



# Annual Report of the Idaho Geological Survey

Fiscal Year 2010

# **Annual Report of the Idaho Geological Survey**

**Fiscal Year  
2010**

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# HIGHLIGHTS

The funding and collegial support provided through cooperative projects have long been integral components of the agency's operation. The activities highlighted for the 2010 Annual Report represent long-term research, service, and education programs by the Survey. Over time, the staff has developed wide-ranging interdisciplinary networks in support of its mission. For a one-year snapshot of what has been a very productive synergy, look at the *Partners and Collaborators* section for the many organizations currently involved in Survey projects. This is a tribute to the staff's interest, initiative, and ingenuity in building these relationships. Details of the staff's professional engagement in the agency's agenda are in the staff *Publications and Activities* section at the end of this report.

## Mission Statement



The Idaho Geological Survey is the lead agency for collecting and disseminating geologic information and mineral data in the state. In addition to its main office in Moscow at the University of Idaho, the Survey has satellite offices in Pocatello at Idaho State University and in Boise at the Idaho Water Center and also Boise State University. Staff geologists conduct applied research with a strong emphasis on producing maps and information on Idaho's geologic setting, earth resources, and geologic hazards. Externally funded projects enhance this research.

## **Administration**

### **Partners and Collaborators**

The Survey's statewide mission encourages interdisciplinary partnerships and collaboration with many other agencies, organizations, and universities. This broad cooperation ranges from direct grants for individual projects to the collegial sharing of expertise and information. On the national level, the Survey is also directly involved in the initiatives of the Association of American State Geologists. These alliances offer many opportunities to engage in projects that enhance the agency's applied research and outreach.

### **Funding Partners**

Arizona Geological Survey ~ Idaho Bureau of Homeland Security ~ Idaho Department of Environmental Quality ~ Idaho Department of Lands ~ Idaho Department of Water Resources ~ Idaho State University ~ Idaho Transportation Department ~ Incorporated Research Institutions for Seismology ~ National Park Service ~ National Science Foundation ~ Snake River Section, Society for Mining Metallurgy and Exploration ~ U.S. Bureau of Land Management ~ U.S. Department of Energy ~ U.S. Forest Service ~ U.S. Geological Survey ~ U.S. Mine Safety and Health Training Program ~ University of Idaho Research Office ~ Washington State University

### **Collaborators**

American Geological Institute ~ Association of American State Geologists ~ Belt Association ~ Boise State University ~ Bonner County Museum ~ Cooperative Ecosystem Studies Units ~ Earthquake Engineering Research Institute ~ Greater Portneuf Water Resource Partnership ~ Ice Age Floods Institute ~ Idaho Concrete and Aggregate Producers Association ~ Idaho Conservation League ~ Idaho Geospatial Council ~ Idaho Earth Science Teachers Association ~ Idaho Mining Association ~ Idaho Histori-

cal Society ~ Idaho National Laboratory ~ Idaho Office of Energy Resources ~ Idaho Science Teachers Association ~ Idaho State University ~ Idaho Strategic Energy Alliance ~ Idaho Transportation Department ~ Idaho Water Resources Research Institute ~ Inside Idaho ~ Intermountain Forest Tree Nutrition Cooperative ~ Intermountain Regional Advisory Council, Advanced National Seismic System ~ Latah County Historical Society ~ Lewis Clark State College ~ Montana Bureau of Mines and Geology ~ National Science Foundation, Earthscope Program ~ Natural Resources Conservation Service ~ Nez Perce County ~ North Idaho College ~ Northwest Mining Association ~ Oregon Department of Geology and Mineral Industries ~ Pacific Northwest National Laboratory and Battelle-Pacific Northwest Division ~ Pocatello Ground Water Task Force ~ Tobacco Root Geological Society ~ U.S. Department of Agriculture Plant Materials Center, Agricultural Research, Washington State University ~ University of Utah Seismograph Stations ~ Utah State University ~ Washington Division of Geology and Earth Resources ~ Western North American Volcanic and Intrusive Rock Database ~ Western States Seismic Policy Commission ~ Yellowstone National Park ~ Yellowstone Volcano Observatory

### **Association of American State Geologists**

The Survey is an active participant in the Association of American State Geologists (AASG). As Idaho State Geologist, Roy Breckenridge represented Idaho AASG at the midyear meeting in Denver and the AASG Spring Liaison in Washington, D.C. During the year Roy served as a member of the minerals and policy committee and also served on the geologic hazards committee. The AASG is a strong advocate for the funding and reauthorization of the U.S. Geological Survey's National Cooperative Geologic Mapping Program (NCGMP) as well as research programs for data preservation, minerals, energy resources, and geologic hazards. AASG was successful in receiving an award for a nationwide geothermal database from the U.S. Department of Energy. The three year project includes all state geological surveys and is being led by the Arizona Geological Survey.

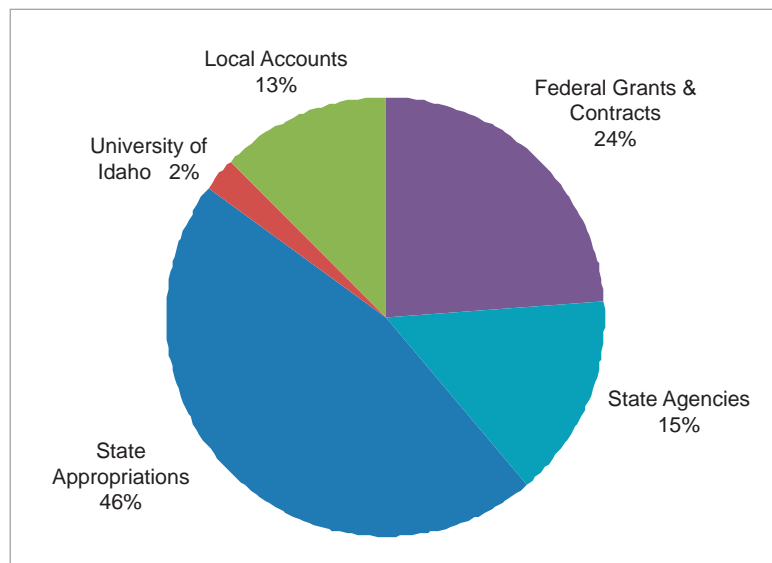
## Fiscal Overview

During the year, mandated reductions in state funding reduced the Survey's FY2010 initial appropriated budget from \$768,600 to \$710,940. The Survey and the University initiated a graduated furlough program to address the salary shortfall. During the legislative session, the Survey's budget was further reduced to \$701,100 for FY2011. The reduction is mostly in personnel funds. These cuts to the budget base adversely change the agency's mission in research, public service, and education.

Budget Fiscal Year 2010				
Appropriation	Beginning Balance	Income	Expense	Ending Balance
Personnel		\$ 693,600.00	\$ 693,600.00	\$ 0.00
Operating Expense		14,748.80	14,748.80	0.00
Capital Outlay		2,591.20	2,591.20	0.00
Total		710,940.00	710,940.00	0.00
U/I Personnel Funds		37,240.31	37,240.31	0.00
Local Accounts	\$117,653.57	76,914.48	110,785.52	\$ 83,782.53
Grants and Contracts	NA	598,421.40	544,631.10	NA
Total	\$117,653.57	\$1,423,516.19	\$1,403,596.93	\$137,572.83

NA = not applicable

## Sources of Funding



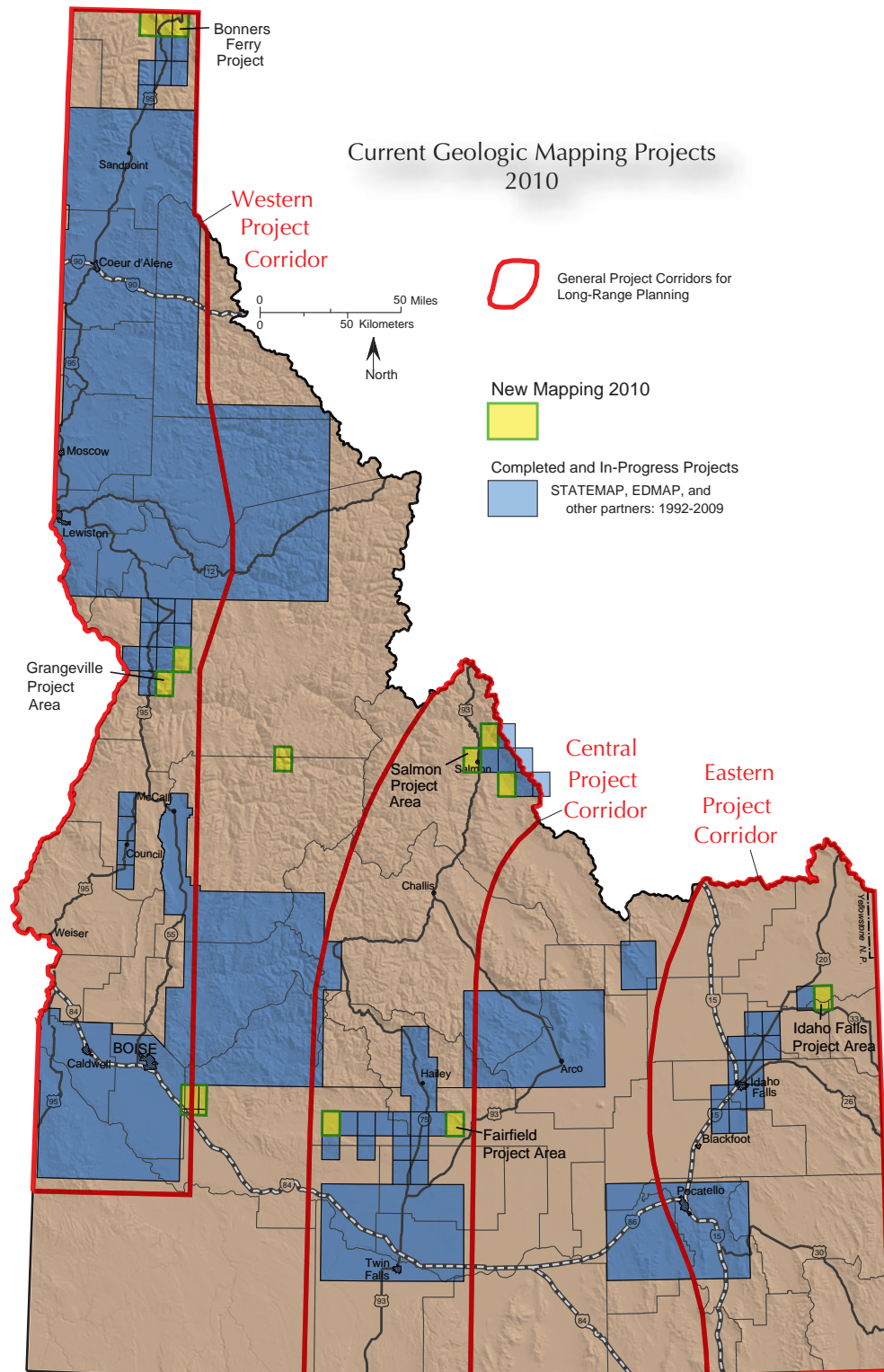


## Research

### Geological Mapping and Related Studies

The Survey's primary research activity is mapping and publishing the geology of Idaho's 7.5' and 30' x 60' quadrangles. Before 1990, geologic mapping in Idaho was primarily conducted in localized rural areas to facilitate extraction of earth resources. In the last two decades, the Survey has been mapping in areas selected specifically because of development impacts in urban settings, for earth-resource needs, and to advance the science. The Idaho Geologic Mapping Advisory Committee (IGMAC) assists the Survey by assessing Idaho's mapping needs and addressing long-term plans for geologic mapping. The committee guides the medium- and short-term mapping plans to take advantage of state partnerships. Idaho's geologic map products have been used, for example, to designate landslide hazards; to define mineralization potential; to delineate rock units that form boundaries of aquifers; to show geologic materials for engineering needs; to better predict groundwater resources; to aid in highway design and construction; and to define geologic resources of public lands which include Idaho's parks, recreation areas, and endowment lands.

Funding of Idaho's geologic mapping program is shared by the STATEMAP component of the National Cooperative Geologic Mapping Program. Since 1993 Idaho has received nearly \$3 million in federal funds and matched an equal amount of state money to complete geologic mapping in Idaho. In 2010 the Idaho Survey again ranked highest in the nation with the largest funding award of all STATEMAP proposals. During the year Survey geologists worked in project areas throughout the state and mapped eleven 7.5' quadrangles.



## **Idaho Geological Mapping Advisory Committee 2010**

**David P. Jackson – Chairman**  
Idaho Bureau of Homeland Security

**Gail Ewart**  
Geospatial Information Officer  
Idaho Department of Administration Geospatial  
Office

**Tom Frost**  
U.S. Geological Survey Minerals Program

**Paul Gessler**  
Geospatial Laboratory for  
Environmental Research, University of Idaho  
IdahoView / America View Program

**Nancy Glenn**  
Boise Center Aerospace Laboratory  
Idaho State University

**Jerome Mapp**  
Idaho Planning Association

**Keith Nottingham**  
Idaho Transportation Department

**Paul Pedone**  
Natural Resource Conservation  
NRCS State Geologist, Oregon and Idaho

**Kenneth C. Reid, PhD.**  
State Archaeologist and  
Deputy SHPO Preservation Office  
Idaho State Historic Office

**John Tracy**  
Idaho Water Resources Research Institute

**Scott Van Hoff**  
U. S. Geological Survey Geospatial Liaison

**Sylvie White**  
TerraPen Geographics  
Maps and More

## Hydrogeology

The Survey cooperates with state and federal agencies, other university programs, and water-users throughout Idaho in research, monitoring and management activities relating to the state's ground-water resources. Research and monitoring activities include analysis and modeling of aquifer hydrogeology, ground-water levels, and ground-water contamination. Management-related activities include assessing the impact of septic sewage disposal on ground water, the water-bearing potential of areas slated for development, the geologic aspects of water supply problems, and communicating research and monitoring results to state and local governments, regulatory authorities, city and county planners, and to private and public interests seeking information about ground water management issues.

Researchers are utilizing hydrogeologic information contained in the Idaho Department of Water Resources' (IDWR) Well Construction Database to better understand the subsurface geologic and hydrologic characteristics of the eastern and western Snake River Plain and other areas. This information, together with surface geologic mapping and historical hydrologic data, is used to develop subsurface models of an aquifer and its response to short- and long-term stresses that affect water supply. Geographic Information Systems (GIS) technology and spatial statistical analysis are being used to integrate information on water levels derived from IDWR's network of water-level monitoring wells and the water levels recorded in drillers logs to extract information about aquifer characteristics beyond what is possible using only data from the monitoring network.

Contamination of Idaho's ground water by nitrate and other compounds derived from septic leachate is one of the most pervasive water-quality management problems in the state. The Survey cooperates with Idaho's Department of Environmental Quality (IDEQ) on a number of fronts related to water quality, including: a



GIS screening tool to assess the risk that septic sewage disposal poses to ground-water quality; the use of spatial statistical techniques to map changes in water quality and delineate Nitrate Priority Areas (NPAs) in a statistically defensible manner; developing spatio-temporal models of changing nitrate levels in NPAs; and providing technical input to IDEQ via the state's Ground-Water Monitoring Technical Committee. The Survey is currently involved in a special working subgroup to reassess the design of the state's water-quality monitoring network, possibly using spatio-temporal optimization of existing water-quality data to maximize the cost/benefit return on the state's future network expenditures.

### **Digital Geologic Maps**

The Survey's digital mapping and GIS laboratory provides services that include digital cartography, spatial data management, database management and design, network system administration, graphic design and desk-top publishing, and Web-site support. The lab continues to compile geology from around the state in a geologic map database in addition to producing geologic maps. Thirty-five geologic maps were published this year. All are available as print-on-demand color maps and can be viewed free on the Web site.

The statewide geologic map database is now available for download on the State Clearing House for Geospacial Data as an ESRI Geodatabase. This GIS database supplies map analysts with the best available geologic map data while helping the Survey to manage the data better and implement software updates and migration. The ESRI Geodatabase format lends itself to future interactive online delivery.

### **Databases and Archives**

The Survey stores and maintains several databases. Many of these data portray spatial information and include additional data tables all stored in relational databases. Interactive data available

on the Survey's Web site include sets of information on earthquake epicenters, mines and prospects, and geologic faults. Mines and prospects data are available for download. The IGS archives were inventoried for the National Geological and Geophysical Data Preservation Program in FY08 and in FY09 precise location information was obtained for over 2,600 mines and prospects within the IGS Mineral Property File collection. In FY10 the emphasis was on archiving mine maps and creating a digital index of the statewide oil and gas well log collection that was obtained in June, 2009. Recent geothermal and oil and gas exploration in Idaho has increased the number of requests for these logs.

## **Geologic Hazards**

Idaho is susceptible to significant hazards from earthquakes. The Survey works to support hazard mitigation in several ways. Public awareness is addressed through website information and direct contact by e-mail, telephone, and occasional public lectures. Landslide hazards are documented in geological mapping conducted through the STATEMAP program. The IGS collaborates with the Yellowstone Volcano Observatory in monitoring volcanism and preparing hazard response in the Yellowstone Plateau area. In 2009, the IGS also collaborated with the U.S. Geological Survey by assisting with the installation of a new seismic monitoring station near McCall. This station will improve monitoring in a region of Idaho notable for earthquake swarms.

In FY10, the Survey conducted earthquake hazard mitigation activities with funding from the Idaho Bureau of Homeland Security (IBHS). These activities consisted of the following:

- Preparation of digital National Earthquake Hazard Reduction Program soil class and liquefaction susceptibility maps at scale 1:24,000 of the Idaho Falls-Rexburg area. These maps will assist engineers and planners design shaking-resistant communities.

- Preparation of *Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes*. Over 170,000 copies of this handbook were released as a supplement in weekend newspapers in Boise, Twin Falls, Idaho Falls, and Pocatello. Additional copies have been distributed to teachers and emergency management officials in northern Idaho.
- Participation in meetings of the Idaho Seismic Advisory Committee. This committee advises IBHS on issues related to earthquake hazards and risk reduction strategies.
- Participation in revision of the earthquake chapter of the Idaho State Hazard Mitigation Plan (SHMP). Updating the SHMP qualifies Idaho for all available federal assistance in the event of disasters. It provides a framework to save lives and reduce vulnerability to natural and man-made hazards.
- Presentation of public lectures on earthquake scenarios and research activities for the Idaho Seismic Advisory Committee Earthquake Hazard Listening Sessions in Meridian and Idaho Falls. The sessions were designed to raise public awareness of regional earthquake hazards.

## **Mines and Mining**

### **Active Mining**

While Idaho's mining industry did suffer in the recession that started in late 2008, many commodity prices, especially precious and base metal prices, were recovering nicely by mid-2009. Consequently, employment and profits were looking up by late 2009 for metal miners. Construction-related materials and industrial mineral operations were still suffering however.

Production data collected by the U.S. Geological Survey show that in 2008, Idaho's non-fuel mineral production value topped \$1 billion. This is the first time the value has reached the billion dollar mark for Idaho, though final precise figures are not out yet. Molybdenum was the leading contributor to the value.

Major mining-related developments in 2009 include the rebound in silver and base metal prices which favored operations at silver mines in the Coeur d'Alene District, resource increases and potential future expansions at the Lucky Friday and Thompson Creek mines, start of mining on new panels at Smoky Canyon phosphate mine, approval of the Environmental Impact Statement (EIS) and other permits needed for the Idaho Cobalt mine in Lemhi County, and release of the Draft EIS for the Blackfoot Bridge phosphate mine. While financing difficulties stymied projects of some junior mining companies, there were still several large projects underway and spending money. Major ones included Azteca Gold's Two Mile deep drilling near Osburn, New Jersey Mining's Toboggan joint venture at Murray, the Crescent mine re-opening announced by SNS, the Golden Meadows project near Stibnite, and Mosquito Consolidated's drilling on the Cumo prospect in Boise County.

During the year requests for minerals information and mine files and reports dramatically increased as a result of the boom in exploration activity. Requests for geologic information related to energy exploration including uranium, geothermal, and oil and gas resources also increased.

## **Mining Histories**

The Survey continues with its popular — and award-winning — series of mine history reports, which combine published references with unpublished materials from its mineral property files. *A History of the Viola Mine in Lemhi County* was published during the year.

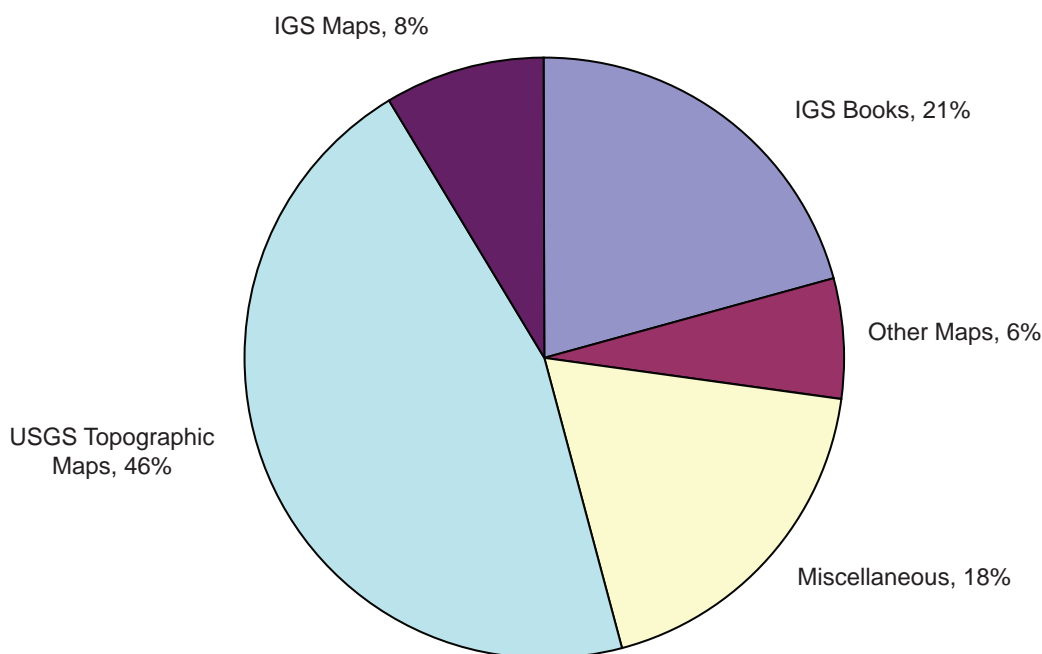


## Outreach

The Survey disseminates geologic and mineral data on Idaho primarily through its publications, Web site, in-house collections, and efforts by the staff in educating the public in the earth sciences.

### Publications

#### Publication Sales



### The Web Site—[www.idahogeology.org](http://www.idahogeology.org)

The Web site provides customers electronic access to its publications and data. Over 97% of IGS publications are now available free for download in PDF format. Finding information on the Web site has been simplified. Publications can be located via search engines on the site. Geologic data are available there as well, including GIS geologic map data sets and geochemical analyses. Information about Idaho mines and prospects can be found quickly and data downloaded easily using another search tool. In FY 2010, 493,582 users visited the Survey website for information and downloaded 205,519 products.

## **Mine Safety Training**

The U.S. Department of Labor's Mine Safety and Health Administration distributes federal grants to 49 states and the Navajo Nation. Grant funds are used to support health and safety training courses and programs designed to reduce mining accidents, injuries, and illnesses.

The University of Idaho, Idaho Geological Survey remains committed to providing expert health and safety training and re-training that meets the requirements for 30 CFR parts 46 and 48 New Miner Training and Annual Refresher Training, and part 49 Mine Rescue Training. In addition, the Survey offers MSHA approved classes on such varied subjects as fall protections, powered haulage, accident prevention, electrical hazards, silicosis prevention, respiratory protection, prevention of hearing loss, substance abuse, hand and forearm safety, Miners rights and responsibilities, water hazards, job safety analysis, mine gases, and hazard communications. Training is conducted on-site whenever feasible and is designed to be as site specific as possible. Before training begins the instructor conducts an inspection of the property with the mine manager or safety supervisor. The program is then adapted to address their findings. Mine Rescue Training consists of actual mock rescues underground, the use of hands-on training, classroom instruction and mine rescue competitions. Surface mine rescue training includes rope rescue training, confined space rescue training, knowledge and control of hazardous materials (HAZMAT). All training includes first aid. During FY 2010 this program trained and certified 1715 miners and industry supervisors in the state and region.

## **Earth Science Education**

In FY2010, the Survey advanced its commitment to earth science education through a summer field workshop for Idaho's educators, an exhibit at the annual Idaho Science Teachers Asso-

ciation (ISTA) meeting, and a two-day field trip for the Annual Meeting of the Pacific Northwest Section of the National Association of Geoscience Teachers.

The Idaho Earth Science Educator Summer Field Workshop was held July 13-18, 2009 in the Hagerman/Glenns Ferry Area, Idaho. Major funding for the workshop was provided by the Idaho Geological Survey. The focus was on volcanism of the Snake River Plain, Lake Idaho, and the Bonneville Flood. Eight K-12 educators from around the state attended the workshop, which was instructed by IGS staff. The educators examined lava flows of various ages, landslides, lava dammed lake deposits, and flood deposits. Participants spent a day with the U.S. National Park Service at Hagerman Fossil Beds National Monument. The workshop concluded with individual teacher projects designed to transform workshop material into activities suitable for use in real classrooms.

On October 1-2, 2009, the Survey exhibited a display on Idaho natural hazards and geology at the annual ISTA meeting in Boise. The meeting was attended by teachers from across the state. The Survey distributed Earth Science Education Week packets to teachers at the meeting. American Geological Institute hosts Earth Science Week in cooperation with sponsors as a service to the public and the geoscience community. Each year, local groups, educators, and interested individuals organize celebratory events. Earth Science Week offers opportunities to discover the earth sciences and engage in responsible stewardship of the earth. The program is supported by the United States Geological Survey, National Aeronautics and Space Administration, the National Park Service, the American Association of Petroleum Geologists Foundation, United States Department of Energy, ExxonMobil, Environmental Systems Research Institute, and other geoscience groups.

Due to funding cuts the Idaho Geological Survey's 2010 field workshop for teachers was incorporated into a two-day field trip at

the National Association of Geoscience Teachers conference at College of Southern Idaho in Twin Falls. The National Association of Geoscience Teachers is an organization interested in promoting excellence in geoscience education at the K-12 and higher education levels. The two-day trip was entitled: Effects of Volcanism and the Bonneville Flood in the Central Snake River Plain.

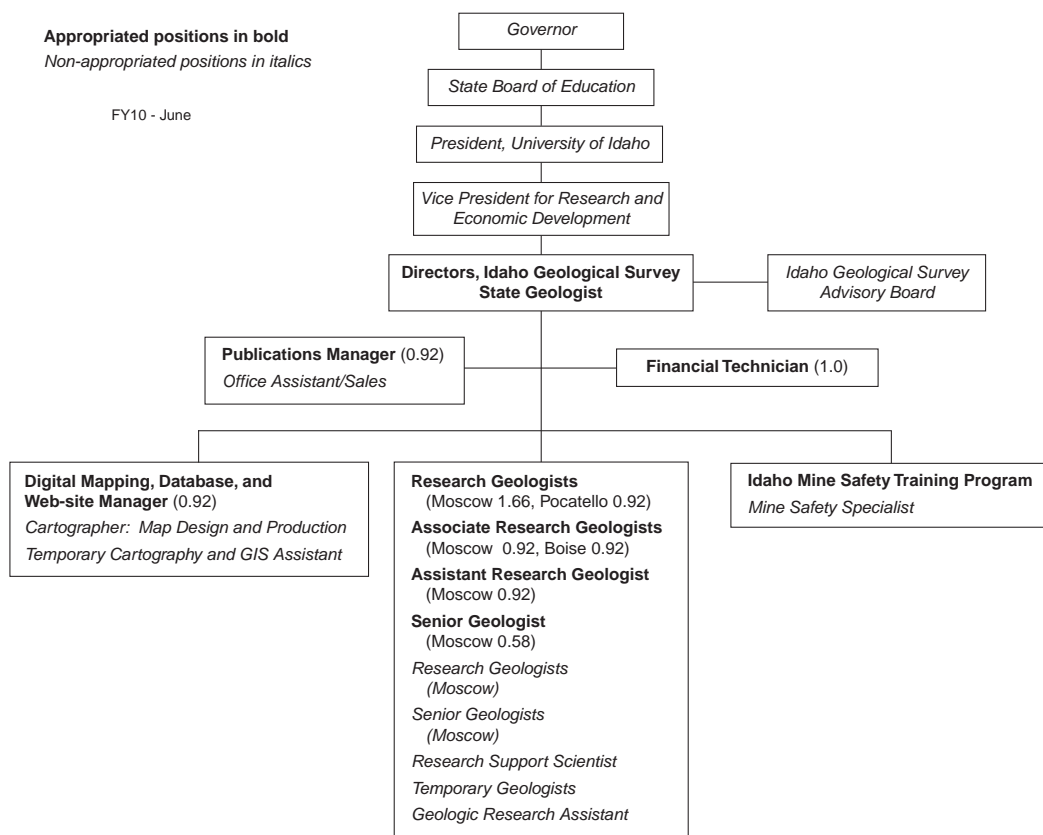


# ORGANIZATION AND PERSONNEL

## Organization Chart

Appropriated positions in bold  
Non-appropriated positions in italics

FY10 - June



# Directory

## Moscow office

Morrill Hall, Third Floor  
University of Idaho  
PO Box 443014  
Moscow, ID 83844-3014  
208-885-7991 Fax 208-885-5826

## Boise satellite

Idaho Water Center, Suite 201  
322 E. Front Street  
Boise, ID 83702-7359  
208-332-4420 Fax 208-332-4400

## Pocatello satellite

Physical Science, Room 201B  
Idaho State University  
MS 8071  
Pocatello, ID 83209-8071  
208-282-4254 Fax 208-282-4414

## Administrative and Support Staff

Roy M. Breckenridge ..... Director and State Geologist  
Kurt L. Othberg ..... Director  
Roger C. Stewart ..... Manager, Publications and Communications  
Tracy Kanikkeberg ..... Financial Technician  
Sherry E. Pixley ..... Office Assistant/Sales

## Research, Full Time

Roy M. Breckenridge ..... Full Research Geologist  
Jane S. Freed ..... Cartographer  
Collette Gantenbein ..... Cartographer/GIS Assistant  
Dean L. Garwood ..... Senior Geologist  
Virginia S. Gillerman ..... Associate Research Geologist, Boise  
John D. Kauffman ..... Senior Geologist  
Reed S. Lewis ..... Associate Research Geologist  
Victoria E. Mitchell ..... Research Support Scientist  
Kurt L. Othberg ..... Full Research Geologist  
William M. Phillips ..... Assistant Research Geologist  
Loudon R. Stanford ..... Manager, Digital Map and GIS Lab  
Michael J. Weaver ..... Mine Safety Specialist, C.M.S.P.  
John A. Welhan ..... Full Research Geologist, Pocatello

## Research and Support, Part-Time

Russell F. Burmester ..... Geologist  
James R. Cash ..... Earth Science Instructor  
Don J. Derrick ..... Work Study  
Glenn F. Embree ..... Geologist  
Richard M. Gaschnig ..... Geologist  
Kelly A. Hugo ..... Work Study  
Becky Kolb ..... Work Study  
Teresa A. Kusic ..... Work Study, Non-lab Research  
Mark D. McFadden ..... Geologist  
Sherry E. Pixley ..... Non-lab Research  
Keegan L. Schmidt ..... Geologist  
David E. Stewart ..... Geologist  
Christopher Tate ..... Work Study

## **Idaho Geological Survey Advisory Board**

**George Bacon**  
Director, Idaho Department of Lands

**Mickey Gunter**  
Chair, Department of Geological Sciences,  
University of Idaho

**David Hawk**  
Representing Office of the Governor

**David Rodgers**  
Chair, Department of Geological Sciences,  
Idaho State University

**David Jackson**  
Idaho Bureau of Homeland Security

**Karl Languirand**  
Idaho Association of Professional Geologists

**Jack Lyman**  
Executive Director,  
Idaho Mining Association

**David Wilkins**  
Chair, Department of Geosciences,  
Boise State University

### **Ex Officio Members**

**Roy Breckenridge**  
Director and State Geologist,  
Idaho Geological Survey

**Kurt Othberg**  
Director, Idaho Geological Survey

# PUBLICATIONS AND ACTIVITIES

## Publications

*Annual Report of the Idaho Geological Survey Annual Report, Fiscal Year 2009:* Idaho Geological Survey Web site, 2009.

*Geologic Map of the Arco 30 x 60 Minute Quadrangle, South-Central Idaho*, by Betty Skipp, Lawrence G. Snider, Susanne U. Janecke, and Mel A. Kuntz: Idaho Geological Survey Geologic Map 47, 42-page booklet, scale 1:100,000, 2009.

*Geologic Map of the Bohannon Spring Quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana*, by Reed S. Lewis, Kurt L. Othberg, Russell F. Burmester, Jeffrey D. Lonn, Loudon R. Stanford, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 113, scale 1:24,000, 2009.

*Geologic Map of the Bonners Ferry Quadrangle, Boundary County, Idaho*, by Roy M. Breckenridge, Russell F. Burmester, Mark D. McFaddan, and Reed S. Lewis: Idaho Geological Survey Digital Web Map 108, scale 1:24,000, 2009.

*Geologic Map of the Goldstone Pass Quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana*, by Jeffrey D. Lonn, Loudon R. Stanford, Russell F. Burmester, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 114, scale 1:24,000, 2009.

*Geologic Map of the Grave Point Quadrangle, Idaho County, Idaho, and Wallowa County, Oregon*, by Keegan L. Schmidt, John D. Kauffman, David E. Stewart, Dean L. Garwood, Kurt L. Othberg, and Reed S. Lewis: Idaho Geological Survey Digital Web Map 111, scale 1:24,000, 2009.

*Geologic Map of the Idaho Parts of the Orofino and Clarkston 30 x 60 Minute Quadrangles*, by John D. Kauffman, Dean L. Garwood, Keegan L. Schmidt, Reed S. Lewis, Kurt L. Othberg, and William M. Phillips: Idaho Geological Survey Geologic Map 48, 35-page booklet, scale 1:100,000, 2009.

*Geologic Map of the Kitty Creek Quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana*, by Reed S. Lewis, Russell F. Burmester, Loudon R. Stanford, Jeffrey D. Lonn, Mark D. McFaddan, and Kurt L. Othberg: Idaho Geological Survey Digital Web Map 112, scale 1:24,000, 2009.

*Geologic Map of the Mt. Coeur d'Alene Quadrangle and Part of the Mica Bay Quadrangle, Kootenai County, Idaho*, by James L. Browne: Idaho Geological Survey Technical Report 09-2, scale 1:24,000, 2009.

*Geologic Map of the Moravia Quadrangle, Boundary County, Idaho*, by Russell F. Burmester, Roy M. Breckenridge, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey Digital Web Map 107, scale 1:24,000, 2009.

*Geologic Map of the Naples Quadrangle, Boundary and Bonner Counties, Idaho*, by Mark D. McFaddan, Roy M. Breckenridge, Russell F. Burmester, and Reed S. Lewis: Idaho Geological Survey Digital Web Map 109, scale 1:24,000, 2009.

*Geologic Map of the Slate Creek Quadrangle, Idaho County, Idaho*, by Keegan L. Schmidt, John D. Kauffman, David E. Stewart, Reed S. Lewis, Kurt L. Othberg, and Dean L. Garwood: Idaho Geological Survey Digital Web Map 110, scale 1:24,000, 2009.

*History of Mines in the Smiley Creek Area of the Vienna Mining District, Blaine and Camas Counties, Idaho*, by Victoria E. Mitchell: Idaho Geological Survey Staff Report 09-6, 56 p., 2009.

*History of the Viola Mine, Lemhi County Idaho*, by Victoria E. Mitchell: Idaho Geological Survey Staff Report 10-4, 34 p., 2010.



- Idaho*, by Roy M. Breckenridge: Association of American State Geologists Journal, v. 60-61, 2009.
- Idaho Mining and Exploration, 2009*, by Virginia S. Gillerman and Earl H. Bennett: Idaho Geological Survey Staff Report S-10-5, 22p., 2010.
- Insights into the Metamorphic Evolution of the Belt-Purcell Basin; Evidence from Lu-Hf Garnet Geochronology*, by N. Alexander Zirakparvar, Jeffrey D. Vervoort, William C. McClelland, and Reed S. Lewis: Canadian Journal of Earth Sciences, v. 47, no. 2, p. 161-179, 2009.
- Lake Indian Road—History and Geology Field Trip Guide, David Thompson Bicentennial Commemoration*, by Tom Sandberg, Roy Breckenridge, and Jack Nisbet: Bonner County Historical Society and Idaho Historical Society, Panhandle National Forest, 12 p., 2009.
- List of Publications–2009*, by Roger C. Stewart: Idaho Geological Survey catalogue available only on the Web site, 2009.
- Major Oxide and Trace Element Analyses for Igneous Rock Samples From Northern Idaho and Northeastern Washington*, by Reed S. Lewis, David M. Miller, and Fred K. Miller: Idaho Geological Survey Digital Analytical Data 5, 2009.
- Major Oxide and Trace Element Analyses for Igneous Rock Samples From South-Central Idaho*, by Reed S. Lewis and Thor H. Kiilsgaard: Idaho Geological Survey Digital Analytical Data 6, 2009.
- Putting Down Roots in Earthquake Country—Your Handbook for Earthquakes in Idaho*, by William M. Phillips, Roy M. Breckenridge, and Kenneth Sprenke: Idaho Bureau of Homeland Security, 37 p., 2009.
- Road Guide to the Columbia River Basalt Group of the Lewiston, Kendrick, Deary, Moscow Area, Idaho*, by James R. Cash and Dean L. Garwood: Idaho Geological Survey Staff Report 10-6, 20 p., 2010.

*Site Inspection Report for Abandoned and Inactive Mines in Southern Idaho: Volume I: Silver City-War Eagle Mountain Area, Owyhee County, Idaho*, by John Kauffman, Earl H. Bennett, and Victoria E. Mitchell: Idaho Geological Survey Staff Report 10-1, 414 p., 2010.

*Site Inspection Report for Abandoned and Inactive Mines in Southern Idaho: Volume II: Flint Creek-South Mountain Area, Owyhee County, Idaho*, by Earl H. Bennett, John Kauffman, and Victoria E. Mitchell: Idaho Geological Survey Staff Report 10-2, 153 p., 2010.

*Site Inspection Report for Abandoned and Inactive Mines in Southern Idaho: Volume III: Miscellaneous Properties, Owyhee County, Idaho*, by Earl H. Bennett, John Kauffman, and Victoria E. Mitchell: Idaho Geological Survey Staff Report 10-3, 324 p., 2010.

*Sources of Nitrate Contamination in Ground Water of Pleasant Valley, Power County, Idaho*, by J.A. Welhan and N. Poulson: Idaho Geological Survey Staff Report 09-7, 56 p., 2009.

*Stratigraphy and Tectonics of the Central and Eastern Portions of the Columbia River Flood-Basalt Province: An Overview of Our Current State of Knowledge*, by Terry L. Tolan, Barton S. Martin, Stephen P. Reidel, John D. Kauffman, Dean L. Garwood, and James L. Anderson, in J.E. O'Connor, R.J. Dorsey, and I.P. Madin, eds., *Volcanoes to Vineyards: Geologic Field Trips Through the Dynamic Landscape of the Pacific Northwest*: Geological Society of America Field Guide 15, p. 645-672, 2009.

## **Abstracts**

*A Risk Assessment Model for Ground Water Septic Contamination*, by John A. Welhan and C. Moore: Proceedings of 14<sup>th</sup> Intermountain Conference on the Environment and 42<sup>nd</sup> Engineering Geology and Geological Engineering Symposium, Pocatello, November 5-6, 2009.

*Crustal Growth and Recycling and Links to Tectonism in the Idaho Batholith and Challis Intrusive Province*, by Richard Gaschnig,

Jeffery D. Vervoort, and Reed S. Lewis: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 589, 2009.

*Geologic Mapping at the Idaho Geological Survey: Success Resulting From the USGS Statemap Program*, by Kurt L. Othberg, Reed S. Lewis, Loudon R. Stanford, and Roy M., Breckenridge: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 39, 2009.

*Ice Age Floods Research and Mapping in Idaho: Results From STATEMAP*, by Roy M. Breckenridge and Dean L. Garwood: Geological Society of America Abstracts with Programs, v. 41, no. 7, paper no. 101-41, 2009.

*Integration of Water Well Records With Geologic Mapping Along the Snake River, Eastern Idaho*, by William M. Phillips and John A. Welhan: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 284, 2009.

*New Mine Developments in Idaho: A Tale of Reserves and Environmental Issues*, by Virginia S. Gillerman: Geological Society of Nevada Great Basin Evolution and Metallogeny, 2010 Symposium Program with Abstracts, p. 50, 2010.

*Regional Stratigraphic Implications From New Mapping of the Northern Beaverhead Range, Montana and Idaho*, by Jeffrey D. Lonn, Reed S. Lewis, Russell F. Burmester, and Mark D. McFadden: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 285, 2009.

*Revised Stratigraphy for Several Saddle Mountains and Wanapum Basalt Units, Columbia River Basalt Group*, by John D. Kauffman and Dean L. Garwood: Geological Society of America Abstracts with Programs, v. 41, no. 7, paper no. 106-11, 2009.

*A Risk Assessment Model for Ground-Water Septic Contamination*, by John A. Welhan and C. Moore: 14<sup>th</sup> Intermountain Conference on the Environment and 42<sup>nd</sup> Engineering Geology and Geological Engineering Symposium, Proceedings, Pocatello, November 5-6, 2009.

*The Tectonic Development of the Eastern Columbia River Flood-Basalt Province*, by Stephen P. Reidel, Terry Tolan, John D. Kauffman, and Dean L. Garwood: Geological Society of America Abstracts with Programs, v. 41, no. 7, paper no. 80-11, 2009.

*Testing Hypotheses on the Origin of the Syringa Embayment in the Salmon River Suture Zone, Western Idaho, USA*, by Keegan L. Schmidt, Reed S. Lewis, Richard Gaschnig, and Jeffrey Vervoort: Geological Society of America Abstracts with Programs, v. 41, no. 7, p. 223, 2009.

## Reports

*2009 Idaho Report to Western States Seismic Policy Council*, by David Jackson and William M. Phillips: Idaho Geological Survey report to the Western States Seismic Policy Council Quarterly e-Newsletter, December.

*An Objective GIS Screening Tool for Rating the Suitability of Land for Septic-based Development*, by J.A. Welhan and C. Moore: Draft Final Project Report, IDEQ Contract C751, 39 p., plus appendices, April.

*Digital Mapping Techniques '08—Workshop Proceedings*, by Association of American State Geologists, U.S. Geological Survey, and Idaho Geological Survey, U.S. Geological Survey Open-File Report 2009-1298, March.

*Effects of Volcanism and the Bonneville Flood in the central Snake River Plain near Twin Falls and Hagerman, Idaho*, by K.L. Othberg and D.L. Garwood, two-day field guide for the Annual Meeting of the Pacific Northwest Section of the National Association of Geoscience Teachers, Twin Falls, Idaho, 35 p., June.

*Geologic Map of the East of Salmon Quadrangle, Lemhi County, Idaho*, by Kurt L. Othberg, Loudon R. Stanford, and Reed S. Lewis: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Fairfield Quadrangle, Camas County, Idaho*, by Kurt L. Othberg and John D. Kauffman: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Gannett Quadrangle, Blaine County, Idaho*, by Dean L. Garwood, Kurt L. Othberg, and John D. Kauffman: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Goldstone Mountain Quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana*, by Reed S. Lewis, Kurt L. Othberg, Loudon R. Stanford, Russell F. Burmester, Jeffrey D. Lonn, and Mark D. McFaddan: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Lucile Quadrangle, Idaho County, Idaho*, by Reed S. Lewis, Keegan L. Schmidt, Kurt L. Othberg, David E. Stewart, and John D. Kauffman: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the McHan Quadrangle, Camas and Gooding Counties, Idaho*, by John D. Kauffman, Kurt L. Othberg, and Dean L. Garwood: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the McKinzie Creek Quadrangle, Idaho County, Idaho*, by John D. Kauffman, Keegan L. Schmidt, Reed S. Lewis, David E. Stewart, Kurt L. Othberg, and Dean L. Garwood: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Meadow Creek Quadrangle, Boundary County, Idaho*, by Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, and Reed S. Lewis: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Moyie Springs Quadrangle, Boundary County, Idaho*, by Russell F. Burmester, Roy M. Breckenridge, Mark D.



McFaddan, and Reed S. Lewis: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Newdale Quadrangle, Fremont and Madison Counties, Idaho*, by Glenn F. Embree, William M. Phillips, and John A. Welhan: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Ritz Quadrangle, Boundary County, Idaho*, by Roy M. Breckenridge, Russell F. Burmester, and Reed S. Lewis: Idaho Geological Survey report to the U.S. Geological Survey for STATEMAP, scale 1:24,000, April.

*Geologic Map of the Twentymile Creek Quadrangle, Boundary County, Idaho*, by Russell F. Burmeister, Roy M. Breckenridge, Reed S. Lewis, and Mark D. McFaddan: Idaho Geological Survey report to the Idaho Department of Lands, scale 1:24,000, August.

*Geodatabase of NEHRP Site Class and Liquefaction Susceptibility Maps for the Idaho Falls - Rexburg Area, Southeast Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, Digital Database DD-2, [www.idahogeology.org](http://www.idahogeology.org), January.

*Ice Age Floods Field Trip—Lake Pend Oreille and the Hoodoo Valley to Priest River, Idaho*, by Roy M. Breckenridge: Coeur du Luge Chapter—Heart of the Floods, Ice Age Floods Institute, 10 p., July.

*Liquefaction Susceptibility Map for the Ammon Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Firth Quadrangle, Bingham County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Goshen Quadrangle, Bingham and Bonneville Counties, Idaho*, by William M. Phillips, John A.

Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Idaho Falls North Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Idaho Falls South Quadrangle, Bingham and Bonneville Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Lewisville Quadrangle, Bonneville and Jefferson Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Menan Buttes Quadrangle, Jefferson and Madison Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Rexburg Quadrangle, Madison County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*Liquefaction Susceptibility Map for the Rigby Quadrangle, Bonneville and Jefferson Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

- Liquefaction Susceptibility Map for the Ririe Quadrangle, Jefferson and Madison Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- Liquefaction Susceptibility Map for the Ucon Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- Liquefaction Susceptibility Map for the Woodville Quadrangle, Bingham County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- National Cooperative Geologic Mapping Program, Idaho*, by Idaho Geological Survey staff: U.S. Geological Survey information sheet, 1 p., May.
- NEHRP Site Class Map for the Ammon Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- NEHRP Site Class Map for the Firth Quadrangle, Bingham County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- NEHRP Site Class Map for the Goshen Quadrangle, Bingham and Bonneville Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.
- NEHRP Site Class Map for the Idaho Falls North Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Idaho Falls South Quadrangle, Bingham and Bonneville Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Lewisville Quadrangle, Bonneville and Jefferson Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Menan Buttes Quadrangle, Jefferson and Madison Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Rexburg Quadrangle, Madison County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Rigby Quadrangle, Bonneville and Jefferson Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Ririe Quadrangle, Jefferson and Madison Counties, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Ucon Quadrangle, Bonneville County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*NEHRP Site Class Map for the Woodville Quadrangle, Bingham County, Idaho*, by William M. Phillips, John A. Welhan, Roy M. Breckenridge: Idaho Geological Survey report to Idaho Bureau of Homeland Security, scale 1:24,000, [www.idahogeology.org](http://www.idahogeology.org), June.

*New Seismic Monitoring Station Installed Near McCall*, by William M. Phillips: Idaho Geological Survey report to the Idaho Bureau of Homeland Security Quarterly Newsletter, October.

*Part 1: Procedures and Test Maps for Digital Liquefaction Susceptibility Maps and NEHRP Soil Class Maps at Scale 1:24,000 for the Idaho Falls Area*, by William M. Phillips, John A. Welhan, and Roy M. Breckenridge: Idaho Geological Survey report (task order no. 003-FY-2009) to the Idaho Bureau of Homeland Security, November.

*Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes*, by Roy M. Breckenridge, William M. Phillips, and Kenneth F. Sprenke: Idaho Geological Survey report to the Idaho Bureau of Homeland Security, November.

## **Presentations**

*A Risk Assessment Model for Ground Water Septic Contamination*, by John A. Welhan: 14<sup>th</sup> Intermountain Conference on the Environment and 42<sup>nd</sup> Engineering Geology and Geological Engineering Symposium, Pocatello, November 6.

*Blackfoot Volcanic Field Neotectonic Features and Sampling Strategies*, by John A. Welhan: ISU field trip, April.

*Denudation Rate Chronologies and the Topographic Development of the San Bernardino Mountains, California*, by Steve Binnie and William M. Phillips: Key Concepts in Geomorphology Vignette Workshop, Portland, Oregon, October.

*Earthquake Risk Management*, by William M. Phillips: Idaho North-Central Public Health District Regional Health Planning Group, Lewiston, May.



*Effects of Volcanism and the Bonneville Flood in the central Snake River Plain near Twin Falls and Hagerman, Idaho*, by Kurt L. Othberg and Dean L. Garwood: Annual Meeting of the Pacific Northwest Section of the National Association of Geoscience Teachers, Twin Falls, Idaho, June.

*Eolian Landforms and Deposits of the Eastern Snake River Plain, Idaho*, by William M. Phillips: Key Concepts in Geomorphology Vignette Workshop, Portland, Oregon, October.

*Geologic and Mining History of Latah County*, by Reed S. Lewis: Potlatch Public Library, Potlatch, April.

*Geologic Mapping at the Idaho Geological Survey: Success Resulting From the USGS Statemap Program*, by Kurt L. Othberg: Geological Society of America annual meeting, Session T1, Geological Mapping: Key to Successful Management of Water and Land Resources II, Portland, Oregon, October.

*Geologic Setting of Coeur d'Alene*, by Roy M. Breckenridge: Chamber of Commerce Leadership Project, Coeur d'Alene, September.

*Geology and Geologic Hazards Framework Layers: An Update*, by Loudon R. Stanford: Idaho Geospatial Forum, Boise, October.

*I Came, I Digitized, I Posted: An Existential Look Back Over Twenty Years of Digital Mapping in Idaho*, by Loudon R. Stanford: Digital Mapping Techniques 10, Sacramento California, May.

*Ice Age Floods Research and Mapping in Idaho: Results from STATEMAP*, by Roy M. Breckenridge and Dean L. Garwood: Geological Society of America annual meeting, Portland, Oregon, October.

*Ice Age Floods Field Trip—Lake Pend Oreille and the Hoodoo Valley to Priest River, Idaho*, by Roy M. Breckenridge: Coeur du Luge Chapter—Heart of the Floods, Ice Age Floods Institute, Sandpoint, July.

*Idaho Earthquake Scenarios and Research Activities*, by William M. Phillips: Idaho Seismic Advisory Committee Earthquake Hazard Listening Session, Meridian, March.

*Idaho Earthquake Scenarios and Research Activities*, by William M. Phillips: Idaho Seismic Advisory Committee Earthquake Hazard Listening Session, Idaho Falls, March.

*Idaho Mining*, by Virginia S. Gillerman: Idaho Department of Commerce, China trade representative, Boise, August.

*Idaho Mining and Exploration 2009*, by Virginia S. Gillerman: Snake River Section (SME) Society for Mining Engineers, Pocatello, February.

*Idaho Mining and Exploration, 2009*, by Virginia Gillerman: Northwest Mining Association 2009 Convention, Reno, Nevada, December.

*Indigenous Nations Institute Strategic Plan and 5-year Budget*, by B. Goodwin, D. Anderson, L. Murillo, J.A. Welhan, M. McCurry, and K. Trimmer: presentation to BIA Assistant Secretary Larry EchoHawk, April.

*Integration of Water Well Records with Geologic Mapping Along the Snake River, Eastern Idaho*, by William M. Phillips and John A. Welhan: Geological Society of America annual meeting, Portland, Oregon, October.

*Lake Indian Road—History and Geology Field Trip*, by Tom Sandberg, Roy Breckenridge, and Jack Nisbet: Bonner County Historical Society and Idaho Historical Society, David Thompson Bicentennial Commemoration, Sandpoint, September.

*Learning Through Doing: Some of the Tips, Tricks, and Techniques the Idaho Geological Survey Uses to Capture Data and Produce Maps*, by Collette Gantenbein and Jane S. Freed: Digital Mapping Techniques 10, Sacramento, California, May.

*Mining and Exploration in Idaho*, by Virginia S. Gillerman: Burley Rotary Club, Burley, Idaho, March.

*National Geologic Ice Age Floods Trail in Idaho*, by Roy M. Breckenridge: Federal Interagency Technical Committee, Sandpoint, June.

*New Mine Developments in Idaho: A Tale of Reserves and Environmental Issues*, by Virginia S. Gillerman: Geological

Society of Nevada Great Basin Evolution and Metallogeny, 2010 Symposium, Reno, Nevada, May.

*Overview of GIS Coverages Relevant to Groundwater Protection in the Lower Portneuf River Valley*, by John A. Welhan: Bannock County Groundwater protection Overlay Technical Advisory Committee, April.

*Regional Stratigraphic Implications From New Mapping of the Northern Beaverhead Range, Montana and Idaho*, by Reed S. Lewis: Geological Society of America annual meeting, Portland, Oregon, October.

*A Risk Assessment Model for Ground-Water Septic Contamination*, by John A. Welhan: 14<sup>th</sup> Intermountain Conference on the Environment and 42<sup>nd</sup> Engineering Geology and Geological Engineering Symposium, Proceedings, Pocatello, November.

*Sources of Nitrate Contamination in Ground Water of the American Falls Reservoir Area*, by John A. Welhan: Idaho Department of Environmental Quality, Regional Office and Bannock/Power County officials, February.

*Sources of Nitrate Contamination in Ground Water of the American Falls Reservoir Area*, by John A. Welhan: Idaho State University, Geosciences Colloquium, February.

*Tribal Economic Diversification: Developing Geothermal Energy Resources in Southeast Idaho* by John A. Welhan: Department of the Interior, Bureau of Indian Affairs Assistant Secretary Larry EchoHawk, February.

*What IGS Can Do for Preston-Area Groundwater Protection Efforts*, by John A. Welhan and Shannon L. Ansley: Franklin County commissioners and Preston water resources committee, March.

## **Web Products**

*2009 Natural Hazards Field Workshop for Idaho Educators, Hagerman-Glenns Ferry Area, July 12-17, 2009*, by Dean L. Garwood: Idaho Geological Survey Web page, revised.

*Idaho Geological Survey Geologic Map Search: Text File Output/Download in IGS Bibliographic Style*, by Loudon R. Stanford and Dustin Thomas: Idaho Geological Survey Web page, map catalogue search engine.

*Idaho Geological Survey Geologic Map Search: Text File Output/Download in IGS Bibliographic Style*, by Loudon R. Stanford and Dustin Thomas: Idaho Geological Survey Web page, publications catalogue search engine.

*New and Improved IGS Online Help: An In-house Documentation Application*, by Idaho Geological Survey staff: Idaho Geological Survey Web page.

*Publications*, by Roger C. Stewart and Loudon R. Stanford: Idaho Geological Survey Web page, revised as products released.

*Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes*, by Roy M. Breckenridge, William M. Phillips, and Kenneth F. Sprenke: Idaho Geological Survey Web page, new.

*Idaho Oil and Gas*, by Dean L. Garwood: Idaho Geological Survey Web page, new.

## **Operational Improvements**

Documentation of mapping lab processes and techniques (L.R. Stanford, J.S. Freed, C. Gantenbein).

Facilitate software multi-seat site license for ISU Geosciences from Mpatek Corp., Denver CO (J.A. Welhan).

Improved IGS on-line source map database (L.R. Stanford, D. Thomas).

New and improved IGS online help: an in-house documentation application (L.R. Stanford, D. Thomas).

Purchased and rehabilitated large-format scanner for geologic mapping capture purposes (L.R. Stanford).

## Professional Activities

Advisory board, Advanced National Seismic System, Intermountain West Regional Advisory Council (R.M. Breckenridge).

Advisory board meeting, Idaho Geological Survey teleconferences, Moscow, Boise, and Pocatello, January and February (R.M. Breckenridge, K.L. Othberg).

Advisory board meeting, Idaho Geological Survey, teleconference, Moscow, Boise, and Pocatello, July and November (R.M. Breckenridge).

Affiliate, Center for Advanced Energy Studies (CAES), Idaho National Laboratory (V.S. Gillerman).

Annual Meeting of the Pacific Northwest Section of the National Association of Geoscience Teachers, Twin Falls, Idaho, June (D.L. Garwood, K.L. Othberg).

Association of American State Geologists, midyear meeting, Portland, Oregon, October (R.M. Breckenridge).

Chair, hiring committee, GIS-specialist position, Idaho Geological Survey, July-September (W.M. Phillips).

Co-developer, Vulcan laboratory exercises to introduce the software into the Idaho State University curriculum, Geol 210, Spring semester, (J.A. Welhan).

Co-instructors, Idaho Earth Science Teachers summer field workshop, Glens Ferry, July (D.L. Garwood and J.R. Cash).

Co-leader, field trip, Lake Indian Road history and geology, David Thompson Bicentennial, Bonner County Historical Society, September (R.M. Breckenridge).

Coordinator, Belt Association annual meeting, Spokane, Washington, February (R.S. Lewis).

Coordinator, garnet geochronology field trip with Washington State University professor and graduate student, South Fork Clearwater River, April (R.S. Lewis).



- Data capture working group teleconference, Association of American State Geologists and U.S. Geological Survey, March (L.R. Stanford).
- Digital Mapping Techniques Workshop, Sacramento, California, May (C. Gantenbein, J.S. Freed, L.R. Stanford).
- Expert witness, Idaho Department of Water Resources request to participate in public water right hearing (J.A. Welhan).
- Field assistant, installation of new U.S. Geological Survey seismic monitoring station, McCall, August (W.M. Phillips).
- Field trip, Salmon River suture zone, Geological Society of America, October (R.S. Lewis).
- Field trip co-coordinator and co-leader, Blackfoot – Willow Creek volcanic field, SE Idaho, April (J.A. Welhan).
- Field trip co-coordinators and co-leaders, National Association of Geoscience Teachers Pacific Northwest Section meeting, Twin Falls, June (D.L. Garwood, K.L. Othberg).
- Field trip leader, geology of Lake Pend Oreille and Hoodoo channel, Ice Age Floods Institute, Priest River, July (R.M. Breckenridge).
- Field trip leader, mine tours: Cumo, Thompson Creek, Grouse Creek, and Idaho Almaden mines in Idaho; Leeville mine in Nevada, September-November (V.S. Gillerman).
- Field trips, basement rocks of the upper North Fork Clearwater River, Washington State University professor graduate students, August and September (R.S. Lewis).
- Fellow, Society of Economic Geologists (V.S. Gillerman).
- Geological Society of America annual meeting, Portland, Oregon, October (R.M. Breckenridge, D.L. Garwood, R.S. Lewis, K.L. Othberg, W.M. Phillips).
- Instructor, Geology 405/505, field workshop on natural hazards of Idaho, Department of Geological Sciences, University of Idaho summer session, Glenns Ferry, July (D.L. Garwood).

Instructor, Geoscience 497-002, ore deposits and mining, Department of Geosciences, Boise State University, Fall semester (V.S. Gillerman).

Intermountain Forest Tree Nutrition, cooperative technical assistance committee meeting, Spokane, Washington, July (R.S. Lewis).

Introduction and comments, *A most remarkable spring, David Douglas in Idaho and Beyond*, by Jack Nisbet, University of Idaho Bookstore, The Friends of Moscow Library and the Native Plant Society, January (R.M. Breckenridge).

Judge, Twenty fifth annual Mine Rescue Contest, Kellogg, May (M. J. Weaver).

Manager, rock-sample crushing facility, Department of Geological Sciences, University of Idaho (W.M. Phillips).

Members, American Geophysical Union (W.M. Phillips, J.A. Welhan).

Member, American Institute of Professional Geologists (R.M. Breckenridge).

Member, Association of Earth Science Editors (R.C. Stewart).

Member, data capture working group, Association of American State Geologists and U.S. Geological Survey (L.R. Stanford).

Member, financial information group, Office of Business Systems and Accounting Services, University of Idaho (T. Kanikkeberg).

Member, Geological Society of Nevada (V.S. Gillerman).

Member, geology and geologic hazards Idaho framework layers, Technical Working Group, (L.R. Stanford).

Member, Governor's Carbon Sequestration Advisory Committee (J.A. Welhan).

Member, Governor's Geothermal Task Force, Idaho Strategic Energy Alliance, Boise (V.S. Gillerman).

Member, hiring committee, GIS-specialist position, Idaho Geological Survey, September (V.S. Gillerman).

Member, Ice Age Floods Institute (R.M. Breckenridge).

Member, Idaho Ground Water Monitoring Technical Committee (J.A. Welhan).

Member, Idaho State Agencies GIS Stakeholders (L.R. Stanford).

Member, Idaho GIS framework layers, technical working group, geology and geologic hazards (L.R. Stanford).

Member, minerals and policy committee, Association of American State Geologists (R.M. Breckenridge).

Member, Northwest Mining Association (R.S. Lewis, V.S. Gillerman).

Member, Society for Mining, Metallurgy, and Exploration, Inc., (V.S. Gillerman).

Member, steering committee, North American Digital Geologic Map Data Model (L.R. Stanford).

Member, technical committee, Idaho Ground-Water Monitoring (J.A. Welhan).

Members, Geological Society of America (R.M. Breckenridge, D.L. Garwood, V.S. Gillerman, R.S. Lewis, V.E. Mitchell, K.L. Othberg).

Members, Northwest Mining Association (V.S. Gillerman, R.S. Lewis).

Members, Society for Mining, Metallurgy, and Exploration, Inc. (V.S. Gillerman, M.J. Weaver).

Members, Western States Seismic Policy Council (W.M. Phillips, R.M. Breckenridge).

National Association of Geoscience Teachers Pacific Northwest Section annual meeting, Twin Falls, June (D.L. Garwood, K.L. Othberg).

Negotiator, agreement with U.S. Geological Survey to operate and maintain the Boise area seismic station purchased in 2008 by the Idaho Geological Survey, September (W.M. Phillips).

Organizer, Idaho Earth Science Teachers summer field workshop, Glens Ferry, July (D.L. Garwood).

Participant, 4-day workshop on Vulcan software basics, Denver, CO., August (J.A. Welhan).

Participant, Advanced Banner Training, Department of Human Resources, University of Idaho (T. Kanikkeberg).

Participant, Association of American State Geologists, Spring Liaison, Washington, D. C., March (R.M. Breckenridge).

Participant, Cayuse Training, Office of Sponsored Programs, University of Idaho (T. Kanikkeberg).

Participant, Department of Energy Project kickoff meeting on National Geothermal Data Systems project and peer review sessions on ARRA-funded geothermal projects, Washington, D.C., May (J.A. Welhan).

Participant, Earth Science Education Week, hosted by American Geological Institute, supported by U.S. Geological Survey, NASA, the National Park Service, the AAPG Foundation, U.S. Department of Energy, ExxonMobil, ESRI, and other geoscience groups, October (IGS Staff).

Participant, executive committee, 2010 Idaho State Hazard Mitigation Plan Revision, Boise, November (W.M. Phillips).

Participant, field trip, IOCG and Porphyry-related Deposits of Western Nevada, Yerington Area Deposits, Geological Society of Nevada Fieldtrip, Yerington, Nevada, May (V.S. Gillerman).

Participant, Geological Society of Nevada 2010 Symposium, Great Basin Evolution and Metallogeny, Reno, Nevada, May (V.S. Gillerman).

Participant, Human Resources: Summer Session EPAF training, Department of Human Resources, University of Idaho (T. Kanikkeberg).

Participant, Idaho Environmental Forum meetings, Boise, January and April (V.S. Gillerman).

Participant, Idaho Science Teachers Association annual meeting, Boise, Idaho, October (J.R. Cash).

Participant, Idaho State Agency GIS Stakeholders teleconference, March (L.R. Stanford).

Participant, Intermountain Forest Tree Nutrition Cooperative annual meeting, Moscow, April (R.S. Lewis).

Participant, President's Leadership Meetings: government outreach, public policy, marketing and branding, University of Idaho (R.M. Breckenridge).

Participant, Rare Earth Sessions, Society for Mining, Metallurgy, and Exploration, Inc. Annual Meeting, Phoenix, Arizona, March (V.S. Gillerman).

Participant, Shaping Sustainable Communities along the Spokane-Coeur d'Alene Corridor - Non point Pollution Control and Human Dynamics, Stake holders meeting, UI Research Park Post Falls, June, (R.M. Breckenridge).

Participant, Seismic Hazard Meeting, Idaho Bureau of Homeland Security, Meridian, March (V.S. Gillerman).

Participant, short course: *Introduction to the Acquisition, Visualization, and Interpretation of Airborne LiDAR-derived Digital Elevation Models*, Geological Society of America annual meeting, Portland, Oregon, October. (W.M. Phillips).

Participant, short course: *Real Colors of Your Personality*, Staff Affairs Professional Development Week, University of Idaho, October (T. Kanikkeberg).

Participant, teleconference calls, Idaho Seismic Advisory Committee, Idaho Bureau of Homeland Security (W.M. Phillips).

Participant, University of Idaho Research Area Forum on Energy: Idaho Falls Video, February (V.S. Gillerman).

Participant, University of Idaho-Washington State University Spokane-Coeur d'Alene Corridor Signature Research Workshop for stakeholders, Post Falls, March (W.M. Phillips).

Participant, workshop: Vulcan 3-D software basics, Department of Geosciences, Idaho State University (J.A. Welhan).

Registered geologist, Oregon Board of Geologist Examiners (R.M. Breckenridge).

Representative and Disaster Coordinator, Bureau of Homeland Security (BHS) State Agency Emergency Coordinator's Working Group (V.S. Gillerman).

Representative, Idaho Geological Survey: Governor's Zero Based Budget bi-weekly agency meetings, UI Moscow, (R.M. Breckenridge).

Representative and adjunct faculty, Department of Geosciences, Boise State University (V.S. Gillerman).

Representative, affiliate faculty and graduate faculty, Department of Geosciences, Idaho State University (J.A. Welhan).

Representative, Department of Geosciences, Idaho State University (J.A. Welhan).

Representative, Governor's carbon sequestration advisory committee (J.A. Welhan).

Reviewer and member, review panel for 2010 U.S. Geological Survey Mineral Resources External Research Program, Denver, Colorado, November (V.S. Gillerman).

Reviewer, grant proposals, National Geologic and Geophysical Data Preservation Program, Denver, Colorado, March (R.S. Lewis).

Reviewer, *Geology*, November (W.M. Phillips).

Reviewer, proposals for Idaho Hazard Mitigation Program, Idaho Bureau of Homeland Security, Boise, November (W.M. Phillips).

Reviewer, manuscript for *Journal of Contaminant Hydrology* (J.A. Welhan).

Reviewer, Volcano and earthquake monitoring plan for the Yellowstone Volcano Observatory, U.S. Geological Survey Circular, in press (R.M. Breckenridge).

Senior Personnel, Biophysical Sciences and Modeling group, Spokane-Coeur d'Alene Urban Corridor, Water for Sustainability and Climate



(WSC) Signature Research Area, University of Idaho and Washington State University (R.M. Breckenridge, W.M. Phillips, R.S. Lewis).

Secretary, board of directors, Belt Association (R.S. Lewis).

Supervisor, Becky Kolb, work study student, University of Idaho, January-May (W.M. Phillips).

Supervisor, Rachel Daly, intern (D.L. Garwood).

Supervisor, Ramzi Azzabi, intern (R.S. Lewis).

Technical advisor and planning assistance for the Indigenous Nations Institute's geothermal research and economic development planning and fund-raising initiatives (J.A. Welhan).

Technical advisor and proposal assistance for geothermal development, Shoshone-Bannock Tribes Energy Development Office (J.A. Welhan).

Technical advisor to Aberdeen-Springfield Canal Company operations manager (J.A. Welhan).

Technical advisor to Bannock County Groundwater Protection Technical Advisory Committee (J.A. Welhan).

Technical advisor to Bannock County Planning and Zoning Department (J.A. Welhan).

Technical advisor to City of Lava Hot Springs (J.A. Welhan).

Technical advisor to Department of Environmental Quality on statistical analysis of ground-water monitoring data (J.A. Welhan).

Technical advisor to Shoshone-Bannock Tribes Water Resources Department (J.A. Welhan).

Tobacco Root Geological Society meeting and field trips, Philipsburg, Montana, August (R.S. Lewis).

Training, *What Every Employee Should Know About Fraud*, Office of Internal Audit, University of Idaho, December (T. Kanikkeberg).

Training refresher course, Mine Safety and Health Administration, Boise, October (V.S. Gillerman).

## Media Interviews

*Canadian firms seek natural gas in southwest Idaho*, by William L. Spence: Lewiston Tribune, April 25, 2010 (V.S. Gillerman).

*Is There Oil and Gas in the Valley?* by Rocky Barker: Idaho Statesman, September 13, 2009 (V.S. Gillerman).

*Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes*: Twin Falls Times-News, October 22, 2009 (W.M. Phillips).

*Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes*: KBAR radio, Zeb Bell Show, Burley, November 5, 2009 (W.M. Phillips).

*What are We Drinking? Why Portneuf Valley residents need to pay attention to our drinking water source*: Idaho State Journal, May 16, 2010 (S. Ansley and J.A. Welhan).

## Thesis Committees

Rachel Brewer, M.S., Geology, Washington State University (R.S. Lewis).

Rich Gaschnig, Ph.D., Geology, Washington State University (R.S. Lewis).

Keith Gray, Ph.D., Geology, Washington State University (R.S. Lewis).

Cephas Holder, M.S., Geological Sciences, Idaho State University (J.A. Welhan).

Andrew Jansen, M.S., Geology, Washington State University (R.S. Lewis).

Nick Semenza, M.S., Geological Sciences, Idaho State University (J.A. Welhan).

Will Smith, M.S., Geology, Idaho State University (J.A. Welhan).

Ashley Tefft, M.S., Geology, Washington State University (R.S. Lewis).

Chris Tennant, M.S., Geology, Idaho State University (J.A. Welhan).

Kelly Whitehead, M.S., Geology, Idaho State University (J.A. Welhan).

## Grants and Contracts

*Evaluation of septic-siting suitability using an objective GIS ranking methodology*, J.A. Welhan (Idaho Department of Environmental Quality, January 2009-February 2010, \$28,631).

*Geologic Database* : R.S. Lewis (Idaho Department of Lands, July 2009-June 2010, \$6,000).

*Geologic Mapping in the Idaho Falls, Fairfield, Grangeville, Salmon, and Bonners Ferry Areas*: K.L. Othberg, W.M. Phillips, J.D. Kauffman, R.S. Lewis, and R.M. Breckenridge (U.S. Geological Survey STATEMAP Program, May 2009-April 2010, \$253,611).

*Geologic Mapping in the Idaho Falls, Fairfield, Grangeville, Salmon, and Bonners Ferry Areas*: K.L. Othberg, W.M. Phillips, J.D. Kauffman, R.S. Lewis, and R.M. Breckenridge (U.S. Geological Survey STATEMAP Program, May 2010-April 2011, \$232,509).

*Geologic Mapping in the Twentymile Creek 7.5-Minute Quadrangle*: R.S. Lewis (Idaho Department of Lands, August 2008-July 2009, \$6,000).

*Geologic Setting and Mapping of East Ada Project Area*: V.S. Gillerman, R.S. Lewis, and J.A. Welhan (Idaho Department of Water Resources, October 2009 – September 2011, \$94,000).

*Idaho Department of Lands AML (Abandoned Mine Lands) Assistance*: V.S. Gillerman and R.S. Lewis (Idaho Department of Lands, September 2009-September 2010, \$96,567.90).

*Idaho Mine Safety Training Program*: M.J. Weaver (Mine Safety and Health Administration, October 2008-September 2009, \$91,146).

*Idaho Mine Safety Training Program*: M.J. Weaver (Mine Safety and Health Administration, October 2009-September 2010, \$92,578).

*Mine Site Database*: R.S. Lewis (U.S. Department of Agriculture, U.S. Forest Service, Region 4, June 2003-October 2009, \$390,000).

*National Geologic and Geophysical Data Preservation Program: R.S. Lewis (U.S. Geological Survey, July 2009-June 2010, \$22,908).*

*Part 1: Digital Liquefaction Susceptibility Maps and NEHRP Soil Class Maps at Scale 1:24,000 for the Idaho Falls Area: W.M. Phillips, J.A. Welhan, and R.M. Breckenridge (Idaho Bureau of Homeland Security, July 2009-September 2010, \$20,000).*

*Part 2: Digital Liquefaction Susceptibility Maps and NEHRP Soil Class Maps at Scale 1:24,000 for the Idaho Falls Area: W.M. Phillips, J.A. Welhan, and R.M. Breckenridge (Idaho Bureau of Homeland Security, June-September 2009, \$20,637).*

*Putting Down Roots in Earthquake Country: Your Handbook to Idaho Earthquakes: W.M. Phillips, and R.M. Breckenridge (Idaho Bureau of Homeland Security, June-July 2009, \$20,712).*

*Remote Sensing Exploration of Hidden geothermal Resources in Eastern Idaho: T. Sankey, M.McCurry, and J.A. Welhan (NASA Idaho Space Grant Consortium, April 2010 - December 2010, \$3,972)*