approximately 1,500 acres of abandoned mine sites using geomorphic reclamation techniques. Reclaimed sites included open pits, highwalls, mine waste piles, degraded channels, and subsidence areas on both coal and uranium mine sites.

Cost data has been tabulated and analyzed for each project. Factors including market forces, fuel costs, and site specific conditions have been considered with respect to their impact on competitively bid geomorphic reclamation projects. The data shows that, properly planned and constructed, the earthwork costs for a geomorphic reclamation project are driven by the excavation parameters such as material type, haulage length and gradients, and other work requirements much like any other earthwork project without any significant increases in costs to complete the geomorphic reclamation projects.

Mr. Hutson is BRS' Senior Engineer and Project Manager. He is a registered Professional Engineer and Geologist, and a Qualified Person (QP) under TSX regulations. Mr. Hutson has participated in various roles in mine development, permitting and licensing, and mine reclamation projects for more than 23 years in Wyoming.

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Abstract:

C-ALS® Borehole Deployable Laser Scanner for Inaccessible Voids

During mining and reclamation activities, professionals often encounter subsurface voids created by abandoned mine workings or natural karst features. These voids are not often accessible and the conditions inside them unknown. Abandoned mines are designed to flood and prone to collapse. Not having accurate, real time data on the integrity and conditions of these voids can pose serious risks to the safety of workers and to the environment. Current geotechnical methods to detect these voids include ground penetrating radar, electrical resistivity, sonar and/or laser scanning using drone technology. While all these methods have proven useful in certain applications, they often lack quick, reliable, precision data with surface orientation. The Carlson C-ALS® is a unique underground laser cavity monitoring system capable of mapping previously inaccessible voids, safely and quickly. It is also the only borehole-deployable laser scanner on the market. Where deployable, the C-ALS can resolve limitations of other scanning units by providing real-time data collection at a 1cm resolution and tie the resulting point cloud data to surface orientation. The result is a dense 3D model of the void with minimal risk to the user.

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Abstract:
Risk Characterization for Critical Infrastructure Design Engineering – Advanced Geophysical Imaging of Abandoned Underground Coal Mines and Karst Regions
In regions with extractive mining activities or karsting, critical infrastructure must be engineered to manage ongoing ground deformation (e.g. mine collapse, sinkholes) and stresses induced from subsidence over time. Identifying and characterizing subsidence-prone areas with respect to existing and planned infrastructure is key to informing engineering approaches to safely manage the associated risks. Integrated site characterization using advances in seismic imaging technology provides comprehensive site data that geologists, engineers, and geophysicists use to generate high-resolution 3D site models to constrain subsidence magnitudes and rates. For example, subsurface coal mine collapse conditions vary widely based on the style of mining (longwall, retreat, room and pillar, extent of pillar robbing, type of entryway supports, age of workings, gob conditions, and seam thickness). As historic workings are mostly inaccessible, shallow highresolution 3D seismic can successfully image void locations and extents, upward propagating fractures, and groundwater conditions using non-invasive data acquisition technology from the ground surface. The resulting seismic imaging data inform remediation and up-front engineering design for planned infrastructure to mitigate subsidence risks over the project lifespan (e.g. pipelines, powerplant foundations, bridges). Performing these integrated site characterization surveys in areas with historic mining or karsting up-front in a project lifecycle can result in significant project savings and prevent delays in construction and permitting. A custom, modular, integrated seismic acquisition design combined with multiple processing approaches can adapt to a range of subsurface conditions, often poorly constrained prior to seismic imaging. Initial seismic survey locations are targeted based on existing infrastructure and planned infrastructure alignments, historic mine maps, CAD files of underground workings, borehole data, LiDAR and satellite imagery, and geomorphic features. Current technologies allow for high-resolution geophysical imaging to be integral in geotechnical investigations of subsidence, furthering the understanding of risk to critical infrastructure.

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Abstract:
Avondale Mine Reclamation Project
The Curry Hill – Avondale project is the sixth in a series of contiguous reclamation projects that in total have returned 293 acres of formally mine scarred land back to a natural landscape within the Pinchot State Forest. The recently completed project restored 90 acres that included over 3,350 feet of dangerous highwall which in places were up to 100 feet high. Over 1.1 million cubic yards of material was moved to grade this project. Lands that were once filled with hazardous mine strip pits and embankments only utilized for dumping trash and illegal trespassing now allows wildlife to thrive and be utilized by outdoor enthusiasts.
This project benefitted the environment in many ways. Bat populations in Pennsylvania like many parts of the nation have been impacted by white-nose syndrome. Within this project existed three mine openings that exhibited bat habitat that needed to be preserved. So, three cupola bat structures with pipe were constructed. To mitigate the loss of a waterbody at a different site, a three-acre wetland with various plantings was constructed. Approximately 5.5 acres received tree seed and 80 trees were planted to reestablish trees to the site.
The Bureau of Abandoned Mine Reclamation (BAMR) collaborated with partners like the Pennsylvania Department of Conservation and Natural Resources and the Pennsylvania Hemp Industry Council to plant trees and hemp crop at the site.
Earthmovers Unlimited, Inc. began the project in January 2015 and completed the project in December 2017 for approximately $2.3 million.
The paper and presentation will highlight the reclamation project that transformed this site to one that will be appreciated by generations of hunters, hikers and nature lovers. This and the previously completed nearby projects demonstrate how agencies like the BAMR can work together with partners to return abandoned mine sites back to the local ecosystem.

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Abstract:

The Planning and Design of Horizontal Directional Drilling for Pipeline Installation through Abandoned Mine Lands

The last two decades have seen significant advances in non-conventional petroleum drilling technologies that have culminated in a large shale-gas play through-out western Pennsylvania, Eastern Ohio, and Northern West Virginia. The large gas/natural gas liquids production of the Marcellus and Utica shale formations have created the demand for large scale pipeline construction to transport the natural gas and natural gas liquids to markets beyond this region. One method of pipeline construction which is very prevalent is the use of large-scale Horizontal Direction Drilling (HDD). Unlike conventional trenching for pipeline construction, HHD is the directional steering of large diameter bores to cross beneath waterways, roadways, wetlands, urbanized/populated areas, or other sensitive areas where trench installation of the pipeline is not possible or economical. In many cases, the HDD and ultimately the pipeline are at depths far greater than is typical for pipelines installed using open trench methods. Problems, difficulties, and dangers associated with abandoned coal mines and the drilling of the HDD, and possibly the integrity of the pipeline, can be avoided and mitigated through proper planning and design of pipeline construction. HDD methodology and potential complications near areas that have been mined are presented. Case studies from recent pipeline construction in Pennsylvania are discussed in context of the necessity for proper planning and pipeline design through the bituminous coal fields.

Kelsey Q. Jones, P.E.

Abstract:

Development Phase of the Pine Grove North Waterline Extension Project

Since the late 1980's, in accordance with the Surface Mining Control and Reclamation Act (SMCRA), the Pennsylvania Department of Environmental Protection Bureau of Abandoned Mine Reclamation (PADEP BAMR) has utilized part of its annual AML Grant to fund Priority 1 and 2 waterline extension projects in situations where it has been clearly documented that pre-SMCRA mining activities were the predominate impact upon available supply. The first phase of the Pine Grove North waterline extension project is approximately 13 miles with approximately 6 miles planned for future phases.

Pine Grove North waterline is located in Lawrence Township, Clearfield County, and covers a total of 12 problem areas. Once completed, it will service 148 homes and businesses that have been affected by pre-SMCRA mining. PA DEP BAMR has allocated $4.1 million from the 2016 AML Pilot Funds for this waterline while the remaining $33,171.50 will be paid from Pennsylvania's regular AML grant. The Authorization to Proceed (ATP) of the Pine Grove North waterline covers a large footprint, allowing for further extension of the waterline if future AML Pilot Funds become available.

This presentation will briefly discuss the investigation of the area including the Hydrology Report and mining history. It will cover the development process including the PHMC clearances and Phase I Archaeological Survey needed for the pump station and water storage tank, and the locations where the waterline went "cross-country." It will briefly discuss the design partnership with Clearfield Municipal Authority along with the current construction status. It will also highlight this project as a 2016 AML Pilot Project and the economic and community benefits of the project. The presentation will highlight how Pennsylvania's AML water supply replacement approach is providing potable water to landowners with degraded and diminished water supplies caused by pre-SMCRA mining activities.

1 Oral paper presented at the 2018 National Association of Abandoned Mine Land Programs (NAAMLP) 40th Annual Conference at Kingsmill Resort, 1010 Kingsmill Rd, Williamsburg, VA, September 9-12, 2018.

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Geomorphic Reclamation and Landscape Heterogeneity: Results of Vegetation Analysis and Implications for Wildlife

Kurt Fleisher1
Kristina M. Hufford2

Abstract:
Severe land disturbances caused by surface mining damage the environment by causing pollution, by destroying habitats, by diminishing land aesthetics, and by creating hazards, which threaten public and private property. In Wyoming, anthropogenic disturbances caused by infrastructure development for resource extraction contribute to habitat loss for wildlife species such as greater sage-grouse (Centrocercus urophasianus) and pronghorn (Antilocapra americana). Changes in the plant community have the potential to alter an ecosystem via changes in structure and function, with a corresponding loss of habitat quality. Reclamation serves to mitigate the effects of mining by reconstructing the landscape to its former status. The traditional reclamation method results in terrestrial rebuild that is characterized by uniformity in slope in which topsoil is spread across the manufactured landscape. In contrast, geomorphic reclamation intends to mimic heterogeneous landforms that are not susceptible to severe erosional processes. The geomorphic design incorporates drainages, slopes, and aspects that naturally blend into the surrounding environment. Two surface mines in western Wyoming present an opportunity to compare reclamation methods and study the environmental outcomes of the geomorphic technique. We assessed differences in plant community recovery across reclamation types and undisturbed rangeland, with particular interest in the consequences for wildlife habitat and vegetation density, composition, and diversity. Data include nadir image analyses that allow for landscape-level assessment of vegetation functional groups between traditional and geomorphic sites; BLM Assessment Inventory and Monitoring (AIM) vegetation transects that describe plant community characteristics, such as canopy cover, vegetation height, and species data at a finer scale. Initial results indicate that both shrub height and Shannon diversity differ significantly between geomorphic and traditional reclamation. We will discuss results and describe similarities and differences between geomorphic and traditional reclamation methods for resulting plant community diversity and habitat quality indices.

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Maria T. Kasecky, P.E.

Abstract:

Implementation of the 2016 AML Pilot Program in Pennsylvania: Successes, Challenges and Lessons Learned

The Abandoned Mine Land (AML) Pilot Program, authorized by Congress under the Consolidated Appropriations Act (signed by President Obama on December 18, 2015), provided $30 million of US Treasury Funds to Pennsylvania's (PA) AML Program for federal fiscal year FY2016. Language contained in the authorizing bill specifies that the funding be used "for the reclamation of abandoned mine lands in conjunction with economic and community development and reuse goals. State AML programs, in consultation with economic and community development authorities, shall develop a list of eligible AML projects in Appalachian counties that have a nexus to economic and community development, and select qualifying AML projects that have the potential to create long-term economic benefits."

The purpose of the AML Pilot Program is to both explore ways to return legacy abandoned coal sites to productive reuse and to inform Congress of the programmatic impacts of changes to the underlying federal law (the Surface Mining Control and Reclamation Act (SMCRA)) such as those included in the proposed RECLAIM Act which would create community development projects associated with the reclamation of AML sites.

Since this is a pilot program, PA selected 14 AML sites encompassing a wide variety of project types with a variety of possible economic or community development benefits and partners. PA is allocating all of the AML Pilot Program funds for the construction of SMCRA Title IV eligible AML and AMD problems. The project partners will then work to fund and complete non-AML economic development aspects of the projects. PA's 2016 AML Pilot Grant was approved on June 1, 2016 and has a three-year period of performance. This presentation will discuss the planned reclamation and anticipated benefits for each of the 14 AML Pilot Projects as well as the current status of each including project implementation successes, challenges, and lessons learned.

Additional Key Words: Abandoned Mine Lands (AML), Economic Development

1 Oral paper presented at the 2018 National Association of Abandoned Mine Land Programs (NAAMLP) 40th Annual Conference at Kingsmill Resort, 1010 Kingsmill Rd, Williamsburg, VA, September 9-12, 2018.

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M. J. Hughes, P.E.

Abstract:

Advantages of Having an In-House Construction Crew in an AML Program

Pennsylvania has rich heritage of over two and half centuries of coal mining that has resulted in many legacy abandoned mine land (AML) hazards and environmental problems. The Commonwealth of Pennsylvania's AML program has staffed and equipped two state in-house construction crews. One in the Bituminous region (BD crew) and one in the Anthracite region (AD crew). The state has operated these crews for many years. This presentation will highlight several case studies in the bituminous region where a state operated crew was able to respond quickly and efficiently to mitigate abandoned mine hazards. This presentation will further highlight the advantages of having such crews.

The Bausman Street project was a mine subsidence project that threatened a two-family structure in the City of Pittsburgh. This project eliminated a significant health and safety hazard that had developed under a duplex along Bausman Street. A subsidence hole was discovered after a report of Carbon Dioxide Gas. The residents of both structures were evacuated by the city health department. The area was known to be undermined. The hole was not only under the floor but also under a common wall in the basement of the structure. The in-house crew ventilated the structure and placed approximately 100 yards of flowable fill material into the subsidence hole. From the time the residents were evacuated and the department was notified, until the residents were allowed back into their homes, less than one week had elapsed. It is noteworthy to also say that this was over Memorial Day Weekend.

In addition to the Bausman Street project. two other projects will be highlighted exemplifying the advantages of quick response and adaptability along with cost savings associated with the use of the crews.

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Abstract:
State of the Kiski-Conemaugh River Watershed: 18 years later
In 1999, the Kiski-Conemaugh River Basin Conservation Plan was published, making it one of the first rivers conservation plans in the Commonwealth of Pennsylvania. It was a heavily utilized document, with, ultimately, 88% of its 120 recommendations implemented to some degree.
In 2017, the Kiski-Conemaugh Stream Team, a program of the Conemaugh Valley Conservancy, published an update to that plan that quantified changes in the 1,888 square-mile watershed since 1999, provided a status report of the 120 recommendations, made new recommendations, and engaged the public. Visually and anecdotally, people knew these rivers were improving, but no one had quantified and publicized these changes since the original Conservation Plan was issued. The State of the Kiski-Conemaugh River Watershed showed that rivers that were previously net acidic were now net alkaline and supporting a completely different fish community. Instead of fish species tolerant of pollution dominating the collections, surveys were now dominated by fish more sensitive to pollution, and fish diversity increased. This recovery is a result of laws and regulations, a decline in industry, and the increase of public-private partnerships that local watershed associations and county conservation districts, as well as state agencies, utilize to implement Abandoned Mine Drainage abatement and Abandoned Mine Lands restoration projects.
Despite all these improvements, the watershed remains at a tipping point in that if existing AMD systems are not maintained, we could lose the gains we've collectively made. Unfortunately, watershed groups struggle with securing funds to maintain systems and recruiting new, younger volunteers to carry on their work. Still, the passion and persistence of professionals and volunteers alike, as well as some larger, active AMD treatment systems planned by the state, continue hope that these rivers will only continue to improve, adding to the eco-tourism potential of Western Pennsylvania.

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Abstract:
Title: Statistical Evaluation of Bituminous Remining Projects in West-Central Pennsylvania
This study focuses on bituminous remining operations within three major coal producing counties in the southwest-central portion of Pennsylvania. Datasets were selected based on the presence of pre-existing pollutional discharges associated from historical mining operations, adequate dataset content, and mathematical recalculation of all contaminant mass loading rate data to illustrate a 95% confidence interval about the median for individual monitoring parameters. Focus was then placed on statistical comparison of baseline and post-remining pollutional loading ranges for iron, manganese, aluminum, acidity, sulfate, and flow for 101 discharges within 25 sites evenly distributed over the study area. Project results include statistically significant improvement in 23% of all observed discharge datasets, with 33% of the data experiencing no significant change in pollutional loading values. Further, 27% of the discharges were segregated from statistical comparison due to all flow being eliminated by the remining process, and 17% of the discharges evaluated experienced a statistically significant increase in loading after remining occurred, illustrating an 83% non-degrading result in pollutional loading. Another product of this investigation includes comparison to previously published trends for remining in Pennsylvania, resulting in an overall geographically and analytically expanded study that can be used by other regulatory, academic, and industrial mining entities. Peripheral review topics included mapping sorted discharge locations, reporting statistics for individual coal seam datasets, and reclamation methodologies known as Best Management Practices (BMPs) employed.

Michael C. Korb, P.E.

Abstract:

Support your Local Mine Tour

Many of our friends and neighbors are unaware of the essential part mining has played in the country's growth and economy. If they have any opinion of mining at all, it likely is a negative view of its environmental, social, and human legacies. Community views are those of relics of the 1918s rather than of the realities of the 2018s.

People's perceptions of mining are often based on media messages. News outlets and social media ordinarily report about accidents or subsidences or water pollution. It is no wonder that there are negative perceptions about mining.

A 1994 Roper survey of public perceptions of basic industries ranked mining last, just below tobacco. And an April 2017 poll done for the National Mining Association showed less than 10 percent of voters had any idea of the scale of power plant emissions reductions, mine reclamation or other yardsticks of mining's progress.

There are some 70 mine tours in at least 23 states, and many more mining museums. It is a comfortable weekend trip to a tourist mine for about 85% of the population of the US. There is a mine tour an hour away from San Francisco, and one an hour and 10 minutes from Manhattan. If you visit one of these you often get the 1918s' version rather than the 2018s'. Few tour guides have any knowledge of today's mining realities.

This presentation will look at and discuss some of the tourist mines and museums, and ways that the mining associations' and industry's support of these sites might make a difference in the public's perception of mining.

Patrick M. Webb, P.E.

Abstract:

Planning and Implementation of the 2017 AML Pilot Program in Pennsylvania

The Consolidated Appropriations Act of 2017, (Public Law 115-31), authorized the federal Office of Surface Mining Reclamation and Enforcement (OSMRE) to provide funding for Fiscal Year (FY) 2017 for the Abandoned Mine Land (AML) Reclamation Economic Development Pilot Program (AML Pilot Program). For FY2017, the AML Pilot Program is providing grants to the six Appalachian states with the highest amount of unfunded high-Priority coal AML problems based on OSMRE's AML inventory data as of September 30, 2016. Kentucky, Pennsylvania (PA), and West Virginia are each receiving $25 million, while Alabama, Ohio, and Virginia are each receiving $10 million. The purpose of the funding is to accelerate the remediation of AML sites with economic and community development end uses. The intent of the AML Pilot Program is to explore and implement strategies to return legacy coal sites to productive uses. This is the second year that AML Pilot Program funding has been authorized by Congress. PA received $30 million in AML Pilot Program funding in FY 2016.

As a requirement of the AML Pilot Program, state AML programs, in consultation with state and local economic and community development authorities, are required to develop a list of eligible projects in Appalachian counties that demonstrate a nexus with AML cleanup and economic and community development. From over two dozen AML Pilot project proposals received and evaluated, PA is targeting 12 AML sites encompassing a wide variety of project types with a variety of possible economic or community development benefits and partners. PA is again allocating all the AML Pilot Program funds for the construction of SMCRA Title IV eligible AML and AMD problems. The project partners will then work to fund and complete non-AML economic development aspects of the projects. PA's 2017 AML Pilot Grant was approved on November 1, 2017 and has a three-year period of performance.

This presentation will discuss the planned reclamation and anticipated benefits for each of the 12 AML Pilot Projects as well as the status of each including any issues which could impact their successful implementation.

Additional Key Words: Abandoned Mine Lands (AML), Economic Development

1 Oral paper presented at the 2018 National Association of Abandoned Mine Land Programs (NAAMLP) 40th Annual Conference at Kingsmill Resort, 1010 Kingsmill Rd, Williamsburg, VA, September 9-12, 2018.

2 Patrick M. Webb, P.E. is a Mining Engineer Manager with BAMR - pawebb@pa.gov PA DEP-BAMR, Cambria District Office, 286 Industrial Park Road, Ebensburg, PA 15931, 814-472-1800

Mohamed Gamel

Abstract:

Challenges to Mine Backfilling using New Grouting Techniques in Previously Mitigated Areas

Mohamed Gamal[(1)], Melissa Bautz[(2),)] and Dave Hibbard[(3)]

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This presentation covers the challenges faced during the recent backfilling of mine voids in areas where previous subsidence mitigation efforts were conducted in late 1980's and early 1990's. These historical backfilling methods included sand slurry and low mobility cementitious grout backfilling techniques within the same area. Despite the significant reduction of mine related subsidence risk after the historic mitigation work, subsidence propagation and sinkhole development continued within these areas. . This prompted WY AML to use more advanced grouting techniques and grout mixes to further reduce mine related subsidence risk associated with sinkhole development and formation. The previous backfilling work, in addition to flooded mine conditions, created challenges that required special consideration in construction methods and the grout mix design selection, which are discussed in this presentation. These challenges included drilling difficulties, early refusal, annulus grout surfacing, a non-treated, highly structurally disturbed overburden, and ground movement.

Areas that were mitigated using the new techniques one year or more ago have yet to show any sign of new sinkhole development or formation. This approach will need future subsidence monitoring over time to judge the long-term success of this new backfilling approach.

Topic: Mine Reclamation/NASLR

Natalie Kruse

Abstract:

Statistical Modeling of Mine Pool Formation in Underground Coal Mines of Ohio

Lindsey Shafer, Frederick Twumasi, Rebecca Steinberg, Zachary Matthews, Nora Sullivan, Robert Delach, Jen Bowman, Natalie Kruse*, Dina Lopez

*Associate Professor of Environmental Studies, Ohio University, Building 22, The Ridges, Athens, Ohio 45701, 740-593-9526, krusen@ohio.edu

Estimation of post-mining water level is a key task when proposing a new coal mine. There is no clear data-driven methodology to conduct this prediction. Data from post-SMCRA mines in Ohio were evaluated to determine an empirical relationship between mining, hydrologic, and geologic parameters and the post-mining water level. Two methodologies were undertaken to determine this relationship: multivariate statistical analysis and artificial neural networking. Multivariate statistical analysis used principal component analysis (PCA), multiple linear regression (MLR), principal component regression (PCR), and partial least squares regression (PLS) using The Unscrambler X software. Artificial neural networking analysis was performed using NeuroShell 2. PLS produced the regression with the lowest error, about 4%. Key variables relating pre- to post-mining water level were surface and coal elevation, overburden thickness, thickness of coal, thickness of clay and shale in overburden, thickness of sandstone in overburden, thickness of limestone in overburden, accumulated volume of coal mined, area of underground mines within a 4-mile buffer, and average annual precipitation. The root mean square error was approximately 21 feet, however, this is not low enough to be an improved estimation method. Artificial neural network modeling was then used to create a regression with lower error. The best fit polynomial was a second degree polynomial based upon surface elevation, elevation of coal, thickness of coal, thickness of clay and shale in the overburden, thickness of sandstone in the overburden, thickness of limestone in the overburden, accumulated volume of coal mined, area of underground mines within a 4-mile buffer, and average annual precipitation. The artificial neural networking model reduced error to approximately 1% of the depth to coal, approximately 6 feet for many Ohio coal mines. Additional data is being incorporated into the artificial neural networking model to further refine the algorithm and is being programmed into an ArcGIS tool.

Natalie Kruse

Abstract:

Mapping the risk of acid mine drainage impairment in the coal-bearing region of Ohio

Rebecca Steinberg, Natalie Kruse*, Nora Sullivan, Jen Bowman, Dina Lopez

*Associate Professor of Environmental Studies, Ohio University, Building 22, The Ridges, Athens, Ohio 45701, 740-593-9526, krusen@ohio.edu

As funding for abandoned mine land reclamation, treatment, and management declines, it is important to identify areas that are at risk of future impairment due to acid mine drainage. Ohio University has an online geodatabase that includes nearly 30,000 water quality measurements in the coal-bearing region of Ohio that can be combined with other publicly available data to test a methodology for evaluating the risk of acid mine drainage. Data sources for the analysis include: water quality data gathered from Ohio University's www.watersheddata.com, abandoned underground mines, abandoned surface mine, post-SMCRA mines, surface and bedrock geology maps, the national hydrography dataset, mine features including known subsidences, shafts, and mine openings, and a digital elevation model. The coal-bearing region of Ohio was sub-divided into 10-digit hydrologic units (10-digit HUC) for analysis and data sources have been applied to these land areas. For example, the number of acres of abandoned underground mines in the 10-digit HUC is an input to the statistical analysis. The Unscrambler X software was then used to conduct multivariate analysis to relate mining, hydrologic, geologic, and geographic variables to the known water quality in the 10-digit HUC based on data in www.watersheddata.com. Analyses using multiple linear regression, principal component analysis, principal component regression, and partial least squares regression will be analyzed for the best predictive power. The resulting statistical relationship will be applied to the area to create a map of the risk of impairment by acid mine drainage by 10-digit HUC. This methodology is transferrable to other regions and could be applied to risk management plans for future mine land management.

Natalie Kruse

Abstract:

Development of a tool to estimate post-mining water level in Ohio

Rebecca Steinberg, Nora Sullivan, Lindsey Shafer, Zachary Matthews, Frederick Twumasi, Robert Delach, Jen Bowman, Natalie Kruse*, Dina Lopez

*Associate Professor of Environmental Studies, Ohio University, Building 22, The Ridges, Athens, Ohio 45701, 740-593-9526, krusen@ohio.edu

There is a need to estimate post-mining water level during mine permitting. An algorithm relating pre-mining to post-mining water level has been developed based upon data from wells and boreholes used in underground coal mine permits in Ohio. Using the Model Builder function in ArcGIS Pro, we built a tool that uses the algorithm to calculate the post-mining water level at well locations that appear in a permit application. The input layers to the model include a digital elevation model, a raster layer of coal elevation, a raster layer of coal thickness, a point layer with well locations including details of the overburden encountered in that well and static water level measurements, and a layer of both abandoned and post-SMCRA underground coal mines. The input data is visualized over the permit area and the input layers are used to calculate variables that are used in the algorithm. Variables used in the algorithm to estimate post-mining water level include: surface elevation, elevation of coal, thickness of coal, thickness of clay and shale in the overburden, thickness of sandstone in the overburden, thickness of limestone in the overburden, accumulated volume of coal mined, area of underground mines within a 4-mile buffer, and average annual precipitation. The algorithm calculates estimated post-mining water level by setting accumulated volume of coal mined to the maximum planned in the permit and setting the elevation of the bottom of each well location to the elevation of coal. The point results are interpolated into a raster layer representing water level. This raster layer of estimated post-mining water level is then compared with the digital elevation model and areas with a risk of surface discharge are identified and visualized. The same methodology could be undertaken for other states to relate hydrologic, geologic, and mining parameters to post-mining water level.

Rich Palladino
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Abstract:

Using Foam as a Transportation Medium For Backfilling Underground Voids

Underground voids are the result of historic mining, active mining, and some are naturally occurring. In the case of abandoned underground mine voids, surface subsidence can occur as the old mine workings collapse, resulting in potential property damage and dangerous surface openings. Usually, these voids and mine workings are inaccessible and backfilling work must be conducted remotely, through boreholes drilled from the surface, that provide a conduit for the backfill material.

Traditional remote backfilling methodologies include hydraulic backfilling, which requires large volumes of water to transport the material, and grouting, which incorporates portland cement and/or fly ash with sand, resulting in a strong, but costly void filler.

ARX-Transport™ technology was developed as a cost-effective alternative to traditional backfilling methods, by replacing the water, cement and fly ash, with pre-generated foam to transport the sand or other backfill material into open voids. The foam dissipates in 24 to 48 hours, leaving only the backfill material, which self-compacts. The foam can be engineered for greater or lesser persistence, depending on the dissipation requirements.

For attendees, learning objectives and topics to be discussed include:

1. Description of the technology and concept
2. Subsidence mitigation for AML applications
3. Gravity placement application without pumping
4. Placement application using pumping equipment
5. Underwater placement applications (inundated voids)
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8. General and relative comparison of costs with other backfilling methods

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2 Patrick M. Webb, P.E. is a Mining Engineer Manager with BAMR - pawebb@pa.gov PA DEP-BAMR, Cambria District Office, 286 Industrial Park Road, Ebensburg, PA 15931, 814-472-1800

Michael A. Stayrook, E.I.T.

Review of Reforestation Efforts of the Bituminous District for Abandoned Mine Reclamation of PA

Abstract:

Since the early 1980's, in accordance with the Surface Mining Control and Reclamation Act (SMCRA), the Pennsylvania Department of Environmental Protection Bureau of Abandoned Mine Reclamation (PADEP BAMR) has utilized its annual AML Grant to reclaim AML health and safety features throughout the Commonwealth of Pennsylvania. Along with this, Pennsylvania has implemented the Appalachian Regional Reforestation Initiative (ARRI)/Forestry Reclamation Approach (FRA) on many of its projects in order to restore forests on coal mined lands throughout the state. PADEP BAMR is on the forefront of ARRI/FRA implementation for AML programs. ARRI/FRA is being implemented in many rural AML projects throughout the bituminous coal fields of Pennyslvania. As of today, there have been approximately 35 projects completed implementing the ARRI/FRA technique and many more planned. There have been a variety of different construction techniques attempted to futher understand how ARRI/FRA can continue to develop in Pennsylvania. The goal of ARRI/FRA in Pennsylvania is to plant more high-value hardwood trees, increase survival/growth rates and expedite the establishment of forest habitat through natural succession.

This presentation will briefly discuss various abandoned mine reclamation projects where FRA/ARRI has been incorporated in the bituminous coal fields of Pennsylvania. It will highlight the successes, challenges and lessons learned for various techniques used on Pennsylvania AML projects. Also, the future of ARRI/FRA implementation for Pennsylvania will be discussed briefly.

1Oral paper presented at the 2018 National Association of Abandoned Mine Land Programs (NAAMLP) 40th Annual Conference at Kingsmill Resort, 1010 Kingsmill Rd, Williamsburg, VA, September 9-12, 2018.

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Kelsey Q. Jones, P.E.

Abstract

Development Phase of the Pine Grove North Waterline Extension Project

Since the late 1980's, in accordance with the Surface Mining Control and Reclamation Act (SMCRA), the Pennsylvania Department of Environmental Protection Bureau of Abandoned Mine Reclamation (PADEP BAMR) has utilized part of its annual AML Grant to fund Priority 1 and 2 waterline extension projects in situations where it has been clearly documented that pre-SMCRA mining activities were the predominate impact upon available supply. The first phase of the Pine Grove North waterline extension project is approximately 13 miles with approximately 6 miles planned for future phases.

Pine Grove North waterline is located in Lawrence Township, Clearfield County, and covers a total of 12 problem areas. Once completed, it will service 148 homes and businesses that have been affected by pre-SMCRA mining. PA DEP BAMR has allocated $4.1 million from the 2016 AML Pilot Funds for this waterline while the remaining $33,171.50 will be paid from Pennsylvania's regular AML grant. The Authorization to Proceed (ATP) of the Pine Grove North waterline covers a large footprint, allowing for further extension of the waterline if future AML Pilot Funds become available.

This presentation will briefly discuss the investigation of the area including the Hydrology Report and mining history. It will cover the development process including the PHMC clearances and Phase I Archaeological Survey needed for the pump station and water storage tank, and the locations where the waterline went "cross-country." It will briefly discuss the design partnership with Clearfield Municipal Authority along with the current construction status. It will also highlight this project as a 2016 AML Pilot Project and the economic and community benefits of the project. The presentation will highlight how Pennsylvania's AML water supply replacement approach is providing potable water to landowners with degraded and diminished water supplies caused by pre-SMCRA mining activities.

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Rich Palladino
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Abstract:

Using Foam as a Transportation Medium For Backfilling Underground Voids

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The Planning and Design of Horizontal Directional Drilling for Pipeline Installation through Abandoned Mine Lands

Abstract:
The last two decades have seen significant advances in non-conventional petroleum drilling technologies that have culminated in a large shale-gas play through-out western Pennsylvania, Eastern Ohio, and Northern West Virginia. The large gas/natural gas liquids production of the Marcellus and Utica shale formations have created the demand for large scale pipeline construction to transport the natural gas and natural gas liquids to markets beyond this region. One method of pipeline construction which is very prevalent is the use of large-scale Horizontal Direction Drilling (HDD). Unlike conventional trenching for pipeline construction, HHD is the directional steering of large diameter bores to cross beneath waterways, roadways, wetlands, urbanized/populated areas, or other sensitive areas where trench installation of the pipeline is not possible or economical. In many cases, the HDD and ultimately the pipeline are at depths far greater than is typical for pipelines installed using open trench methods. Problems, difficulties, and dangers associated with abandoned coal mines and the drilling of the HDD, and possibly the integrity of the pipeline, can be avoided and mitigated through proper planning and design of pipeline construction. HDD methodology and potential complications near areas that have been mined are presented. Case studies from recent pipeline construction in Pennsylvania are discussed in context of the necessity for proper planning and pipeline design through the bituminous coal fields.

Ryan Schipper
Ryan Schipper, Golder Associates Inc. Denver, Colorado, USA
Neal Gallagher, Golder Associates Inc. Denver, Colorado, USA
Gary Leach, California Department of Parks and Recreation, USA
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Abstrac:t

Performance Review of a Passive Treatment System for Fe, As, Mn at the Empire Mine State Historic Park

Empire Mine, located in Grass Valley, California, was one of the richest hard rock mines in California. Over its 106 year life, the mine produced nearly 5.6 million ounces of gold before it closed in 1956. The mine property is operated by the California Department of Parks and Recreation as Empire Mine State Historic Park and contains 367 miles of now flooded underground workings. While the mine was active, the Magenta Drain Tunnel (portal) was used to dewater the underground workings. Following closure, mining influenced water (MIW) discharged from the portal. Flows from the portal vary seasonally and contain arsenic, iron, and manganese in excess of Federal and State standards. NPDES permit limits for arsenic, iron, and manganese from the portal flow are 10, 300, and 50 µg/L respectively.

A full-scale passive treatment system (PTS), which has been in operation since November 2011, was designed and constructed to treat MIW from the portal to meet permit limits. The PTS consists of a 4,930 m3 settling pond, followed by a 0.4 hectare aerobic wetland, and a 0.5 hectare horizontal-flow manganese removal bed (MRB). PTS flowrate varies seasonally and has averaged 160 gpm with a peak near 1000 gpm. Metal removal results in the system have improved over time, corresponding with maturation of the PTS. Since February 2013, the PTS has provided effective removal of permitted metals to trace levels. During this time arsenic, iron, and manganese in PTS influent averaged 75 µg/L, 5,492 µg/L, and 2,385 µg/L, respectively. PTS effluent averaged 3 µg/L, 34 µg/L, and 11 µg/L, respectively. In addition to metals removal, the PTS has also increased pH, increased dissolved oxygen, and reduced turbidity. A review of PTS performance is presented.

Author Info

Ryan Schipper is a Senior Engineer with Golder Associates Mine Water Treatment Group based out of Lakewood, Colorado. He has a Bachelor's degree in Civil and Environmental Engineering from Rose Hulman Institute of Technology, and a Master's degree in Environmental Engineering from Colorado School of Mines. Ryan is a registered Professional Engineer in the State of Colorado and Indiana. He is responsible for performing feasibility level evaluation, treatability testing, detail design, construction support, and commissioning of passive and active water treatment systems in North America and overseas.

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Sandra K. Holoman, P.E.

Wheatley Engine Shaft Subsidence Emergency AML Reclamation Project

Schuylkill Township, Chester County, Pennsylvania
Sandra K. Holoman, P.E.
Mining Engineer
Pennsylvania Department of Environmental Protection
Bureau of Abandoned Mine Reclamation, Wilkes-Barre District Office
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Presentation Abstract

The Emergency AML Reclamation Project known as Wheatley Engine Shaft Subsidence involved the remediation of an abandoned silver-lead mine shaft subsidence located adjacent to and beneath the attached garage of a private residence in Schuylkill Township, Chester County, Pennsylvania. The 15' by 15' by 85' deep subsidence left a significant portion of the garage footer exposed and undercut most of the garage floor. The Grip-Tite Push Pier Foundation Support System was installed prior to backfilling the shaft to prevent movement and further damage to the structure during the backfilling work. The installation of the Grip-Tite Push Pier Foundation Support System is specialized work requiring a trained, certified contractor to install the hydraulically driven steel push piers to competent load bearing strata. The remediation work consisted of mobilizing equipment to the site, installing 6 steel push piers to support the garage foundation, backfilling the shaft subsidence with 518 tons of rock and 81 cubic yards of flowable fill, drilling coreholes in the garage floor, placing 36 cubic yards of flowable fill through the coreholes, replacing the concrete driveway apron, repaving the shared driveway damaged by the work, seeding affected areas, demobilizing equipment, and cleanup of the area upon completion of the project.

Construction began on September 15, 2016 and was completed on November 8, 2016. The work was performed by T. Brennan Heavy Equipment, LLC of Carbondale, PA, at a final cost of $105,791.34. The contract was funded from the Pennsylvania Non-Coal Fund, a special state fund.

This project not only effectively eliminated a significant health and safety hazard, but also, through the innovative use of current technology (push pier foundation support system), provided subsidence remediation professionals with a lower cost and easier to install method of supporting structures on future projects where the stability of a structure is a concern.

Autumn Coleman and Scott Graham

Montana AML Establishing Partnerships Model

Presenters: Autumn Coleman, Montana AML Program Manager and Scott Graham, Montana AML Project Manager
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Mine Reclamation/NASLR Technical Session

Montana is a vast state with wildly varied recreational and natural resources. From the mountainous west to the eastern expanse, Montana's resources draw people from across the world. Preservation of our landscape requires collaboration to identify, reclaim, restore, and sustain land and water impacted by historic mining. Montana's Abandoned Mine Lands Program and its partners are the tip of the spear for restoration of our natural landscape. From hard rock mines in the west to the historic coal mines in the east, we have developed partnerships with federal and state agencies and local governments, watershed coalitions, conservation districts, community groups, and non-governmental organizations to reclaim mine-impacted landscapes. Abundant engagement, project value, excellent long-range vision, and focus identify and extend limited available funds.

Excellent examples include the Davis and Jeffries No. 18 Mine sites in Roundup, MT. These abandoned mine sites are located on the banks of the Musselshell River and their legacy impact both flood control and riparian and aquatic habitat in the river corridor. With community support from Musselshell County, the City of Roundup, and the Musselshell Watershed Coalition, we have been able to leverage funds from Montana Abandoned Mine Lands, USEPA Brownfields, FEMA, Montana Fish, Wildlife and Parks, and the Montana Department of Natural Resource Conservation to provide flood mitigation and improve habitat in the reach of the Musselshell River near Roundup, MT to attain the overall goal of restoring the site. We will examine the evolution of this partnership and how the vision of community groups and local government has created project with the goal of restoring the river in this area a goal that will mitigate flooding, improve a critical resource, and provide public access to the river. The presentation will focus on the new model: finding your partners (traditional or non-traditional); defining the mission/objectives; and combining funding for successful projects.

Steve Kravits

Title - Landslide Mitigation Through Directional Directionally Drilled AMD Boreholes

Presented by: Steve Kravits
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Abstract:

This Presentation is part of the Mine Reclamation / NASLR Session

Abandoned coal and hard rock mines can contain pools of water that can unpredictably and uncontrollably drain from the abandoned mines to the surface causing health, safety and environmental problems. Strategic placement of directionally drilled boreholes targeting low elevation points of these pools of water have proven effective in immediate and long-term, controlled diversion and drainage of these pools of water mitigating landslides and leakage to the surface.

The purpose of this presentation is twofold, namely, to present the results of directionally drilling gravity water drainage boreholes targeting abandoned old works of the Harmon Mining Company, Harmon Mine closed in the 1940's as contracted by VA DMME / AML contracts at Charlie Hollow and Harmon Memorial Baptist Church including wellhead design and procedures, directional surface and downhole permissible navigation equipment and directional techniques employed; and briefly describe the use of more complex directional applications for horizontal and vertical-to-horizontal directional drilling techniques used in conjunction with each other to accomplish gravity drainage systems in abandoned mine pools that are present in various coal seam elevations even where rapidly changing surface topography is present.

The directionally drilled boreholes at Charlie Hollow and Harmon Baptist Church locations were successful in intercepting the desired low elevation points of the water pools draining up to 1,000 gpm initially with continued water production over one year after drilling completion resulting in significant decreases in vertical monitoring well water pool elevations and observed surface leakage which culminated in adequate mine seal construction and mitigation of future landslides.

Richard L. Beam and, Tom Malesky

OVERVIEW OF ACTIVE MINE DRAINAGE TREATMENT FACILITIES CURRENTLY OPERATED BY THE PA DEP BUREAU OF ABANDONED MINE RECLAMATION

Abstract:

Richard L. Beam, P.G. , Tom Malesky, P.E.

Perpetual treatment of coal mine drainage (CMD), is a challenging task. The Pennsylvania Department of Environmental Protection (PA DEP), Bureau of Abandoned Mine Reclamation (BAMR) owns, operates, and/or maintains numerous active and passive CMD treatment facilities. This presentation will highlight the eight (8) active CMD treatment facilities that BAMR currently operates.

Coal mine drainage has plagued the waters of the Commonwealth of PA for as long as coal mining has been around. Pennsylvania has over 5,500 miles of streams that are impaired to one degree or another due to CMD from legacy coal mining operations. Pennsylvania began to quantify and attempt to deal with this enormous environmental issue in 1968 with the passage of a state law, The Land and Water Conservation Act (a.k.a. "Operation Scarlift") which authorized a $500 million bond issue to assess and deal with legacy abandoned coal mine problems including CMD. Several active CMD treatment facilities were built under Operation Scarlift of which a few are still in operation today. More recently, using funding from both the PA Capital Budget and the AMD Set-Aside funding, derived from PA's annual AML Grants, BAMR has constructed several new and modern large-scale CMD treatment plants. BAMR has and continues to operate active treatment facilities in both the bituminous and anthracite coal fields.

The decision on how and when to construct and operate active treatment facilities is never easy. Not only do these facilities require significant capital costs, but annual operation and maintenance costs must also be taken into consideration when deciding on such long-term endeavors.

A review of BAMR's eight (8) active CMD treatment facilities will highlight BAMR's on-going efforts to heal the effects of past coal mining and also to give restored streams back to the citizens of the Commonwealth of PA.

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Tom Clark

Susquehanna River Basin Mine Drainage Data Portal: Additions and Improvements for 2018

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Abstract:
In 2017, the Susquehanna River Basin Commission (SRBC) partnered with the United States Army Corp of Engineers on an internally funded project to upgrade SRBC's online and publically accessible Mine Drainage Data Portal. Improvements include additional coverages (i.e. high quality/exceptional value streams, wild trout, Class A, coal permit information, public lands), scrolling coordinate system, a tool to locate your position in the field, and layouts that fit and function on smart phones and tablets. The Mine Portal currently has water quality results for 1,327 AMD discharge and 2,404 stream stations throughout the Susquehanna River Basin, accumulated and station-organized from various Federal agencies, Commonwealth departments, and non-profit organizations. Having data from various sources, station-organized is very powerful due to the ability to analyze water quality trends throughout the decades at numerous stream and discharge sites throughout the Basin. Consequently, the ability to quickly graph and complete trend analysis of this stored water quality data has also been included within the portal website. This analysis tool allows for presentation quality graphs to be manufactured and quickly copied and inserted into your presentation or publication.
The presentation will be a demonstration on the classic and updated functions, as well as how the Mine Portal can now be easily used in the field on handheld devices.

William D. Neider, P.E.

Title: Utilization of an Echosounder Drone for AMD Treatment Ponds

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Abstract:
As acid mine drainage (AMD) treatment facilities are getting older and no longer meeting effluent limits, there is a need to accurately evaluate existing treatment ponds' functionality. As funding decreases for state agencies due to the current state of the coal industry, a cost-effective approach to gather field data used in evaluating existing AMD treatment ponds is needed to optimize state funding. Utilization of a remote-control drone with echosound technology is a cost-effective way to quickly and accurately gather field data for treatment facility analysis. The Echosounder drone gathers existing elevations to determine depth of water and thickness of sediment within a treatment pond. Field information gathered by the drone is combined with traditional surveyed topography or LiDAR data to create surfaces of the pond with and without the residing sediment. Data collected by the drone in recent projects has proven to be accurate and has mirrored what was found during construction, including basin geometry and sediment layer thicknesses. A combination of the field-gathered information, along with the water quality data collected, is used to determine the most cost-effective approach to AMD treatment to meet effluent limits. This includes the ability to clean out sediment within a pond to obtain required capacity in lieu of lengthening and/or widening a pond. Accurately determining sediment thickness and the landscape of the pond bottom minimizes the footprint of pond upgrades by maximizing the use of the existing facility geometry. Drone technology minimizes project cost from the initial field data gathering, design, and construction phases, and the data from this technology can be uploaded and viewed almost instantaneously. AMD treatment design is only one application of this technology; it can also be utilized for maintenance of treatment ponds.