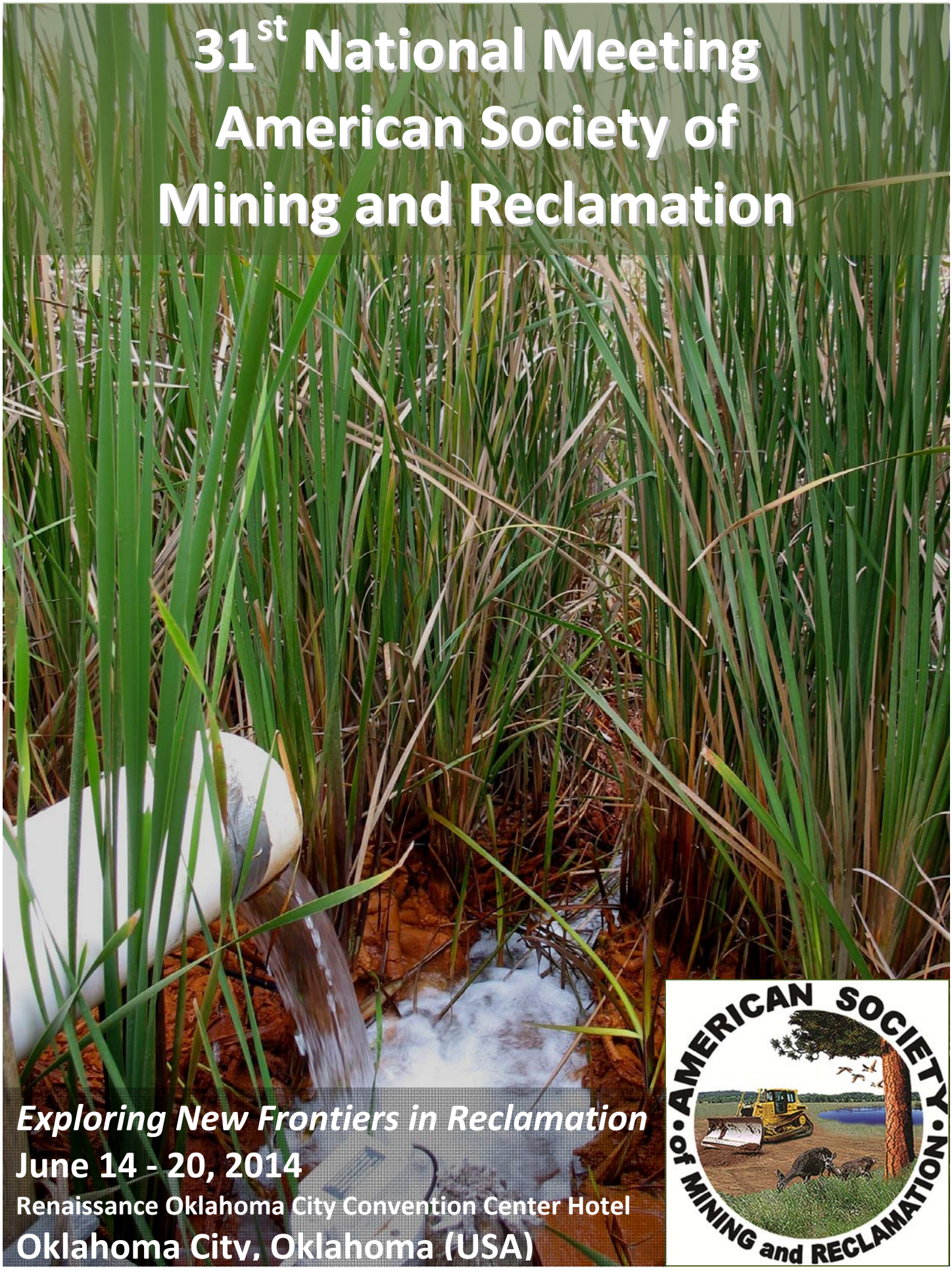
31st National Meeting American Society of Mining and Reclamation



Exploring New Frontiers in Reclamation

June 14 - 20, 2014

Renaissance Oklahoma City Convention Center Hotel

Oklahoma City, Oklahoma (USA)

Thank you to our ASMR 2014 Meeting Sponsors!

Gold ($5000+) Sponsors

Office of Surface Mining Reclamation and Enforcement

CREW
Center for Restoration of Ecosystems and Watersheds
University of Oklahoma

Silver ($3000) Sponsor

Peabody Energy

Bronze ($1000) Sponsors

Blackbird Environmental LLC

Environmental

WaTER
Water Technologies for Emerging Regions
Water & Sanitation for all

We Plug Holes!
FOAM CONCEPTS, LLC
800.556.9641
www.foamconceptsllc.com

Oklahoma Aggregates Association
OKAA

bp

OERB
Oklahoma Energy Resources Board

The UNIVERSITY of OKLAHOMA
School of Civil Engineering and Environmental Science

DEQ
OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

ASMR National Executive Committee (2013-2014)

President:	Robert W. Nairn
Past President:	Bruce Buchanan
President-Elect:	Joe Friedlander
NEC Members:	Len Ballek
	Michele Coleman
	Robert Dunker
	Jarvis Harper
	Barry Stewart
Technical Division Representative:	Jennifer Franklin
Executive Secretary:	Robert Darmody

ASMR 2014 National Meeting Committee

Chair:	Robert W. Nairn
Technical Program:	Robert C. Knox, Robert W. Nairn, Cindy Murphy and Marlene Smith
Fundraising:	Robert W. Nairn, Robert C. Knox and Robert Darmody
Social Events:	Cindy Murphy and Marlene Smith
Early Career Professionals' Social Event:	Julie LaBar, Chris Johnston and Cally Driessen
Sponsor and Exhibitor Registration:	Robert Darmody
Attendee Registration:	Oklahoma Center for Continuing Education
Field Tours:	Marlene Smith, Cindy Murphy, David Cates, Craig Kreman, Geoff Canty and Mark Helm
Workshop:	Russell Dutnell
Student Staff:	Nick Shepherd, Juan Arango, Julie LaBar, Leah Oxenford, Noah Berg-Mattson, Brendan Furneaux, Jessica Brumley and Jerrett Fowler

Exploring New Frontiers in Reclamation

Oklahoma is a land of unique geography, ecology, history and people. Stretching from the Ozark Highlands and Ouachita Mountains in the east, through the Cross Timbers and prairies of the Great Plains, to the tablelands, mesas and caprock canyons of the west, Oklahoma is home to 12 U.S. Environmental Protection Agency Level III ecoregions - making it one of the most ecologically diverse of all the states. Oklahoma history is also varied, from its rich Native American past and frontier "Land Run" settlement to today's vibrant energy and agriculture-driven economy. Oklahoma was one of the last frontier states and was fully opened to European settlement only in the 1890s. The state is home to 39 Native American tribes and Oklahoma culture is rich in this Native American legacy.

Oklahoma also has a significant history of natural resource extraction. Oklahoma coal was first mined commercially in 1873, with greater than 200 million tons produced to present day. The Tri-State Lead-Zinc Mining District was once one of the world's greatest mining fields, with approximately 4,000 mines producing 23 million tons of zinc concentrates and four million tons of lead concentrates over a century of operation. Today, sand and gravel is produced in most counties in Oklahoma from deposits found near rivers and streams. Limestone is one of the most widely available mineral resources of Oklahoma and accounts for about 60% of non-fuel mineral tonnage, with almost 500 million tons mined in the last 25 years. Oklahoma is a major U.S. producer of gypsum, the great majority of which is used in wallboard and plaster products. Oklahoma also currently produces or has produced iodine, tripoli, copper, clay, feldspar, helium, pumice and pumicite, salt and other minerals. Of course, Oklahoma has long been a

leading oil and natural gas producing state. The first recorded oil well was completed in 1859, and the first commercial oil well - the Nellie Johnstone #1 - came on line in 1897. Over 500,000 wells have been drilled in Oklahoma, and oil and natural gas remain economic drivers with roughly one quarter of Oklahoma jobs tied to the energy industry. In recent years, Oklahoma has become a top wind energy producer as well.

In the center of the state is Oklahoma City, a dynamic, modern urban center offering a capital experience for ASMR's 31st National Meeting. The conference theme, "*Exploring New Frontiers in Reclamation*", reflects both Oklahoma's unique history of settlement and its relative youth as the 46th state, as well as ASMR's ongoing membership expansion into the full suite of reclamation practitioners.

The meeting location is near the "Bricktown" entertainment district of Oklahoma City, just east of downtown. The former warehouse district includes over 50 dining and drinking establishments. The Bricktown entertainment district also includes the *Chickasaw Bricktown Ballpark* (home of the AAA OKC Redhawks - at home on Saturday, Sunday and Monday June 14, 15 and 16), the *Bricktown Canal* (with water taxi service), and many other attractions. The *Oklahoma City National Memorial* (former site of the Alfred P. Murrah Federal Building), *Myriad Botanical Gardens and Crystal Bridge Tropical Conservatory*, *Oklahoma City Museum of Art, Chesapeake Energy Arena* and *Oklahoma City Civic Center* are all within walking distance. More information can be found at these links: Oklahoma Tourism (http://www.travelok.com/), Oklahoma City Tourism (http://www.travelok.com/Oklahoma_City), Oklahoma City Convention and Visitors Bureau (http://www.visitokc.com/) and Bricktown Entertainment District (http://welcometobricktown.com/ and http://bricktownokc.com/).

Continuing Education Units

Through the Oklahoma Center for Continuing Education, full conference registrants will be eligible for 1.5 Continuing Education Units (CEUs). Workshop registrants will be eligible for an additional 1.5 CEUs (total 3.0 CEUs).

Pre-Conference Workshop

FGM 101 - Introduction to Fluvial Geomorphology
Dates: Saturday June 14 (9:00 AM to 5:00 PM) and Sunday June 15 (9:00 AM to 4:00 PM)
Location: Cox Convention Center Room 17 and nearby field sites
Instructor: Russell Dutnell, PE
Number of attendees: Minimum - 6; Maximum - 18
Cost: $150

Workshop Description: FGM 101 - Introduction to Fluvial Geomorphology. Have you seen the acronym FGM and wondered what it was, only to discover that it stands for Fluvial Geomorphology and still wonder what it is? Well, simply put, FGM is the study of the form and process of streams and rivers as they flow over the land. This two-day short course will provide the basic concepts of FGM and how they may be applied to restore streams to conditions better suited to handle flood flows and transport sediment, while maintaining the biological integrity of our planet's waterways. The workshop will include classroom instruction, outside demonstrations and a field trip. The workshop will be taught by Russell Dutnell, a Professional Engineer who has been applying FGM in stream and river restoration projects for over 15 years. He is currently the owner and sole proprietor of Riverman Engineering, PLC, located in Norman, Oklahoma specializing in FGM, stream assessment and stream restoration.

Post-Conference Field Tours

Due to insufficient numbers of registrants, the field tours were cancelled. The following information is provided for reference only.

Coal, Hydroelectric Power and the Tri-State Lead-Zinc Mining District

Field Tour Description: This exciting overnight field tour will feature stops at the Grand River Dam Authority's Grand River Energy Center (formerly the Coal Fired Complex), Pensacola Dam, and Ecosystems and Education Center all on day one. The Energy Center features both coal-fired generation and, by 2017, a new combined cycle gas unit that is designed to be the most efficient in the United States. Attendees will also visit the historic Tri-State Lead-Zinc Mining District. Straddling the boundaries of three states (Oklahoma, Kansas and Missouri) and two U.S. Environmental Protection Agency regions (Regions 6 and 7), the jurisdictional complexities of the mining district are often cumbersome and convoluted, especially considering the presence of significant Native American land holdings in Oklahoma. The district includes four U.S. EPA Comprehensive Environmental Response Compensation and Liability Act (CERCLA or Superfund) sites. Attendees will view unreclaimed areas, a waste repository, waste injection sites, a full-scale passive treatment system and the site of the first tribally-led Superfund cleanup.

Limestone Mining and Reclamation

Field Tour Description: Limestone is one of the most widely available mineral resources in Oklahoma and accounts for about 60% of non-fuel mineral tonnage, with almost 500 million tons mined in the last 25 years. Three major production areas exist: the Tulsa-Rogers-Mayes Counties region north of the Arkansas River, the Wichita Mountains area of Comanche and Kiowa Counties and the Arbuckle Mountains region of Murray and Pontotoc Counties. This field

tour will visit an active quarry operated for more than 40 years by a major producer in the Arbuckle Mountains.

Abandoned Mine Reclamation in Eastern Oklahoma

Field Tour Description: Oklahoma coal was first mined commercially in 1873. The history of Oklahoma coal mining is inextricably linked with the state's Native American legacy as Indian Territory and the opening of the American West by the railroads. Eastern Oklahoma is home to active surface and underground operations as well as many abandoned and inactive mines. Reclamation of some of these sites is complicated by past disposal of oil field waste materials. Reclamation practices include passive treatment systems, alkaline injection technology sites, collapse/subsidence abatement areas and land reclamation areas.

Silent Auction

The Silent Auction raises funds for the ASMR Student Travel Fund to assist our talented students in attending future meetings. All items are displayed prominently in the Cox Convention Center Great Hall. Bidding will begin on Sunday afternoon and continue through Wednesday at 12:00 PM, after which winners will be announced at lunch. Items will be accepted through Sunday afternoon June 15.

Wild Women of Reclamation

The Wild Women of Reclamation (WWR) group convenes Monday morning June 16 at 7:00 AM for a breakfast meeting and discussion in Technical Session Room 17. Several women will provide brief presentations on their careers to date. Discussions on the opportunities and challenges in the reclamation industry will follow.

Haulin' ASMR

Haulin' ASMR is an informal runner's club that gets together for some exercise before ASMR activities begin. Anyone interested in running may meet in the Renaissance Hotel lobby at 6:30 AM, Sunday through Thursday.

Welcome Reception

Sunday, June 15, 6:00 to 8:00 PM in the Great Hall
Light appetizers and refreshments available. Visit with old and make new acquaintances and learn about the latest in reclamation research and technical development.

Plenary Session Speakers

Monday June 16, 8:30 AM to 12:00 PM

Michael Teague, Oklahoma Secretary of Energy and Environment

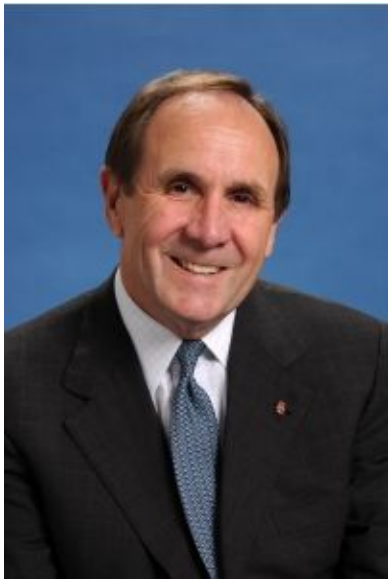
Michael Teague is serving as Oklahoma's first secretary of Energy and Environment. Prior to his appointment, Michael served in the U.S. Army for nearly 30 years before retiring with the rank of Colonel. He served as commander for the Tulsa District of the U.S. Army Corps of Engineers, where he was responsible for a civil works program encompassing all of Oklahoma, a large portion of southern Kansas and the panhandle of northern Texas. Throughout his career, Michael has dealt with power generation and distribution, water desalinization, and environmental impact studies. He has facilitated and negotiated numerous solutions regarding federal and state agencies, tribes, and local stakeholders and has acted as a liaison between the Tulsa District and the United States Congress. Michael also served in operational assignments in Germany, Honduras, Saudi Arabia, Egypt, and numerous stateside duty stations. He deployed several times to the Middle East and central Asia, including commanding the 52nd Engineer Battalion in support of the 101st Airborne Division as part of

Operation Iraqi Freedom in 2003. He received a bachelor's degree in civil engineering from Norwich University and master's degrees in operations analysis from the Naval Postgraduate School and in national security and strategic studies from the Naval War College.

Austin Holland, Research Seismologist, Oklahoma Geological Survey

Austin Holland is a research seismologist with the Oklahoma Geological Survey (OGS). He has been with the OGS since January of 2010. Since arriving at the OGS, Austin has worked on issues of triggered seismicity. He is currently finishing his PhD at the University of Arizona, where his focus has been primarily on measuring deformation of the Earth using high precision GPS and earthquake seismology. He received his Bachelor of Science in Geology from the University of Idaho and his Master of Science in Geophysics from the University of Texas at El Paso. He also worked at the Department of Energy's Idaho National Laboratory for 12 years in the seismic monitoring program.

Berrien Moore III, University of Oklahoma Vice President for Weather and Climate Programs, Dean of the College of Atmospheric and Geographic Sciences and Director of the National Weather Center



Dr. Berrien Moore III is an internationally recognized Earth scientist. He has published extensively on the global carbon cycle, remote sensing, mathematics, and environmental policy. He joined the University of Oklahoma in 2010 as the Chesapeake Energy Corporation Chair in Climate Studies in the School of Meteorology. Prior to joining the University of Oklahoma, Moore was the Executive Director of Climate Central, a nonprofit organization based in Princeton, New Jersey and Palo Alto, California. From 1988 to 2008, Moore was the Director of the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire. He has been a visiting research scientist at the Laboratoire de Physique et Chimie Marines, Université Pierre et Marie Curie in Paris and at the Institute of Meteorology at the University of Stockholm. He also has been engaged with senior management of NASA and has lent his leadership and expertise across a broad range of boards and committees of the National Academy of Science. Most recently, he was co-chair of the Academy's first Decadal Survey in Earth Science and

Applications from Space. His current service includes the Committee of Earth Studies of the National Research Council, the Jet Propulsion Laboratory Advisory Council, and the Board of Directors of the University of New Hampshire Foundation.

ASMR Awards Luncheon

Monday June 16, 12:00 PM to 2:00 PM in the Great Hall

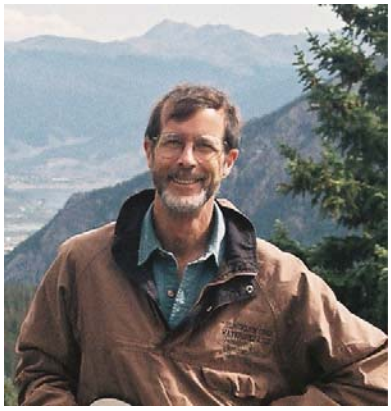
The ASMR Awards Luncheon is the highlight of the annual meeting, where both professional (William T. Plass Award, Reclamationist of the Year, Barnhisel Reclamation Researcher of the Year, Pioneers in Reclamation Award and Special Awards) and student (BS, MS and PhD Memorial Scholarships, Student Research Grant and Student Travel Grant) award winners are honored.

Please note that because the ASMR Awards Luncheon is being held on Monday this year, Student Oral Presentation and Poster Awards will be announced in a special luncheon awards ceremony on Wednesday June 18, along with the winner of the ASMR 2014 Win Free Stuff Photo Contest.

2014 William T. Plass Award Winner - Margaret H. Dunn

Established by ASMR to honor Bill Plass for his long-time commitment to mine land reclamation and for his major role in the establishment and organization of ASMR, the Plass Award is the most prestigious society award and reflects outstanding contributions in the areas of mining, teaching, research, and/or regulatory or environmental consulting as they relate to land reclamation. **Margaret Hensley Dunn**, PG, CPG, is the President of Stream Restoration Inc., a non-profit that focuses on developing public-private partnerships with all stakeholders interested in working together to implement sustainable solutions to mine drainage issues. Her efforts include the recovery and use of metal-bearing material (sludge) from passive treatment systems to provide funding for small watershed groups, and the development and maintenance of www.datashed.org to provide watershed groups with the means to upload water monitoring data about their passive treatment systems. As a professional geologist and President of BioMost, Inc., Margaret, as co-inventor, has been issued four U.S. Patents relating to passive mine drainage treatment technology.

2014 Barnhisel Reclamation Researcher of the Year Award Winner - James J. Gusek



The Barnhisel Researcher of the Year award recognizes substantive contributions to the advancement of reclamation science and/or technology through scientific research. **Jim Gusek**, PE, is a senior engineer with Sovereign Consulting Inc. He graduated from the Colorado School of Mines in 1973 with a BS in Mining Engineering. He specializes in the design of passive treatment systems for mining influenced water. Since 1987, his work with acid rock drainage prevention and passive water treatment systems has included about 50 projects throughout the U.S. and internationally. He is on the steering and mitigation committees of the Acid Drainage Technology Initiative - Metal Mining Sector (ADTI-MMS). Jim has been an ASMR member since 1993 and is a founding member and former president of the Denver Professional Chapter of Engineers Without Borders.

2014 Reclamationist of the Year Award Winner - Paul Eger

The Reclamationist of the Year award is given to individuals demonstrating outstanding accomplishments in the practical application or evaluation of reclamation technology. For over 35 years, **Paul Eger** has worked with environmental issues related to mining, in both the public and private sectors. For most of his career, Paul was a principal engineer for the Minnesota Department of Natural Resources, Division of Lands and Minerals. He was a pioneer in the use of wetlands to remove trace metals from mine drainage. He has also been a leader in the development of cost-effective and environmentally safe reclamation using waste products, such as biosolids, municipal solid waste compost, and dredge material from Lake Superior. His most recent positions with Global Minerals Engineering and Sovereign Consulting involved the design of passive and low maintenance "semi-active" treatment systems, site assessments, and environmental feasibility studies.

2014 Memorial Scholarship (PhD) - Benjamin Uster, University of Canterbury

Benjamin Uster is a graduate student in Environmental Sciences with a specialization in chemical and physical processes of the environment. He is currently a 3rd year PhD student in the Hydrological and Ecological Engineering Group of the Civil and Natural Resources Engineering Department at the University of Canterbury (Christchurch, New Zealand). He earned a bachelor's degree in Geosciences (2007) and a master's degree in Environmental Sciences (2009) from the University of Lausanne (Switzerland). His work focused on the contamination of a mountain stream by acid mine drainage in the Rosia Montana Valley (Romania). After graduating, he worked as a scientific collaborator in the Environmental Microbiology Laboratory of the Ecole Polytechnique Fédérale de Lausanne (Switzerland) where he conducted research on uranium bioreduction and uranium biomineral stability.

2014 Memorial Scholarship (MS) - Michael Curran, University of Wyoming

Michael Curran earned bachelor's degrees in Biological Science, Geography, and Foreign Language and Literature (Ancient Greek/Roman Studies) and a minor in Religious Studies from the University of Delaware in 2008. More recently, Michael earned a Master of Science degree in Rangeland Ecology and Watershed Management and a graduate certificate in Reclamation Ecology from the University of Wyoming in May 2014. Michael's MS

thesis was titled "Using Data Management to Improve Oil and Natural Gas Pad Reclamation" and involved creating a large database using data from BP America Production Company, and other private and public sources. Michael will continue his education and work towards a PhD at University of Wyoming. Multiple other oil and gas production companies have begun to contribute to the database that was started as part of his MS program, and the Bureau of Land Management and U.S. Fish and Wildlife Service have shown interest in using the database to help with decision making on the policy side of the reclamation spectrum.

2014 Memorial Scholarship (BS) - Niklas Folke, Montana Tech

Next fall, **Niklas Folke** will be entering his senior year studying Mining Engineering at Montana Tech. He has completed two internships working at open-pit copper mines in Arizona with Freeport-McMoRan and is currently working on his third internship, doing mine rehabilitation work with Mining and Environmental Services in Colorado. Over several years, the exposure that he has had to the world of mining has allowed him to see the wide-range of challenges faced by industry professionals every day. It is his goal to graduate and enter the workforce as a competent and forward-thinking mining engineer, who solves these industry challenges without compromising safety or degrading the environment.

Pioneer in Reclamation - Wayne Erickson

ASMR defines a Pioneer of Reclamation as any person who has made a significant contribution to the advancement of the art and science of the reclamation of mined or drastically disturbed lands and/or achieved an acknowledged mined land reclamation accomplishment. **Wayne Erickson**, CPESC, is President and Principal Environmental Scientist of Habitat Management, Inc. He is a managing Member of Habitat Construction, LLC and Secretary Treasurer of Valcrete, Inc. Wayne has a BS from Colorado State University with a double major in Forest Biology/Botany and is an honorably discharged Viet Nam Navy Veteran. He has over 35 years of operational and project development, environmental permitting, natural resource management and land reclamation experience in the mining and oil/gas extractive industries and on other drastically disturbed lands.

Special Award - Wyoming Abandoned Mine Lands Division, Wyoming DEQ

On occasion, ASMR recognizes especially notable efforts in land and water reclamation by providing Special Awards. This Award will be received by **Alan Edwards** (left) and **Bill Locke** (right). Alan Edwards is the Administrator of the **Wyoming Abandoned Mine Lands Division**. He is an engineer with experience in construction and project management, including work in both the public and private sectors in various capacities. Bill Locke is a Wyoming Professional Engineer with 38 years of experience in engineering consulting and government. In 2000, he accepted his current position as AML Program Manager.

Early Career Professionals' Social Event

Monday June 16, 6:00 to 10:00 PM at TapWerks Ale House, 121 East Sheridan Ave., Bricktown.
The Early Career Professionals will host their 5th Annual social event to provide individuals who are just starting their journey in mining and reclamation with a relaxed setting where they can interact with those who have amassed a wealth of knowledge over their careers. The event is casual and includes food, refreshments and live music. Attendees will walk from the conference venue to the event.

Poster Session and Mixer

Tuesday June 17, 5:00 to 7:00 PM in the Great Hall
Poster presenters are responsible for setting up posters at their designated, numbered locations. Posters will be displayed on an air wall in the Great Hall for the entire conference. Pins will be provided for mounting posters.

Poster Session - Great Hall
1. GIS Analysis of Changes in Volume and Mass of Chat Piles in the Picher Mining District, Ottawa County, Oklahoma, 2005–10 by J. Smith
2. Soil Test and Bermuda Grass Forage Yield Responses to Animal Waste and FGD Gypsum Amendments by J.J. Read, A. Adeli, D.J. Lang, K.K. Crouse, N.R. McGrew and J.D. Friedlander
3. Dual Microcapillary Barriers in Conjunction with Water Harvesting Can Increase Reclamation Success in the Wamsutter Natural Gas Production Area by S. Cude, J. Norton, T. Kelleners and M. Ankeny **(student)**

Poster Session (continued)

4. Long-Term Effect of Herbaceous Species Cover on the Development of Soil Properties on Reclaimed Mine Site by R. Anderson, E. Bair, J. Gillespie, M. Livas, E. Salkind, A.O. Abaye and C.E. Zipper **(student)**
5. Preliminary Greenhouse Investigation of Selenium Removal from Soil by Phytoremediation by R.G. Paudel, P.D. Stahl and C.F. Strom **(student)**
6. Current State of Frac Sand Mine Reclamation Techniques in Wisconsin by Y.B. Johnson, S.M. Alvarez and A.L. Delyea-Petska **(student)**
7. Comparison of Long-term Recovery Between Managed and Unmanaged Reclaimed Mine Lands by T. Macy and N. Kruse **(student)**
8. Characterization and Heavy Metals Status in Pre-mined Soils in North-East Botswana by O. Dikinya **(student)**
9. Late Summer Native Establishment by J. Paternoster
10. Bats Associated with Inactive Mine Features in Southeastern Arizona by A.M.D. Barclay
11. Effects of Hydromulch Products on Rapid Vegetative Establishment on Mississippi Roadsides by B. Stewart, T.J. Bradford, G. Munshaw and W. Philley
12. Application of Remote Sensing for Modeling Mine Fire and Vegetation: A Case Study of Jharia Coalfields, India by P. Kumar, R.K. Chopra and B.C. Dey
13. Utilization of River Sediments as Topsoil to Reclaim Brownfields and Other Sites by R.G. Darmody and J.C. Marlin
14. Hydrology and Geochemistry of the Palzo Surface Mine, Williamson County, Illinois – 2003-2013 by P.T. Behum, R. Kiser and B. Johnsrud **(student)**
15. Biogenic Hydrogen Sulfide Production for Metal Recovery Dissolved in Acid Mine Drainage by S. Ji, I. Nam, G. Yim, Y.W. Cheong, C. Oh and J.S. Ahn
16. Effects of Mushroom Compost with Limestone Granules on Metal Removal in Vertical Flow Column by Y. Cheong, G. Yim, S. Ji, O. Chamteut, S.E. Young and H. Ji-Hae
17. Open Limestone Channel Treatment Dynamics: A Case Study Treating Low-pH Coal Mine Drainage in PA by A. Conrad, K. Palmer, A. Rose and W. Strosnider **(student)**
18. Passive Co-Treatment of Polymetallic Acid Mine Drainage at Cerro Rico de Potosí, Bolivia by R. Peer, J. LaBar, B. Winfrey, R.W. Nairn, F.L. Lopez and W. Strosnider **(student)**
19. Assessment of Benthic Macroinvertebrate Community Impairment from Residual Aluminum Contamination in the Confluence of Middleton Run, Ohio, USA and the Impacts of Ingested Aluminum on Crayfish Growth by W. Hellyer, N. Kruse and K. Johnson **(student)**
20. Dissolution Variability in Open Limestone Channel Substrate: Simple Lab Trials by R. Zoubareva, L. Mignogna, D. Mack, D. Civis, J. Skipper, N. Lassak, A. Conrad, J. Bandstra, A. Rose and W. Strosnider **(student)**
21. Impacts of Aeration on Hydraulic Characteristics of Passive Treatment Systems by J. Arango, K. Strevett and R.W. Nairn **(student)**
22. University of Kentucky ASMR Student Chapter by H. Angel **(student)**

Oklahoma History Center Evening Social Event

Wednesday June 18, 6:00 to 10:00 PM at The Oklahoma History Center, adjacent to the State Capitol building; buses will leave the south side of the Renaissance Hotel at 5:30 and 5:45 PM. Self-guided tours of the Center's five main galleries of Smithsonian-quality exhibits will be followed by a buffet dinner (with a dramatic view of the Capitol) and musical entertainment provided by The Hosty Duo.

Accompanying Person/Significant Other Activities

The Oklahoma City area has an amazing variety of activities and attractions. Whether searching for unique attractions or family-friendly activities, Oklahoma City is the right place. Explore the variety that the city's many districts offer, including arts and entertainment, shopping, history, heritage and so much more. The possibilities are endless!

Within walking distance: Bricktown, The Bricktown Canal, The Oklahoma City National Memorial and Museum, Myriad Botanical Gardens and Crystal Bridge , Oklahoma City Museum of Art, The Red Earth Museum, Jogging Trails (YMCA/Bricktown) and many others.

Oklahoma City: Harn Homestead and 1889ers Museum, Oklahoma City Zoo and Gardens, Gaylord-Pickens Oklahoma Heritage Museum, Science Museum Oklahoma, 45th Infantry Division Museum, Frontier City Amusement Park, White Water Bay Water Park, Remington Park (horseracing and casino), National Cowboy and Western Heritage Museum, National Softball Hall of Fame and Museum, Oklahoma State Firefighter's Museum and others.

Nearby destinations: The University of Oklahoma (OU) in Norman, including the Sam Noble Oklahoma Museum of Natural History and Fred Jones Jr. Museum of Art, Jacobson House Native Art Center, Museum of Osteology, many casinos administered by various Native American tribes.

Statewide: Chickasaw Cultural Center, (80 miles south), Wichita Mountains National Wildlife Refuge (90 miles southwest), Indian City USA Cultural Center (60 miles west), Great Salt Plains State Park (the only place in the world where visitors may dig for hour-glass selenite crystals, 120 miles northwest) and the Nature Conservancy Tallgrass Prairie Preserve (the largest protected remnant of tallgrass prairie left on earth, 140 miles northeast).

Conference Agenda and Technical Program

Saturday June 14, 2014	
09:00-5:00	Workshop: FGM 101 - Introduction to Fluvial Geomorphology - Room 17
Sunday June 15, 2014	
09:00-4:00	Workshop: FGM 101 - Introduction to Fluvial Geomorphology (continued)
09:00-5:00	Exhibitor Set up - Great Hall D and E
09:00-5:00	National Executive Committee Meeting - Lee Room (Renaissance Hotel)
1:00-6:00	Registration - Pre-Function Area
6:00-8:00	**Welcome Reception - Great Hall**
Monday June 16, 2014	
06:30-07:30	Haulin' ASMR Runners Club - Leave from Renaissance Hotel lobby
07:00-09:00	**Buffet Breakfast - Great Hall** Wild Women of Reclamation Breakfast Meeting - Room 17
07:00-12:00	Registration - Pre-Function Area
08:30-12:00	**Plenary Session - Great Hall**
08:30-08:45	Welcome - Robert W. Nairn, Conference Chair
08:45-09:15	Native American Welcome - American Indian Spirit Dancers
09:15-9:30	A Welcome from the Oklahoma Secretary of Energy and Environment - Michael Teague Oklahoma Secretary of Energy and Environment
09:30-10:00	The American Society of Mining and Reclamation: The First 40 Years by R.G. Darmody and J. Skousen
10:00-10:30	**Break - Great Hall**

Monday June 16 (continued)				
10:30-11:15	Recent Earthquakes in Oklahoma: Significance and Perspective - Austin Holland, Research Seismologist, Oklahoma Geological Survey			
11:15-12:00	Weather, Water and Climate: The Grand Challenges - Berrien Moore University of Oklahoma Vice President for Weather and Climate Programs			
12:00-2:00	**ASMR Awards Luncheon - Great Hall**			
	Room 17	**Room 18**	**Room 19**	**Room 20**
	Special Session: 20th Anniversary of USBM Passive Treatment IC 9389 Moderator: W. Strosnider	**Innovative and Emerging Reclamation Technologies** Moderator: J. Friedlander	**Forestry and Wildlife** Moderator: J. Franklin	**Soils and Overburden** Moderator: W.L. Daniels
2:00-2:30	Effective Passive Treatment of Coal Mine Drainage by R.S. Hedin, T. Weaver, N. Wolfe and G. Watzlaf	Common Sense Solutions for Management of Global Warming by K.C. Vories and J. Vories	Bats Associated with Inactive Mine Features in Southeastern Arizona by A.M.D. Barclay	TDS Related Leaching Potentials of Coal Spoil and Refuse from Tennessee and Virginia by Z.W. Orndorff, W.L. Daniels, C.E. Zipper and M.J. Eick
2:30-3:00	Implementation of Passive Treatment for Irreversibly Damaged Waters by R.W. Nairn		Impact of Mine Drainage on the Genetic Diversity of Brook Trout by F.J. Brenner, G.T. Herald, L.M. McGarvey, L.Q. Rittenhouse and S.M. Rummel	Gray Sandstone as a Topsoil Substitute on Surface Coal Mines in Appalachia by L. Wilson-Kokes and J. Skousen **(student)**
3:00-3:30	Creating Anaerobic Environments to Control Acid Generation in Pyritic Material by R.L. Kleinmann	The Lionkol Project, Practical Application of Geomorphic Mine Land Reclamation Methods by H.H. Hutson and B. Thoman	Pine Plantations on Reclaimed Minelands: Growth Rates Versus Unmined Lands by J. Priest, J. Stovall, D. Coble, B. Oswald and H. Williams **(student)**	Beneficial Use of Coal Bed Natural Gas Produced Water Through Managed Irrigation in the Powder River Basin of Wyoming by C. Driessen, K. House and K. Harvey
3:30-4:00	**Break - Great Hall**			

Monday June 16 (continued)				
	Room 17	**Room 18**	**Room 19**	**Room 20**
	Special Session: 20th Anniversary of USBM Passive Treatment IC 9389 Moderator: W. Strosnider	**Innovative and Emerging Reclamation Technologies** Moderator: J. Friedlander	**Forestry and Wildlife** Moderator: J. Skousen	**Soils and Overburden** Moderator: W.L. Daniels
4:00-4:30	Land Application of Biochemical Reactor Effluent: An Innovative Method for Mitigating Acid Rock Drainage by J.J. Gusek	Late Summer Native Establishment by J. Paternoster	Tree and Ground Cover Establishment Over Seven Years as Affected by Seeding and Fertilization Rates by J. Franklin and D. Buckley	Prime Farmland Crop Yields from Four Soil Reconstruction Treatments Following Mineral Sands Mining: A 9 Year Summary by Z.W. Orndorff, W.L. Daniels, M.S. Reiter and A.F. Wick
4:30-5:00	Panel Discussion: 20 Years of Passive Treatment	New Progresses of Land Reclamation in China by W. Xiao, Z. Hu and Y. Fu	Case Study: Shullsburg (WI) Lead/Zinc Mine Reclamation by T. Hunt	Agricultural Impacts of Longwall Mine Subsidence: The Experience in Illinois, USA and Queensland, Australia by R.G. Darmody, R. Bauer, D. Barkley, S. Clarke and D. Hamilton
5:00-5:30	Panel Discussion: 20 Years of Passive Treatment (continued)		Meadow Creek Restoration/ Stibnite Mine Idaho by L. Ballek	Phytoremediation on Lead and AMD Soils by L. Sakiah, M. Makgae and S. Tlowana **(student)**
6:00-10:00	**Early Career Professionals' Social Event - TapWerks Ale House, Bricktown**			

Tuesday June 17, 2014				
06:30-07:30	Haulin' ASMR Runners Club - Leave from Renaissance Lobby			
07:00-09:00	**Buffet Breakfast - Great Hall**			
	Room 17	**Room 18**	**Room 19**	**Room 20**
	Passive Treatment Systems: Biochemical Reactors Moderator: T. Wildeman	**Special Session: Sediment Management** Moderator: D. Townsend	**Forestry and Wildlife** Moderator: L. Ballek	**Soils and Overburden** Moderator: C. Johnston
08:30-09:00	Biochemical Reactors for Treating Mining Influenced Water by P. Eger, C. Baysinger, D. Cates and S. Hill	Mobility of Arsenic in Sediments of Coalbed Natural Gas (CBNG) Disposal Pond Playas in the Powder River Basin, Wyoming by K.C. McNicholas and K.J. Reddy **(student)**	Influence of Spoil Type on Discharged Water Quality and Hydrologic Function of Experimental Reforestation Plots in Pike County, Kentucky by K. Sena, C. Barton, C. Agouridis, P. Angel and R. Warner **(student)**	Application of FPXRF Technology and Field Expedient Sample Preparation Techniques by M. Stinnett, R. Thomas and J. Yfante
09:00-09:30	Bench Scale Biochemical Reactor Treatment of Uranium, Radium and Selenium by R. Schipper, E. Blumenstein, T. Rutkowski and B. Nielsen	Remediation of Tar Creek Sediments and Adjacent Mine Waste Areas: Design Considerations by B. Burnett	Vegetation and Soil Development in Planted Pine and Naturally Regenerated Hardwood Stands 48 Years After Mining by J. Franklin and J. Frouz	Soil Metal Concentrations in Proposed Wetland Development Areas near the Tri-State Lead-Zinc Mining District by. R.W. Nairn and D. Townsend
09:30-10:00	Column Study Treatability Testing for *in situ* Remediation of Mining-Influenced Water by N.T. Smith, N. Anton, D. Reisman, A. Frandsen, R. Olsen, M. Sieczkowski and D. Smith	Sediment Metal Concentrations in Selected Coves of Grand Lake by S. Zawrotny, J. Arango, L. Diede, A. McLeod, M. Salisbury, G. Rutelonis, R.C. Knox and R.W. Nairn	*Forestry and Wildlife Technical Division Meeting*	Evaluation of Land Reclamation Suitability in Juye Coal Mining Area by J. Li, X. Zhao, W. Li, Y. Wang and J. Liu
10:00-10:30	**Break - Great Hall**			

Tuesday June 17 (continued)				
	Room 17	**Room 18**	**Room 19**	**Room 20**
	Passive Treatment Systems: Biochemical Reactors Moderator: J. LaBar	**Special Session: Sediment Management** Moderator: D. Townsend	**Stream Ecology** Moderator: B. Furneaux	**Soils and Overburden** Moderator: C. Johnson
10:30-11:00	Hydrology and Geochemistry of the Palzo Surface Mine, Williamson County, Illinois 2003-2013 by P.T. Behum, R. Kiser and B. Johnsrud **(student)**	Investigations of Bioavailability, Toxicity and Accumulation of Trace Metals from Shallow Sediments in Grand Lake Following Simulated Disturbance Events by S. Morrison, S. Nikolai, D. Townsend and J. Belden **(student)**	Assessment of Benthic Macroinvertebrate Community Impairment from Residual Aluminum Contamination in the Confluence of Middleton Run, Ohio, USA and the Impacts of Ingested Aluminum on Crayfish Growth by W. Hellyer, N. Kruse and K. Johnson **(student)**	Towards Closure of the Fire Road AMD Mine in New Brunswick, Canada by K. Phinney, M. Coleman, K. Butler and S. Pelkey
11:00-11:30	The Use of Waste Mussel Shells to Treat Acid Mine Drainage in Upward-Flow Sulfate-Reducing Bioreactors by B. Uster, A.D. O'Sullivan, J. Pope, D. Trumm and M. Milke **(student)**	Dredging Management in Grand Lake O' The Cherokees, Oklahoma: Developing Permitting Strategies Using Shoreline Classifications, Substrate Characteristics, and Contaminant Concentrations by S. Nikolai and D. Townsend	The Recovery of an AMD-Impacted Stream Treated by Steel Slag Leach Beds: A Case Study in the East Branch of Raccoon, Creek, Ohio by C. Hawkins, N. Kruse, A. Mackey and J. Bowman **(student)**	Variability in Phosphorus Sorption by Acid Mine Drainage Residuals Under Flow-Through Conditions by J. Bowen, C. Penn and R.W. Nairn **(student)**

	Tuesday June 17 (continued)			
	Room 17	**Room 18**	**Room 19**	**Room 20**
11:30-12:00	The Use of Sewage Sludge and Crocodile Manure for Treating Acidic Metalliferous Mine Drainage by J. Robinson	Utilization of River Sediments as Topsoil to Reclaim Brownfields and Other Sites by R.G. Darmody and J. Marlin	Fishes of a Contaminated Stream After Operation of a Passive Treatment System by N. Shepherd, W. Matthews, R.W. Nairn, J. Barkstedt and N. Franssen **(student)**	*Soils and Overburden Technical Division Meeting*
12:00-1:30	**Lunch - Great Hall** (Technical Division Chairs and JASMR Associate Editors Lunch Meeting - Great Hall)			
	Room 17 **Passive Treatment Systems: Aerobic Systems** Moderator: T. Danehy	**Room 18** **Special Session: Sediment Management** Moderator: D. Townsend	**Room 19** **Ecology** Moderator: G. Schuman	**Room 20** **Soils/Tailings** Moderator: Z. W. Orndorff
1:30-2:00	Impacts of Aeration on Hydraulic Characteristics of Passive Treatment Systems by J. Arango, K. Strevett and R.W. Nairn **(student)**	Pedogenesis and Local Water Quality Effects of Upland Placement of Saline Dredge Spoils in Virginia by W.L. Daniels, N.W. Haus, G.R. Whittecar and C.H. Carter lll	Biodiversity Assessment of an Ecologically Engineered Treatment System for Metals-Contaminated Mine Drainage by B. Furneaux and R.W. Nairn **(student)**	The History of Zinc Smelting in Oklahoma by R. Kottke
2:00-2:30	Storm Event-Driven Metal Transport Dynamics Between the Initial Oxidation Cells of a Passive Treatment System by L.R. Oxenford and R.W. Nairn **(student)**	Panel Discussion: Sediment Management		Remediation and Redevelopment of Historical Smelters in Oklahoma by R. Kottke
2:30-3:00	Performance of the Swank Open Limestone Channel, Cambria County, PA by W. Strosnider, A. Conrad and A.W. Rose	Panel Discussion: Sediment Management (continued)	Comparison of Long-term Recovery Between Managed and Unmanaged Reclaimed Mine Lands by T. Macy and N. Kruse **(student)**	Tar Creek: Early History and Legacy of Mining in the Tri-State Mining District by A. Hughes

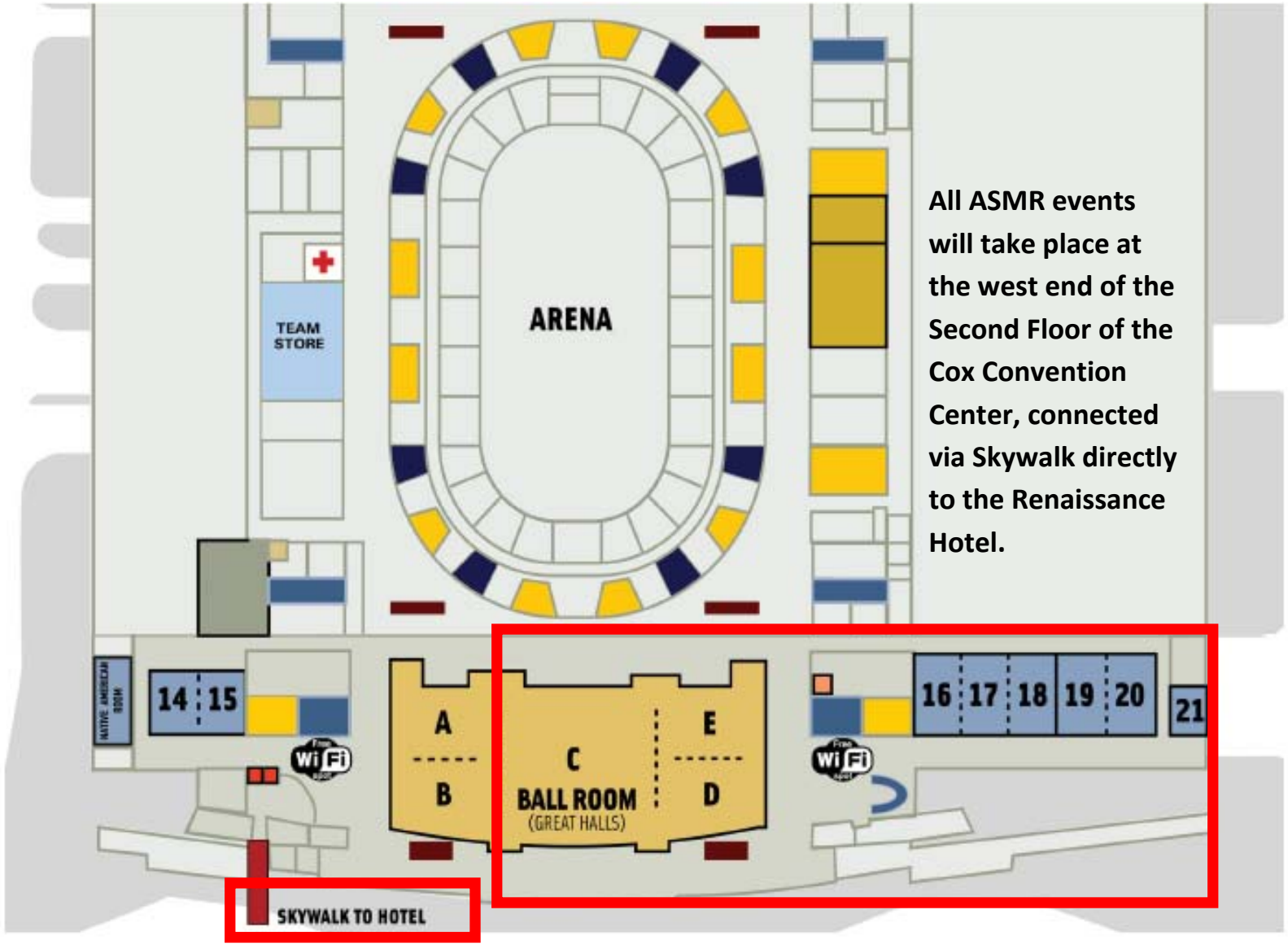
Tuesday June 17 (continued)				
3:00-3:30	**Break - Great Hall**			
	Room 17	**Room 18**	**Room 19**	**Room 20**
	Passive Treatment Systems: Aerobic Systems Moderator: G. Geidel	**Aggregate Mining and Slope Stabilization** Moderator: G. Canty	**Ecology** Moderator: B. Stewart	**Tailings** Moderator: A. Hughes
3:30-4:00	An Evaluation of Passive Treatment Systems Treating Oxic Acidic Mine Drainage by A.W. Rose	Dolese Bros. Co., Davis Quarry, Mining, Water Management and Stream Enhancement by M. Helm and T. Dupuis	Influence of Water Chemistry and Sediment Transport on Biological Recovery Downstream of Lime Dosers by H. Bedu-Mensah and N. Kruse **(student)**	Tar Creek: Superfund Remedy for Mine and Mill Wastes on Operable Unit 4 Remediation by D. Datin
4:00-4:30	Solving Mine Drainage Problems at the Soudan Mine; The Final? Answer by P. Eger, P. Jones, D. Green and B. Forder	Environmental Considerations of Proppant Frac Sand Mining and Processing by K. Ware	Litter Decomposition Rates in Mine Water Wetlands and Ponds by J. Brumley and R.W. Nairn **(student)**	Geochemical Modeling to Assess Impact of Chat Fine Injections on Aquifer Quality at the Tar Creek Superfund Site, Oklahoma by B. Schroth, R. Thomas and S. Irving
4:30-5:00	Steel Slag Leach Bed Longevity Analysis by S. Landers, S. Maj, A. Mackey and N. Kruse	Stabilization of the Pensacola Dam West Abutment by S.R. Jacoby, C. Landrum and S. Walker	Warm-Season Grass Production on Two Mine Soils Amended with Spent Mushroom Compost by J.S. Banfill and R.C. Stehouwer **(student)**	Water Quality Impacts from Mining at the Tar Creek Superfund Site by D. Cates
5:00-7:00	**Poster Session and Mixer - Great Hall**			

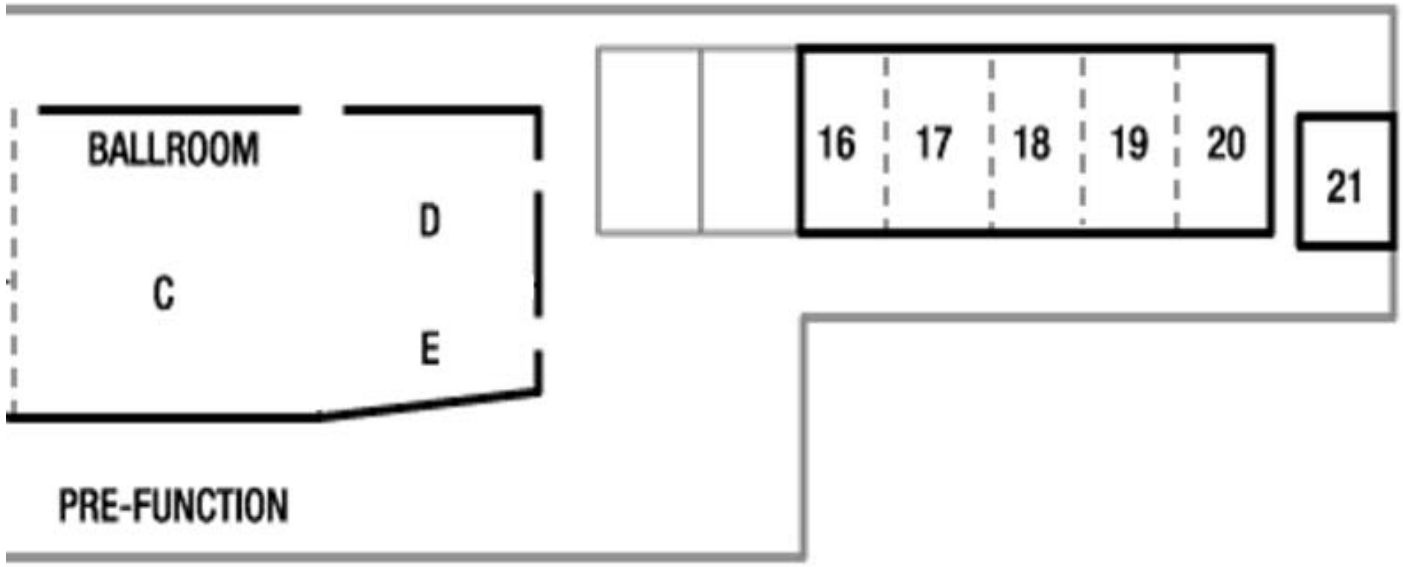
Wednesday June 18, 2014			
06:30-07:30	Haulin' ASMR Runners Club - Leave from Renaissance Lobby		
07:00-09:00	**Buffet Breakfast - Great Hall**		
	Room 17	**Room 18**	**Room 19**
	Passive Treatment Systems: Other Technologies Moderator: L.R. Oxenford	**Tailings: Innovative Approaches** Moderator: D. Cates	**Ecology** Moderator: P. Stahl
08:30-09:00	Sequestration of Heavy Metals on Manganese Oxide Coatings in Passive Treatment Systems by J.J. Gusek, L. Josselyn and D. Millsap	Potential Recovery of Aluminum, Titanium, Lead, and Zinc From Fine Tailings in the Abandoned Picher Mining District of Oklahoma by W.J. Andrews, R.W. Nairn and C.J.G. Moreno	
09:00-09:30	Getting the Lead Out (and Other Trace Metals) - Solving Mine Water Problems With Peat-Based Sorption Media by P. Eger, P. Jones and D. Green	Tribal-Led Remedial Action at the Tar Creek Superfund Site - Catholic 40 by C. Kreman and T. Kent	Reclamation in Southeastern Wyoming: Beauty is in the Eye of the Beholder by B. Schladweiler and C. Adams
09:30-10:00	Passive Co-Treatment of Polymetallic Acid Mine Drainage at Cerro Rico de Potosi, Bolivia by R. Peer, J. LaBar, B. Winfrey, R.W. Nairn, F.L. Lopez and W. Strosnider **(student)**	*Tailings Technical Division Meeting/ Geotechnical Engineering Technical Division Meeting*	Reclamation Success Variables on Highway Construction Projects in Colorado by A.J. DeJoia, A. Hirsch, B. Roeder and M. Banovich
10:00-10:30	**Break - Great Hall**		

Wednesday June 18 (continued)			
	Room 17 **Challenges in Passive Treatment** Moderator: R. Kleinmann	**Room 18** **Oil and Gas Reclamation and Remediation** Moderator: S. Sowers	**Room19** **Ecology** Moderator: P. Griswold
10:30-11:00	Rehabilitation of Pennsylvania Passive Treatment Systems by R.M. Mahony, B J. Page, C.F. Denholm, T.P. Danehy, C.A. Neely, S.L. Busler and M.H. Dunn	Bridging the Gaps Between Policy, Practice, and Science by M. Curran and P. Stahl **(student)**	Regional Variance in Site Selection for Land Disturbing Activities in Oklahoma by C. Porter
11:00-11:30	Challenges in Passive Treatment Design: The Future at Tar Creek by D. Cates and R.W. Nairn	Effects of Soil Disturbance and Packed-Box Amendment Study on Two Sodium-Affected Natural Gas Well Pads in Wamsutter, WY by S. Day, J.B. Norton and C.F. Strom **(student)**	Establishment and Growth of Switchgrass and Other Biomass Crops on Surface Mines by J. Skousen, C. Brown and D. McMichael
11:30-12:00	Jennings Passive Treatment System Rehabilitation by M.H. Dunn, T.P. Danehy, C.A. Neely, R.M. Mahony, S.L. Busler, B.J. Page and C.F. Denholm	Streamlining Reclamation Monitoring in the Sagebrush Steppe by C. Strom	
12:00-1:30	**Lunch - including Student Oral and Poster Presentation Competition Awards - Great Hall**		
	Room 17 **Water Management** Moderator: A. Rose	**Room 18** **Oil and Gas Reclamation and Remediation** Moderator: R.C. Knox	**Room 19** **Ecology** Moderator: B. Schladweiler
1:30-2:00	Selected Metals in Sediments and Streams in the Oklahoma Part of the Tri-State Mining District, 2000-2006 by W.J. Andrews, M.F. Becker, S.L. Mashburn and S.J. Smith	An Update and Overview of the Oklahoma Energy Resources Board by S. Sowers	The Five Fundamentals of Successful Mined Land Rehabilitation by M.S. Theisen and L.G. Girard

	Wednesday June 18 (continued)		
	Room 17	**Room 18**	**Room 19**
2:00-2:30	Active Alkaline Addition Schemes for Removal of Diverse Contaminants From ARD by T. Wildeman, K. Vatterrodt, L. Figueroa and C. Bucknam		Solar-Powered Irrigation System - Jewett Lignite Mine, Jewett, TX by D. Ezell and J. Young
2:30-3:00	Monitoring Experimental Valley Fills Designed for Reduction of Total Dissolved Solids in Discharged Waters by D. Evans and C. Zipper	Assessment and Remediation of Salt Contamination at Oil and Gas Well Drilling Sites by J.B. Fisher	Application of Remote Sensing for Modeling Mine Fires and Vegetation in Jharia Coalfields, India by P. Kumar, R. Chopra and B.C. Dey
3:00-3:30	**Break - Great Hall**		
	Room 17	**Room 18**	**Room 19**
	Water Management Moderator: C. Neely	**Oil and Gas Reclamation and Remediation** Moderator: R.C. Knox	**Ecology** Moderator: M. Curran
3:30-4:00	Upper He Creek Water Balance Evaluation by T.W. Schmidt and K.L. Milmine	Land Application of Drill Cuttings by C. Penn and A. Whitacker	Patterns of Tree and Plant Community Development Across Different Soil Types on a Reclaimed Oil Sands Mine Site by B. Pinno, A. Lewis and R. Errington
4:00-4:30	Analysis of Microbial Communities in Vertical Flow Bioreactors at the Tar Creek Superfund Site by K.E. Duncan, R.W. Nairn, K. Strevett and J.K. Choi	Preventing New Groundwater Pollution from Old Oilfield Areas by P. Billingsley and J. Harrington	*Ecology Technical Division Meeting*
4:30-5:00	*Water Management Technical Division Meeting*		*Land Use Planning Technical Division Meeting*
5:30-10:00	**Evening Social Event - Oklahoma History Center** Buses depart south side of Renaissance Hotel at 5:30 and 5:45, return at 9:15 and 9:45		
	Thursday June 19, 2014		
	National Executive Committee Meeting - Lee Room (Renaissance Hotel)		

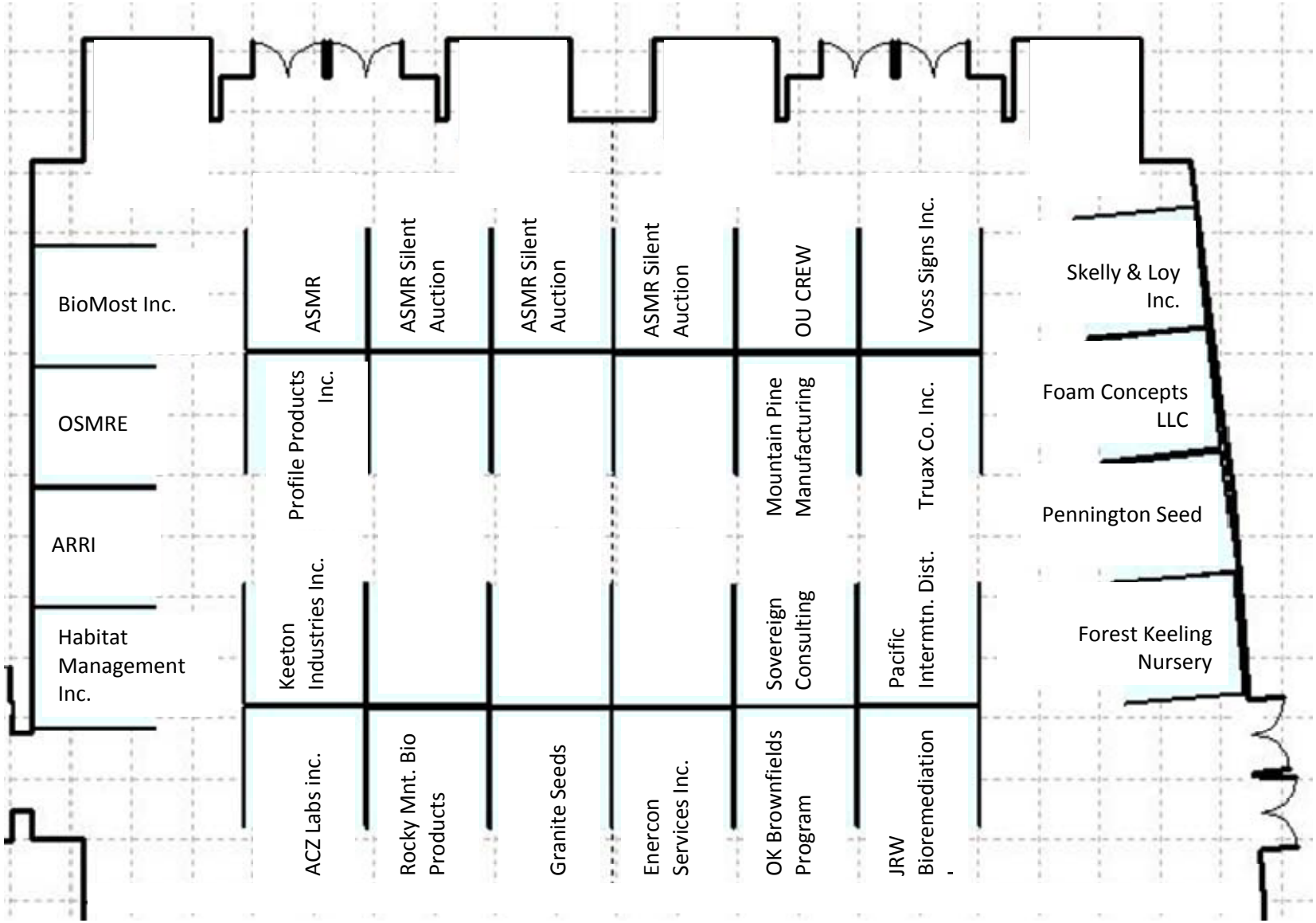
Cox Convention Center Meeting Rooms





Function	Location
Registration	Pre-Function Area
Plenary Session, Breaks, Lunches, Receptions, Poster Session	Great Hall Ballroom C
Exhibitors and Silent Auction	Great Hall Ballrooms D and E
Conference Office	Room 16
Concurrent Technical Sessions	Rooms 17, 18, 19, 20
Speaker Preparation	Room 21

ASMR 2014 Exhibitor Booths



Notes:

Thank you to our ASMR 2014 Meal and Break Sponsors!

$1000 Level

Texas Mining and Reclamation Association

$500 Level

Mushroom Farmers of Pennsylvania

The University of Oklahoma Office of the Vice President for Research
Norman Campus & Norman Campus Programs at OU-Tulsa

Wyoming Reclamation & Restoration Center
Working with land, air, water & wildlife

$300 Level

BKS Environmental Associates, Inc.

Watershed Restoration, Inc.

granite SEED and erosion control

And the Early Career Professionals' Event Sponsors!

Platinum ($500) Sponsor

American Society of Mining and Reclamation

Gold ($250-$499) Sponsors

VirginiaTech
www.vt.edu

Wyoming Reclamation & Restoration Center
Working with land, air, water & wildlife

Silver ($150-$249) Sponsors

BKS Environmental Associates, Inc.

KC Harvey Environmental, LLC

ASMR 2014 Exhibitors

ACZ Laboratories, Inc.
Steamboat Springs, CO
(800) 334-5493
www.acz.com

Appalachian Regional Reforestation Initiative

BMI mining & reclamation services

Habitat Management
Environmental & Natural Resource Services

30 Years

Mountain Pine Manufacturing
Beetle-Kill Wood Products

ENERCON
Excellence—Every project. Every day.

JRW Bioremediation
Cleaned by Nature

Office of Surface Mining Reclamation and Enforcement

CREW
Center for Restoration of Ecosystems and Watersheds
University of Oklahoma

American Society of Mining and Reclamation

KEETON INDUSTRIES
Other Ponds and Lakes are Green with Envy®

Empowering Oklahoma

Oklahoma Corporation Commission
Energy • Transportation • Utilities

Profile®
Solutions for your Environment™

truax Company, Inc.

Forrest Keeling .com
RPM®

We Plug Holes!
Foam Concepts, LLC
800.556.9641
www.foamconceptsllc.com

Rocky Mountain Bio Products
A Division of Bowman Construction Supply, Inc.

PENNINGTON®

Voss Signs®
Custom & Stock Signs for Long Term Outdoor Use

Sovereign Consulting Inc.

Skelly and Loy
Engineering - Environmental Consultants

granite SEED
and erosion control