

Arizona Geological Survey Sunset Review Factors 1 July 2001 to 30 June 2011

Open-File Report
OFR-11-10

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Arizona Geological Survey Sunset Review 2011

The *Arizona Geological Survey Sunset Review Report, 1 July 2001 to 30 June 2011*, was prepared for the Arizona Legislature's sunset review process and was provided to a 10-member Legislative Committee of Reference (COR), co-chaired by Sen. John Nelson and Rep. Kate Brophy-McGee. The contents of the AZGS sunset review report directly respond to questions required by the sunset review process and additional issues expressed by the COR.

On 17 October 2011, the COR committee conducted the Arizona Geological Survey's "Sunset Review". Following State Geologist Lee Allison's presentation to the committee, the COR voted unanimously to endorse continuation of the Arizona Geological Survey for 10 years, the maximum allowed by law. Their recommendation will be drafted into legislation that will be presented to the full Legislature in January 2012.

Arizona's Sunset Review Legislation and Process. The following comes directly from, *The Handbook on Sunset and Sunrise Review: 50th Legislature 2011-2012*. "Established by Laws 1978, Chapter 210, Arizona's sunset review process requires the Legislature to periodically review the purpose and functions of state agencies to determine whether continuation, revision, consolidation or termination is warranted. Sunset reviews are based on audits conducted by either the Office of the Auditor General (OAG) or a Committee of Reference (COR). Following the audit, a public hearing is held by the COR to discuss the audit and receive testimony from agency officials and the public."

"Agencies subject to sunset review automatically terminate (sunset) if legislation to continue the agency is not approved by the Legislature and Governor."

SUNSET REVIEW REPORT

ARIZONA GEOLOGICAL SURVEY

July 1, 2001 to June 30, 2011

prepared for the COMMITTEE OF REFERENCE

Senator John Nelson, Chair
Representative Kate Brophy McGee, Co-Chair

by
M. Lee Allison
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Arizona Geological Survey

SUNSET FACTORS

1. The objective and purpose in establishing the agency and the extent to which the objective and purpose are met by private enterprise in other states.

Introduction

The Arizona Geological Survey (AZGS) helps protect lives and property from geologic risks and contributes to the discovery and characterization of natural resources for their wise use towards economic development.

History

The Arizona Geological Survey began as the Office of the Territorial Geologist (1883-1912). The Office was integrated with the University of Arizona Bureau of Mines (1893-1915) and subsequently became known as the Arizona Bureau of Mines (1915-1977) within the University of Arizona. The Legislature, in 1977, created the Bureau of Geology and Mineral Technology with a Geological Survey Branch to replace the Arizona Bureau of Mines. In 1987, the Legislature reshaped the Geological Survey Branch into the Arizona Geological Survey, and removed it from administration by the University to become an independent state agency. As an independent agency, the mission of the AZGS shifted from teaching and research to applied geology and public service for the state.

The Arizona Oil and Gas Conservation Commission (agency) was eliminated in 1991. As such, the functions and one of its four FTEs were transferred to the Arizona Geological Survey. The

five-member governing board (Commission), appointed by the Governor, was assigned administrative and staff support from the Arizona Geological Survey, effective July 1, 1991.

In 2011, the Arizona Department of Mines and Mineral Resources (ADMMR) was consolidated with the Arizona Geological Survey. Signed by Governor Brewer on April 6, 2011 and effective in FY2012, SB1615 provides for the formal consolidation of ADMMR and AZGS.

Objective and purpose

The Arizona Geological Survey was established to be a primary source of geologic information and inform, advise, and assist government, industry, and the public about the geologic character of Arizona, geologic hazards and limitations, and mineral resources ((ARS 27-152).

AZGS is specially instructed to:

- Inform, advise and assist the public in matters concerning the geological processes, materials and landscapes and the development and use of the mineral resources of this state.
- Encourage the wise use of the lands and mineral resources of this state toward its development.
- Provide technical advice and assistance in geology to other state and local governmental agencies engaged in projects in which the geologic setting, character or mineral resources of the state are involved.
- Provide technical advice and assistance in geology to industry toward the wise development and use of the mineral and land resources of this state.

To carry out these objectives the Arizona Geological Survey:

- Conducts fieldwork and investigations to map and describe bedrock and surficial units, identify and characterize geologic hazards and societal risks, and seek out and evaluate energy and mineral resources.
- Publishes and disseminates objective, scientific information to the public in a timely manner.
- Provides archival storage of, and public access to, geologic data, maps, reports, files, rock cuttings and cores from wells, and other samples.
- Provides administrative and staff support for the Arizona Oil and Gas Conservation Commission.
- Maintains an internet web site that includes information about Arizona Geological Survey products and services available and the geologic character of this state.
- Maintains a computerized bibliographic database of maps and reports on the geology of Arizona.

The purpose of this work is to improve understanding of the geologic character of Arizona's land, mineral, and energy resources and support governments and the public in making well-informed and prudent land- and resource-management decisions.

What is meant by "geologic character?"

The geologic character of Arizona includes the following components:

- Bedrock units such as limestone, sandstone, and granite and their weathered products (surficial materials: sand, gravel, clay, etc.)
- Geologic processes or substances that are known or have potential to cause loss of life or injury to people, cause property damage, or impact the location, construction, and maintenance of buildings and infrastructure (earthquakes, flooding, land subsidence and earth fissures, natural dissolving of rocks such as limestone and salt, drying out and cracking of clay-rich soils, arsenic, radon gas, etc.)
- Metallic mineral resources (including copper, gold, silver, iron, manganese, molybdenum)
- Nonmetallic resources (including sand, gravel, limestone, clay, salt, potash, gypsum, cement, zeolites, rare earth elements)
- Energy and associated resources (coal, coal-bed methane, oil, gas, geothermal, carbon dioxide, and helium)

Our constituents and customers who use geologic information cover a broad range of the community, including:

Citizens and citizen groups	Elected officials and staff
Land- and resource-management agencies	Consultants
Engineering and applied geology firms	Hydrologists and hydrogeologists
Energy- and mineral-exploration companies	Students and teachers
Attorneys, insurance companies	Libraries and book dealers
Trade associations	Home buyers, real estate agents
Emergency responders and managers	Construction and builders

Privatization of State Geological Survey duties

No State Geological Survey is, or ever has been, contracted out to be run by private enterprise. To our knowledge, this has never been seriously discussed in any state. During the current economic recession, State Geological Surveys around the nation are taking budget cuts and a few are slated to have their state funding removed entirely as cost-cutting measures, but none are proposed for privatization.

We can speculate as to why this has not happened:

- There are potential conflicts of interest for companies engaged by the state to seek out mineral resources, in owning lands or interests, or in access to proprietary data. As an example, AZGS has been contracted by another state agency to carry out geologic

studies that could not be done by anyone in the private sector due to potential conflicts they each had with other clients.

- Private sector geologists in general, earn more than state employees, in part due to the high salary structures in the petroleum and mining industry. As of this writing the average salary for jobs currently open for geologists in Arizona is \$68,000. In comparison, only two geologists at AZGS earn this amount or more, each with a PhD and over 25-30 years' experience. Nationwide, the average salary for geologists is \$78,000.
- State Geological Surveys can compete for certain contracts, grants, or awards that are not available to the private sector. In addition, many of these require state matching funds. It is hard to envision private companies putting up their own funds to match federal funds to benefit the state.

AZGS contracts with individuals, companies, agencies, and universities to assist in carrying out its duties on an as-needed basis. However, one of the limiting factors is finding contractors without potential conflicts of interest.

2. The extent to which the agency has met its statutory objective and purpose and the efficiency with which it has operated.

Technical assistance in development of mineral and energy resource potential [§27-152.01]

During the Sunset Review period the Arizona Geological Survey released 8 open-file reports on mineral, oil, gas, and other subsurface resources, and updated 4 reports on oil and gas production on an annual basis.

AZGS continues to be a cooperating agency with the Bureau of Land Management (BLM) on the northern Arizona mining (uranium) withdrawal Environmental Impact Statement (EIS), and with the U.S. Forest Service on the Rosemont copper EIS.

AZGS took over custody of the Arizona Department of Mines and Mineral Resources in January 2011, when it exhausted state appropriations, in order to preserve ADMMR's irreplaceable files and keep them available to agencies, industry, and the public. AZGS hired the staff of ADMMR, except the director due to his retirement, and maintained the department's services as before.

AZGS reports on potash in the Holbrook basin triggered extensive exploration effort by industry over the past three years that promises to lead to world-class mining district capable of producing hundreds of *billions* of dollars of potash for fertilizers.

The State Geologist appoints an Oil & Gas Administrator who serves as the principal executive officer of the Oil & Gas Conservation Commission, a gubernatorally-appointed state regulatory body. The Commission meets quarterly. FY11 saw as many drilling permits issued as in the previous nine years due almost entirely to the potash exploration program in the Holbrook basin. A report documenting this potential was published by the AZGS.

Year	Permits Issued
FY2001	1
FY2002	5
FY2003	1
FY2004	6
FY2005	9
FY2006	2
FY2007	14
FY2008	21
FY2009	16
FY2010	2
FY2011	77

Protection of lives and property from geologic hazards and risks

During the Sunset Review period the Arizona Geological Survey released 18 reports and maps on geologic hazards and limitations. AZGS responded to numerous natural disasters across the state involving floods, debris flows, landslides, and post-wildfire hazards and characterized areas for mitigation measures. The Survey acquired 8 broadband seismometers to create the first statewide earthquake monitoring network. The network is documenting never-before detected small earthquakes across the state to provide better evaluation of seismic hazards to critical facilities including the Palo Verde Nuclear Generating Station.

The Earth Fissure Mapping Program produced a variety of products including county fissure maps for Maricopa, Pinal, Pima, and Cochise counties; Study Area maps for 22 of 24 regions; annual reports on results; technical studies; and a brochure aimed at the public. During the period from December 2007 to October 2008, over 82,000 copies of these materials were downloaded. Based on the number of maps and reports released since then, we conservatively estimate more than 125,000 Earth fissure maps and reports have been downloaded through FY2011 and it could easily be substantially higher than this.

Despite budget cuts, AZGS has maintained support for this critical function and is on or somewhat ahead of schedule in completing the first state-wide detailed compilation and surveyed locations of Earth fissures.

Data integration and management

AZGS statutes require that we “maintain a computerized bibliographic database of maps and reports on the geology of this state that is accessible to the public,” and “Operate and maintain a central repository and a computerized database for reports, books, maps and other publications regarding the geology, mineral resources and associated technologies.”

AZGS consolidated its Geographic Information Systems (GIS), Information Technology (IT), and data base functions into the Geoinformatics Section in 2006, to more effectively implement an agency goal of “everything digital, online, and interoperable.”

The Geoinformatics Section has grown to be the largest section in the Survey and has led to AZGS becoming a national leader in data integration and management. AZGS is the lead agency for the Association of American State Geologists (AASG) in partnership with the U.S. Geological Survey (USGS) to build the national Geoscience Information Network (GIN). GIN has been adopted by the U.S. Department of Energy (DOE) as the data integration framework for the National Geothermal Data System (NGDS). It is also being used as a prototype for the world’s upstream petroleum industry by the non-profit standards organization, Energistics. AZGS signed a Working Agreement on behalf of GIN with the Western Regional Partnership (WRP), an association of 15 federal land management and land use agencies, and 5 Western Governors, including Arizona, to integrate an expected 10,000 GIS map layers into the GIN system.

Federal funds for GIN-related projects are underwriting AZGS efforts to make all Arizona data digitized and online as part of an agency-wide Enterprise Geodatabase.

Total output of reports and maps

The Arizona Geological Survey continuously makes original geologic maps and conducts field investigations to characterize rock units and related deposits that aid in the identification of economic natural resources and natural hazards. Staff geologists summarize the results of their work in reports and make them available to the public. During the Sunset Review period the agency released 228 geologic maps and reports (a publication may include multiple map sheets, e.g., DM-DF-01 with 11 sheets, so that the total number of map sheets published is substantially larger than the total number of geologic map publications).

The agency’s list of publications gives the complete titles of these publications. The publication series in which these maps and reports were released are listed below.

Open-file Reports (70)	Down-to-Earth (9)	Maps (1)
Digital Information (13)	Digital Geologic Maps (66)	Digital Maps (26)
Bulletins (0)	Circulars (2)	Contributed Maps (13)
Contributed Reports (28)		

Information about specific geologic maps, geologic hazards and applied investigations, identification of areas with mineral- and energy-resource potential and non-technical reports for the general public is given in the following paragraphs.

One of the major functions of the Arizona Geological Survey is to prepare original, detailed geologic maps. Of the 70 open-file reports that were released during the Sunset review period, 25 included geologic maps. Most of the maps released have been in the Phoenix-Tucson corridor, which includes about 20 percent of the area and 80 percent of the population of the

state. In recent years, emphasis was on mapping outlying population centers or areas that are experiencing growth or have growth potential. An advisory committee composed of members from land- and resource-management agencies and private-sector companies determines geologic mapping priority areas.

Communicating our results to our stakeholders and the lay public

AZGS statutes direct us to give lectures and talks, conduct workshops, lead field trips and provide information and assistance to public, educational and professional groups; and publish reports and other information, written in nontechnical terms, to inform those not trained in geology about the geologic character of Arizona.

AZGS created a Geologic Extension Service (GES) in 2006 to integrate all our efforts to disseminate information and communicate with customers, stakeholders, and decision-makers. GES combines the publications office, retail outlet, library, map and bookstore, web sites, education, and public inquiries programs.

During the past decade we achieved these results:

- Published 9 volumes in the Down-To-Earth series, with emphasis on geotourism of state and national parks.
- Greatly expanded the AZGS website from 10 Mb to many Terabytes of content.
- Created a dedicated web site for the Oil and Gas Conservation Commission with permits and production reports.
- Built and maintain an additional 7 web sites for projects and collaboration efforts.
- Use a variety of social media to inform our constituencies (*Arizona Geology* blog has over 2800 posts since 2007, with over 500,000 page views; *AZGeology* twitter account has 525 followers; *Groundswell* blog is new in 2010 and covers earthquake hazards; AZGS is on Facebook, uses RSS feeds, and sells publications on Amazon.com).
- Over 650 AZGS publications, including many rare or out of print volumes, were scanned and posted in the online document repository for free viewing or downloading.
- *Arizona Geology* quarterly magazine was converted to digital only, with substantial cost savings and expanded capability for color photos and videos to be included.
- Online interactive viewers allow customers to easily search for Earth fissures near their addresses or to track new drilling permits issued by the Oil & Gas Conservation Commission.

Cooperative projects done under contract with other agencies

The Arizona Geological Survey's enabling statutes specify that the agency shall cooperate with local, county, state, and federal agencies, and shall contract and be contracted with. Routine inquiries from individuals and groups are answered immediately by using available information. Land- and resource-management agencies and groups occasionally need geologic information that does not exist and would take a substantial amount of time to produce. The Arizona Geological Survey collaborates with the requesting agency to provide the information under contract if the following conditions are met: (1) the information requested is within the statutory authority of the Arizona Geological Survey, (2) the agency has an employee who is properly qualified to supervise the project, (3) the agency can hire employees who are properly qualified to assist with the project, and (4) the data, report, or maps produced can be released to the public when the project is finished.

Many of the projects we do are with governmental agencies and require matching funds. Salaries of Arizona Geological Survey geologists paid from the General Fund are used as the required match for the external funds received. Graduate students in geology at the University of Arizona are commonly hired to assist with these projects. Arizona Geological Survey geologists are responsible for writing project proposals, supervising the work of contracted employees, and ensuring that the contracted projects are completed on time and within budget. Projects that are in competition with the private sector are not undertaken.

During the Sunset review period the Arizona Geological Survey completed or is currently carrying out 76 projects under contract with other agencies and groups as follows:

AZGS Sunset Review Factors

Federal Funding			
Funding Agency	Amount	# of Awards	Comments
US Army	\$ 4,874.00	3	
US Geological Survey	\$ 1,804,837.28	16	STATEMAP; Data Preservation
US Forest Service	\$ 144,804.00	6	
Bureau of Land Management	\$ 6,505.00	1	
Department of Energy	\$ 15,367,180.00	3	FY09-FY11; total award \$21,858,224; \$18,000,449 to subs
National Science Foundation	\$ 624,974.00	1	
National Park Service	\$ 191,742.00	1	
FEMA	\$ 696,185.84	4	Passed through AZ Div. of Emergency Management
State of Utah	\$ 4,137.00	1	Through a grant from the U.S. Geological Survey
Vanderbilt University	\$ 29,173.00	1	Through a grant from the National Science Foundation
Boise State University	\$ 274,029.53	1	Through a grant from the U.S. Department of Energy
California Energy Commission	\$ 232,350.00	1	Through a grant from the U.S. Department of Energy
University of Kansas	\$ 5,000.00	1	Through a grant from the National Science Foundation
Total	\$ 19,385,791.65	40	
Non-Federal Funding			
Funding Agency	Amount	# of Awards	Comments
Arizona Geological Society	\$ 4,042.00	2	
Phelps Dodge Inc.	\$ 3,483.00	1	
Arizona Department of Water Resources	\$ 292,717.00	2	
JEF, Inc.	\$ 17,600.00	2	
University of Nevada	\$ 20,828.00	2	
Gila Valley Natural Resource Conservation District	\$ 10,014.00	4	
Statistical Research Inc.	\$ 1,991.00	3	
Flood Control District of Maricopa County	\$ 41,760.82	3	
Arizona State Land Department	\$ 940,884.00	7	
Engineering and Environmental Consultants Inc.	\$ 45,652.00	3	
H.W. Hjalmarson, P.E.	\$ 7,346.00	1	
Environmental and Earth Science Consultants	\$ 1,766.00	2	
Central Arizona Water Conservation District	\$ 50,000.00	1	
Havasupai Tribe	\$ 82,808.00	1	
Mining Foundation of the Southwest	\$ 25,454.00	1	
Arizona Department of Transportation	\$ 64,950.00	1	
Total	\$ 1,611,295.82	36	
All contracts and grants, FY01-FY11	\$ 20,997,087.47		

Operational Efficiency - Comparison to Geological Surveys in other states

Every state in the U.S. as well as Puerto Rico has a State Geological Survey, although in a couple, they are limited to the office of State Geologist or are on temporary hiatus (i.e. Hawaii). State Geological Surveys range in size from one person to 260 people; AZGS finished FY11 with 35 staff (overwhelmingly funded by external grants and contracts). About two-thirds of State Geological Surveys are state agencies, one-third are administratively housed in universities.

Over the last 50 years funding for State Geological Surveys from state appropriations has dropped from an average of about 95% to about 40% currently. Surveys have increasingly funded themselves from other revenue streams, contracts and grants, and sales of publications. AZGS is no exception to this national trend.

AZGS received a significant base budget increase in FY07 for establishment of the Earth Fissure Mapping Program. Subsequently, state budget cuts effectively reduced the AZGS

AZGS Sunset Review Factors

appropriation by about 45%, not counting the increases for uncontrollable expenses. AZGS compensated by aggressively seeking external contracts and grants, increasingly at the federal level.

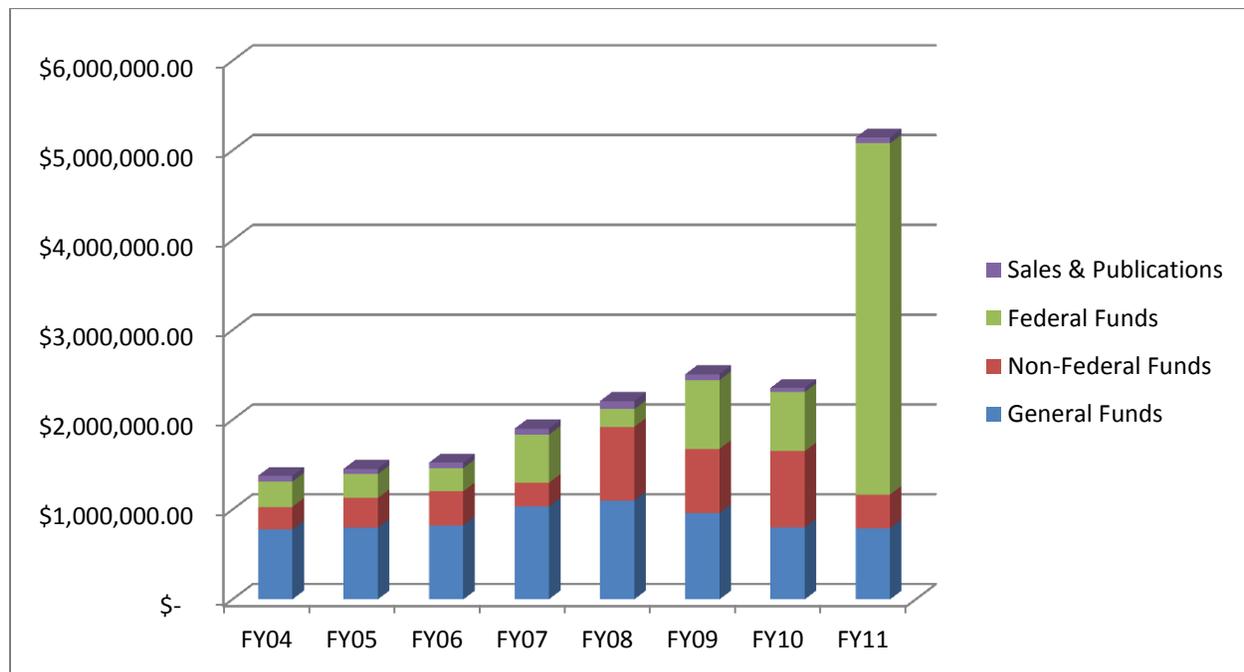


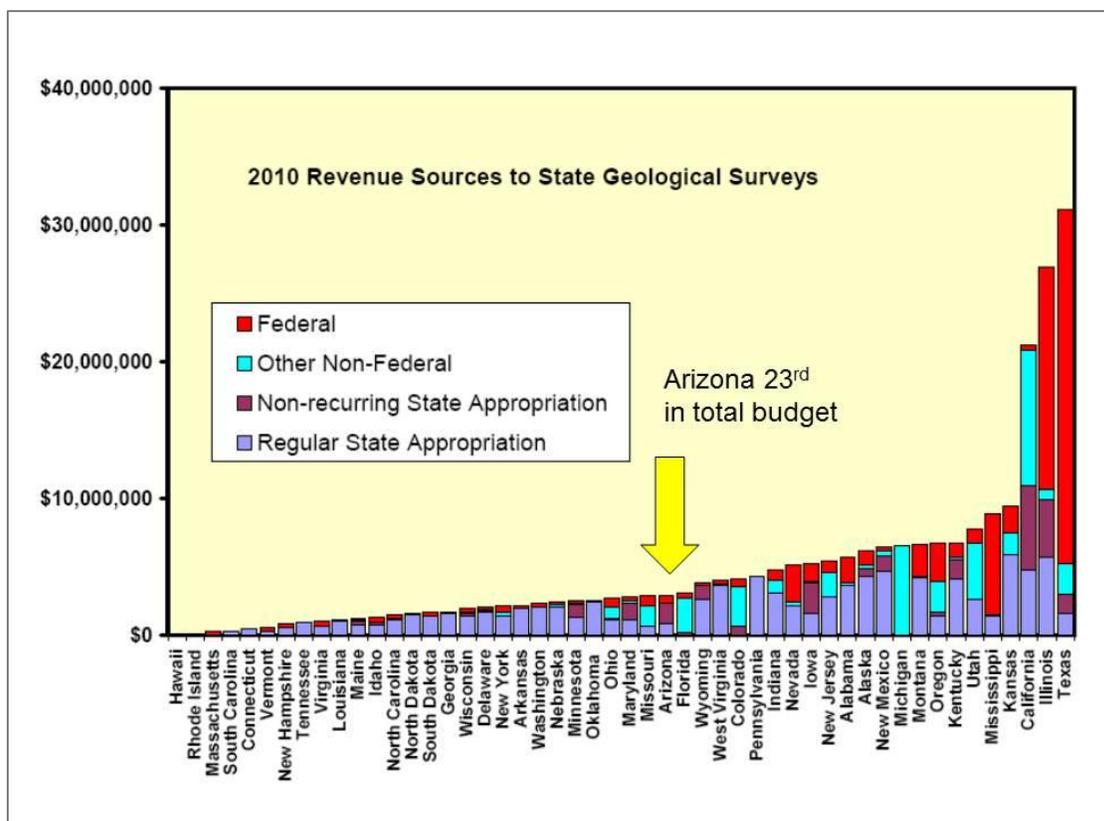
Figure 1: Revenues to the Arizona Geological Survey, FY01-FY11

Year	General Funds	Non-Federal Funds	Federal Funds	Sales & Publications	Totals
FY01	\$ 886,600	\$ 97,800	\$ 174,100	\$ 62,669	\$ 1,221,169
FY02	\$ 881,000	\$ 99,600	\$ 200,100	\$ 62,729	\$ 1,243,429
FY03	\$ 774,800	\$ 266,700	\$ 308,800	\$ 65,578	\$ 1,415,878
FY04	\$ 777,400	\$ 252,400	\$ 281,700	\$ 66,000	\$ 1,377,500
FY05	\$ 796,600	\$ 331,100	\$ 267,900	\$ 59,500	\$ 1,455,100
FY06	\$ 825,000	\$ 379,400	\$ 258,300	\$ 61,500	\$ 1,524,200
FY07	\$ 1,032,900	\$ 264,300	\$ 536,900	\$ 68,700	\$ 1,902,800
FY08	\$ 1,101,100	\$ 820,600	\$ 196,500	\$ 92,400	\$ 2,210,600
FY09	\$ 961,600	\$ 714,800	\$ 766,400	\$ 66,600	\$ 2,509,400
FY10	\$ 800,400	\$ 850,400	\$ 658,700	\$ 47,900	\$ 2,357,400
FY11	\$ 792,600	\$ 375,441	\$ 3,912,364	\$ 66,648	\$ 5,147,053

Figure 2: AZGS Revenue by Source, FY01-FY11

In an annual survey conducted by the Association of American State Geologists, AZGS ranked 27th out of 43 Surveys nationwide that reported their revenues for FY11. However, **AZGS ranked 35th out of the 43 states reporting in amount of state appropriation.** AZGS is doing better than average in bringing in external funds to maintain operations. In FY11 **AZGS was 3rd in the nation in federal funds**, after the Texas and Illinois geological surveys. However, over

80% of the awards to AZGS went out to subcontractors, still leaving AZGS in 8th place nationally in net federal funds.



Comparing state funding on a per capita basis, Arizona is 7th from the bottom at \$0.12. The range nationally is \$0.06 (New York) to \$6.14 (Alaska), with a nationwide average of \$0.29. In the 12 Western U.S. states, Arizona is second from the bottom in state appropriations and bottom of the list in per capita expenditure. The next lowest states (CA, OR, WA, CO) provide their State Geological Surveys 2.5 to nearly 4 times the funding level as Arizona. At the upper end, Montana funds their Survey more than 40 times per capita than what Arizona spends.

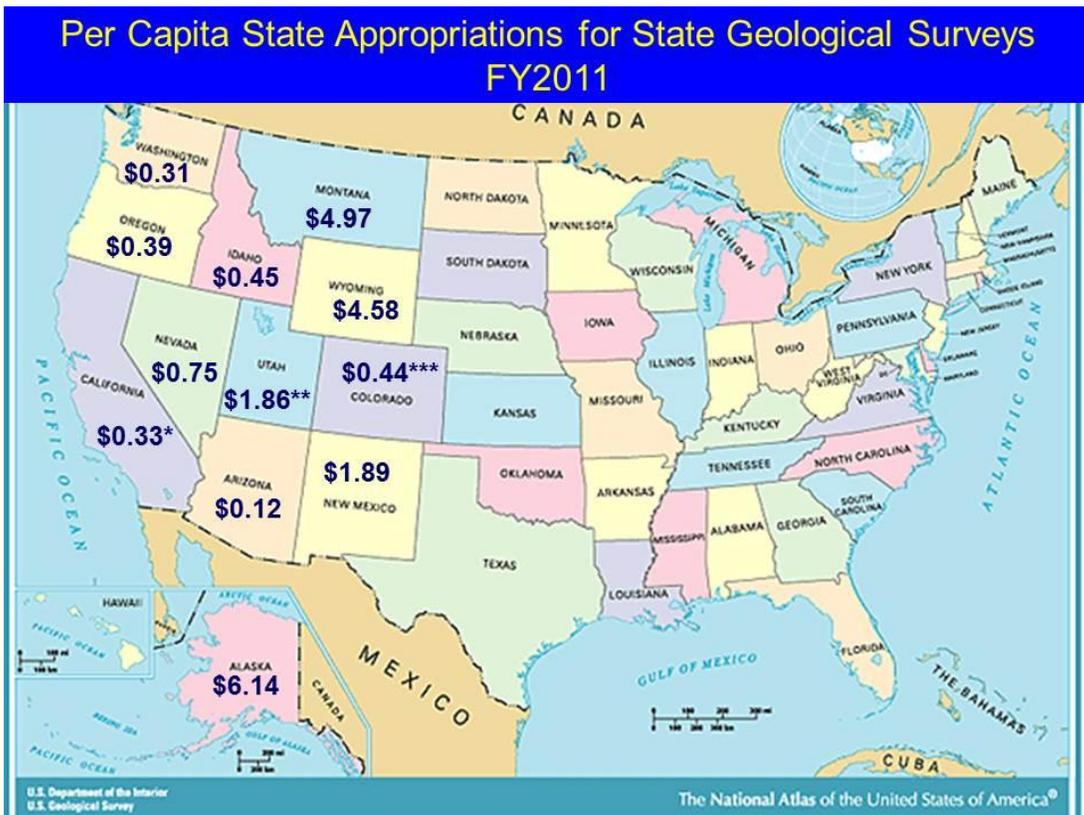
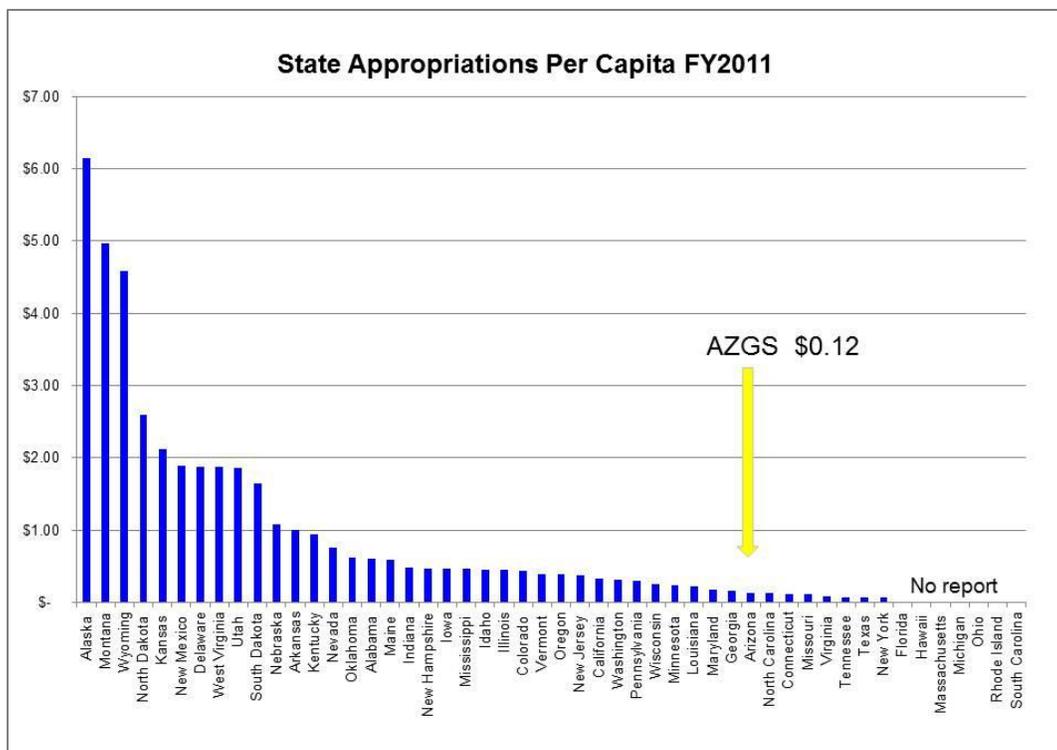
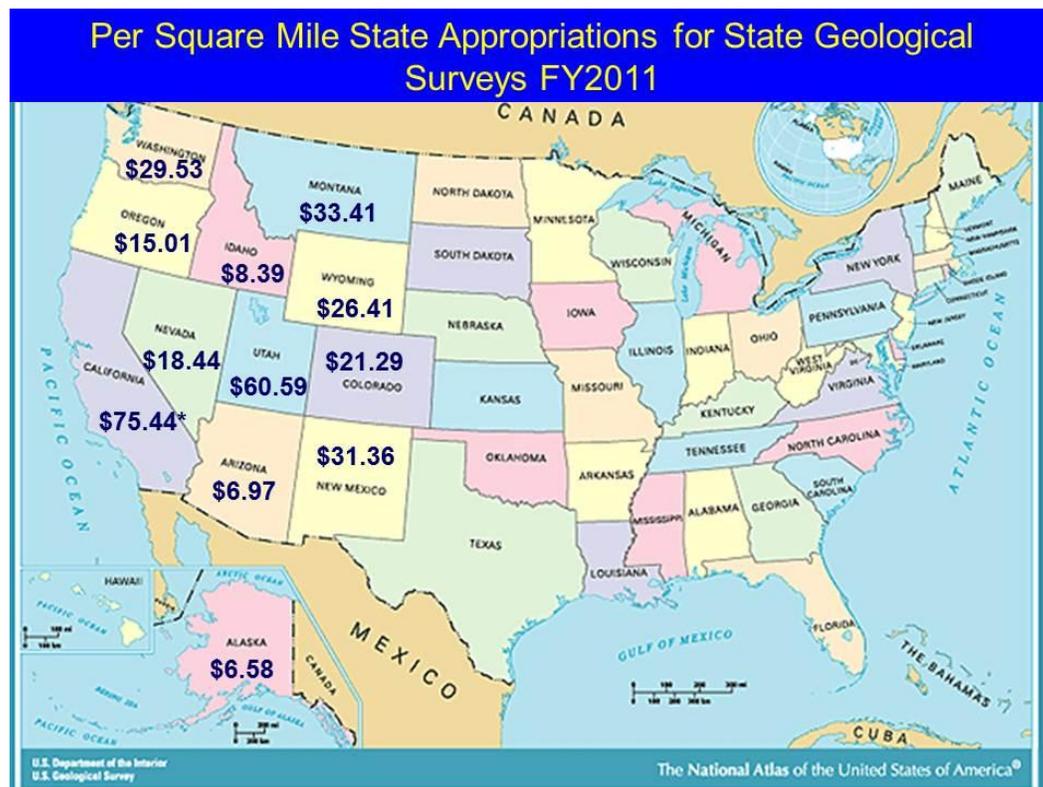
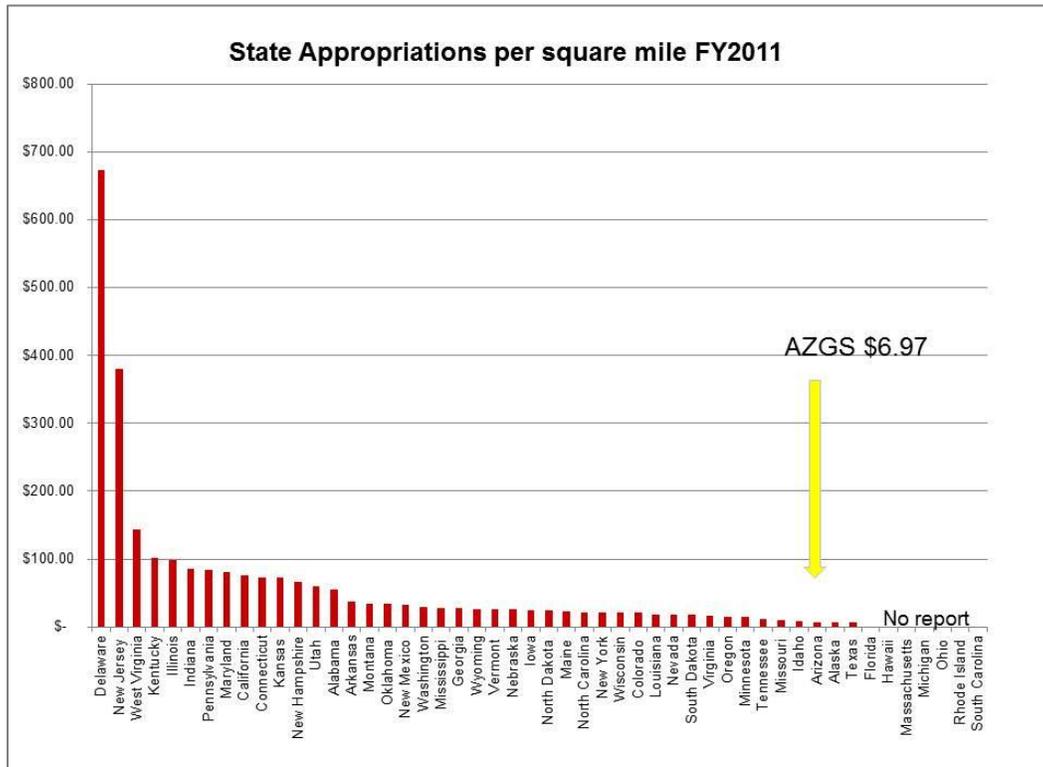


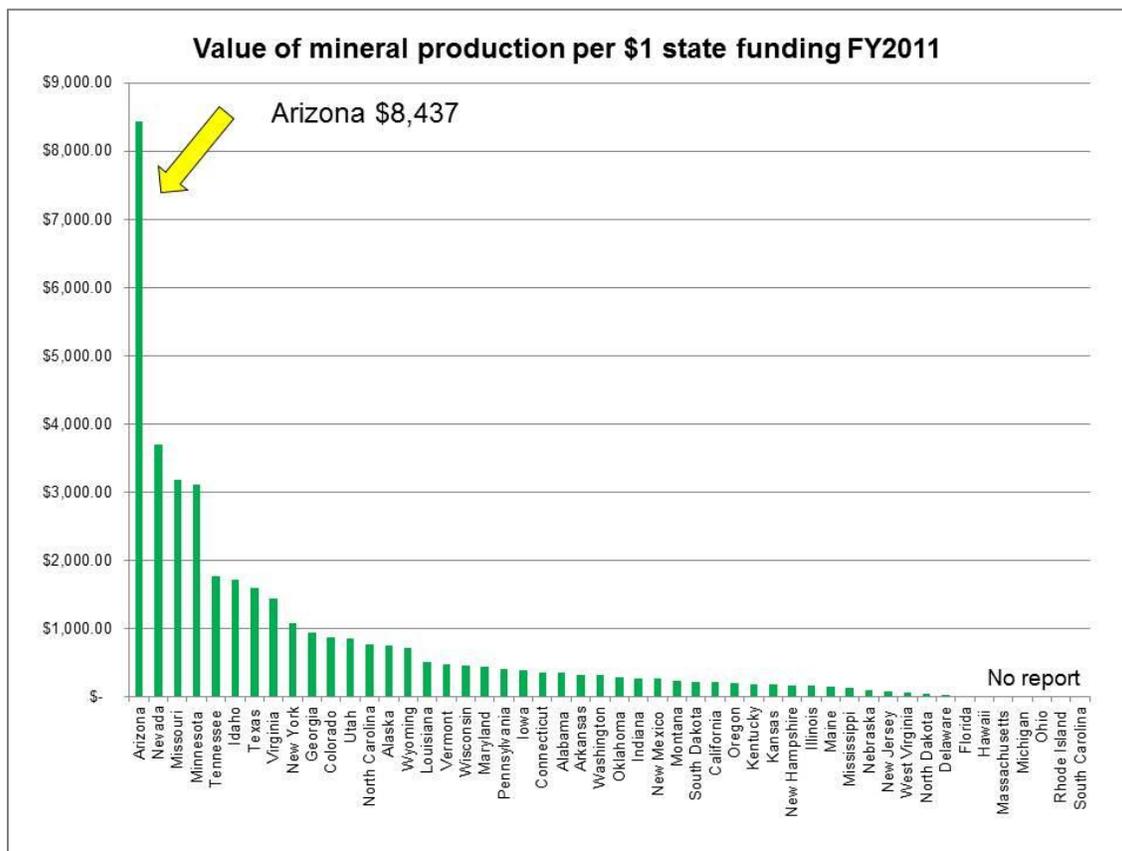
Figure 3: Per capita expenditures by state. *CA appropriation includes seismic hazards and strong motion program funding; **UT includes dedicated share of federal lease royalties; ***CO includes dedicated severance tax funds.

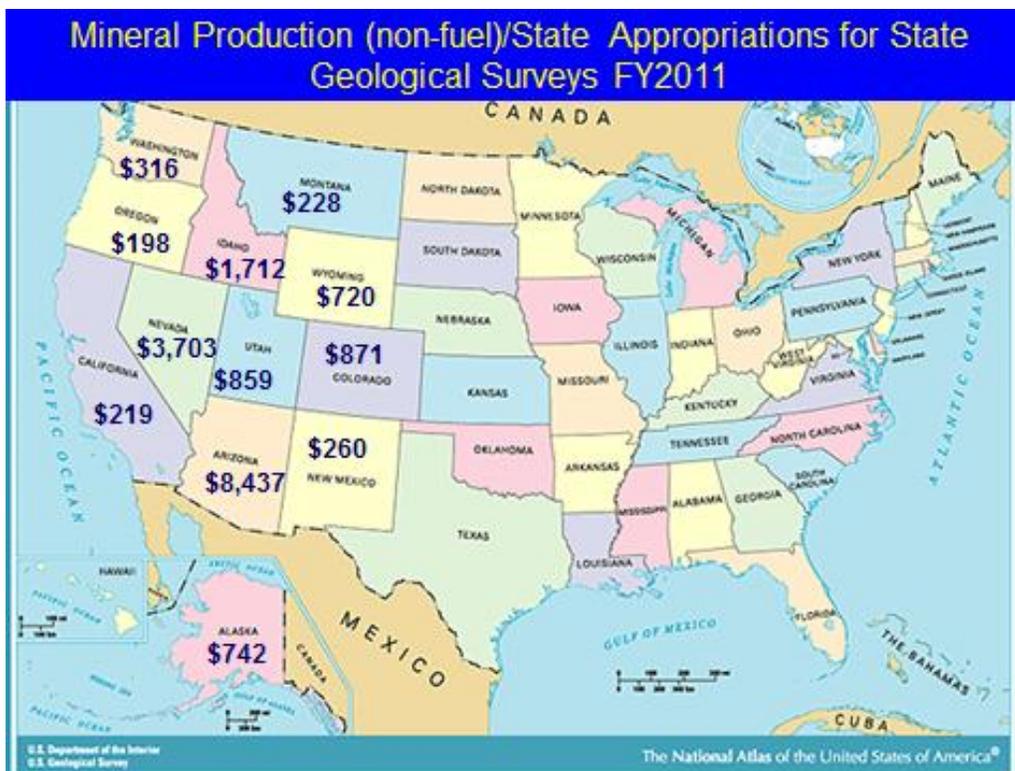
AZGS Sunset Review Factors

On a per square mile basis, Arizona received \$6.97 versus a national average of \$23.86. The range is \$5.98 (Texas) to \$674 (Delaware). In the Western U.S., Arizona and Alaska are roughly tied near the bottom of funding per square mile. Texas is the only state lower.

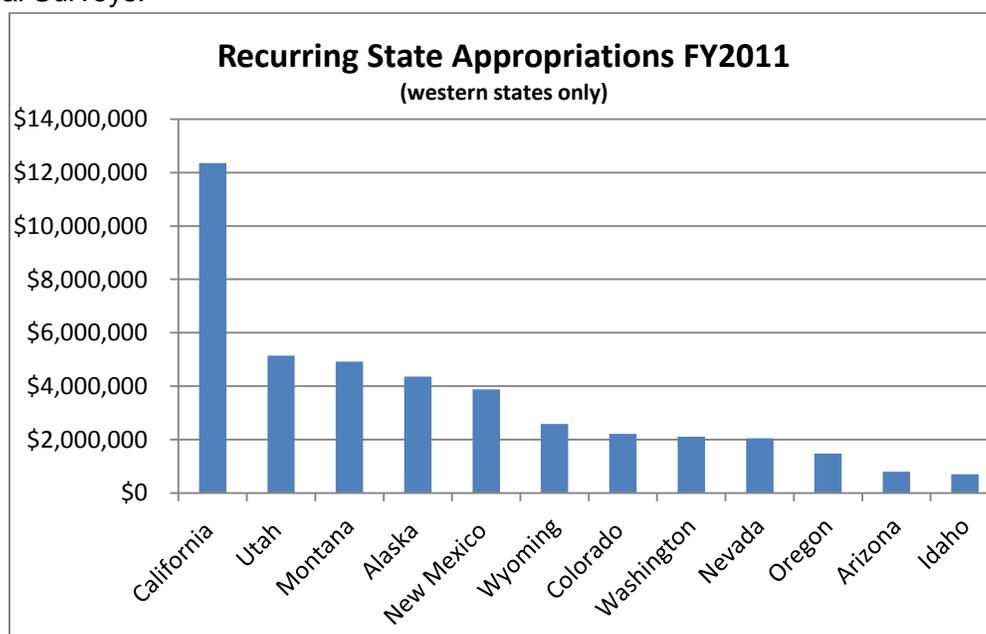


Another metric is to compare the value of annual mineral production (non-fuel) in each state to the state appropriation to their State Geological Surveys. This is not to argue that there is a direct correlation but it does demonstrate states investments in agencies that play significant roles in identifying and characterizing mineral resources. On average, there is \$706 worth of mineral production for each dollar spent by states on Geological Surveys. The low is Delaware at \$7.57 and the high is Arizona at \$8,437. The second highest return is Nevada with \$3,703 in mineral production for each dollar to its Survey.





In summary, **Arizona spends well below the national average on its State Geological Survey**, in absolute dollars. When compared to state expenditures per capita and per square miles, Arizona’s state appropriation is near the bottom. When compared to other Western, public lands states, Arizona invests only 2% to 40% of what the other 11 spend on their State Geological Surveys.



3. The extent to which the agency serves the entire state rather than specific interests.

AZGS deals with geologic hazards and natural resources geographically across the entire state. With geologic hazards, we emphasize responding to those that put people and property at risk, as a result there is more work in urbanized areas. Everyone in Arizona is subject to one or more geologic hazards. These include earthquakes, flooding, landslides, debris flows, rock falls, rock solution and collapse, land subsidence and Earth fissures, radon gas, and natural contamination of ground water. The establishment of the statewide Arizona Broadband Seismic Network is helping us provide a modern assessment of the earthquake hazards, which have long been under evaluated as to their potential destructiveness.

Our technical assistance in wise use of our energy and mineral resources impacts the entire state through economic development and expanded tax base, as well as helping to mitigate any adverse impacts.

We use the broadly-based Geologic Mapping Advisory Committee to prioritize where we carry out our mapping.

We established a Phoenix branch office for the first time in our 120+ year existence to better serve the main population center and the northern half of the state. We are in the midst of integrating that with the former ADMMR staff and office to provide a full-service operation in the Phoenix valley.

We intermittently convene external review panels to assess the nature and extent of our programs and projects and use their recommendations expeditiously, as we did most recently in 2009 to prioritize programs for elimination due to budget cuts.

As part of our Geologic Extension Services we provide geologist led tours across the state and provide our publications to numerous bookstores from Bisbee to the Verde Valley. We also provide publications to the Arizona State Parks and U.S. National Parks through a partnership with the Western National Parks Association.

4. The extent to which rules adopted by the agency are consistent with the legislative mandate.

The Arizona Geological Survey has no authority to promulgate rules and regulations. The Arizona Oil and Gas Conservation Commission, which is attached to the Arizona Geological Survey for technical and administrative support, does promulgate rules and regulations, but has its own Sunset Review. The Commission terminates on July 1, 2016.

5. The extent to which the agency has encouraged input from the public before adopting its rules and the extent to which it has informed the public as to its actions and their expected impact on the public.

AZGS did not adopt any rules during the past decade. However, we do engage with the public about our programs and activities. We solicit public input on our geologic mapping priorities each year which are then finalized by the external Geologic Mapping Advisory Committee.

In the early fall of 2009, the Governor's Office of Strategic Planning and Budget directed AZGS to develop plans for a 30% budget reduction by the end of the calendar year due to revenue shortfalls resulting from the recession. AZGS responded by asking our stakeholders to rank and prioritize all AZGS functions as a guide on what should be cut and what should be preserved. We did this through a two-stage process. We created a list of all AZGS duties or functions broken down into well-delineated topics (Appendix A). These were put online using a public survey tool and widely disseminated to our users, customers, and stakeholders. We asked them to rank each one as to its importance. We received 183 fully completed surveys and summarized the responses (Appendix A).

Second, we asked the Arizona Chapter of the American Institute of Professional Geologists (AIPG) to chair a review committee to similarly evaluate and rank each of the AZGS functions and duties (Appendix B). The committee was comprised of stakeholders from industry, government, and academia. They met at the AZGS offices on October 9, 2009 for a full day. Staff provided overviews and results of each AZGS function and answered questions. The committee prepared a set of recommendations to the Director that were subsequently accepted almost without change. A list of programs and duties were identified as targets for elimination if the budget cuts were enacted as expected. We notified our larger stakeholder community by posting the committee recommendations on the AZGS website and discussing them in the Arizona Geology blog.

However, as this process was unfolding, AZGS was notified that it was being awarded a major contract from the U.S. Department of Energy to populate and deploy the National Geothermal Data System across the country over the following three years, using federal stimulus funds (ARRA). The \$17.7 million award was \$2 million more than AZGS had requested but DOE was enamored enough of our plans and capabilities that they asked us to expand the project from 42 to all 50 states. Subsequently, DOE added another \$4.1 million to the project to include a national program to acquire new geological data to support geothermal exploration.

This influx of federal money would triple the AZGS budget for the next three years, although more than 85% is designated to go 45 subcontractors across the U.S. Even with that, the funds expended by AZGS meant that not only would we be able to fund all existing staff, we would have to grow by about 50% to carry out this project. As a result, the anticipated elimination of programs and functions was not necessary. The process though, validated the usefulness of our duties for our customers and stakeholders, and is an important planning tool for future activities to be conducted by the survey.

6. The extent to which the agency has been able to investigate and resolve complaints that are within its jurisdiction.

NOT APPLICABLE

7. The extent to which the attorney general or any other applicable agency of state government has the authority to prosecute actions under the enabling legislation.

NOT APPLICABLE

8. The extent to which agencies have addressed deficiencies in their enabling statutes that prevent them from fulfilling their statutory mandate.

The Arizona Geological Survey is unaware of deficiencies in our enabling statutes that prevent us from fulfilling the statutory mandate. The paragraphs below summarize the creation of the AZGS as a state agency and modifications to the statutes due to the consolidation of other state agencies.

University to state agency

On July 1, 1988 the Arizona Geological Survey became a stand-alone state agency, after having been part of the University of Arizona since 1915. This was a major change because, for the first time, it placed the agency in an organizational framework in which public service and applied geology are expected (instead of teaching and research), gave the agency increased visibility and accountability to its constituents, and enabled the Arizona Geological Survey to function as a state agency and effectively fulfill its statutory mandate.

Transfer of Oil & Gas Conservation Commission duties

In 1991 the Legislature attached the Arizona Oil and Gas Conservation Commission to the Arizona Geological Survey, which provides administrative and staff support. The 6-member Commission is responsible for regulating the drilling for and production of oil, gas, carbon dioxide, helium, and geothermal resources. This move was necessitated by the low price of crude oil and state revenue shortfall. Fiscal analysts concluded that the Commission (agency), which had a budget of almost \$200,000 and 4 FTEs, could no longer justify its existence as a stand-alone agency. The agency issued only 18 drilling permits in the six-year period 1984-1989 because the low price of crude oil provided little incentive for exploration. Consolidation of the Oil and Gas Commission with the Arizona Geological Survey enhanced the role of the Arizona Geological Survey in subsurface geology and energy resources and provided a home, at least temporarily, for the Commission. If drilling for oil and gas increases significantly and results in commercial production, the needs of the Commission and the state will be reevaluated.

Consolidation of ADMMR with AZGS

The Arizona Department of Mines & Mineral Resources was consolidated with the Arizona Geological Survey, effective July 20, 2011. This culminates a multi-decades long debate over real or perceived duplication of efforts and areas of responsibilities, particularly in regard to preservation of mining and mineral resources maps, reports, and data.

9. The extent to which changes are necessary in the laws of the agency to adequately comply with the factors listed in this subsection.

Earth fissure mapping program

The enabling statutes for the Earth fissure mapping require AZGS to deliver data files to the State Land Department (ARS 27-152.01-3). The State Land Department subsequently produced maps of those areas with overlays showing affected counties, cities, towns, highways and streets for viewing online (ARS 37-173.09). However, due to budget cuts, the Land Department was unable to maintain this function and in 2009, AZGS took over this responsibility and continues it now.

In addition, the law requires that AZGS submit the data only once every five years. In fact, AZGS delivered the results of each study as soon as it was complete.

The current statutes should be revised to

- 1. Eliminate the requirement to deliver the earth fissure data to State Land Department and instead direct AZGS to serve the data publicly, and**
- 2. Eliminate the requirement that the Land Department transfer the data back to AZGS and to the Real Estate Department.** Instead, AZGS can provide the data directly to the Real Estate Department.

There are no adverse consequences to these actions and reflect the procedures that have operated successfully for a number of years, at substantially lower costs than under the original process. The relevant statutes for AZGS and the Land Department are:

§27-152.01. Duties of Arizona geological survey

3. Beginning on or before January 1, 2007 and every five years thereafter, submit to the state land department copies of all data files of known areas of earth fissures for the purposes of section 37-173, paragraph 11. On receipt of the earth fissure maps from the state land department that are based on data files submitted, the Arizona geological survey shall provide any map to any member of the public in printed or electronic format on request. The following notice shall be displayed below each map:

Notice

The state of Arizona has made a reasonable effort to ensure the accuracy of this map when it was produced, but errors may be present and the state of Arizona does not guarantee its accuracy. The map supplements, and is not a substitute for, a professional inspection of property for defects and conditions.

§37-173. Duties [State Land Department]

The division shall:

9. Within ninety days after receiving data files of known areas of earth fissures from the Arizona geological survey pursuant to section 27-152.01, paragraph 3, produce maps of those areas with overlays showing affected counties, cities, towns, highways and streets. The division shall transmit the maps in printed and electronic format to the Arizona geological survey and the state real estate department for purposes of providing public access to the earth fissure maps pursuant to sections 27-152.01 and 32-2117.

ADMMR – AZGS consolidation

The consolidation of the Arizona Department of Mines & Mineral Resources with the AZGS was done with little public comment on the statutory changes. The AZGS statutes were left intact, but the ADMMR statutes were extensively modified and restated as part of the AZGS code. A consequence is that there are differing interpretations of what the AZGS goals and objectives are as well as a potential conflict.

Under ARS 27-102.A, the department is instructed to:

1. Promote the development of the mineral resources and industry of this state.
2. Advocate the development of mineral resources and the production of minerals and mineral products in this state in support of its objectives.

Subsequent sections list other duties (ARS 27-102.A 3 through 12): participation in conferences, studies, maintenance of data and file repositories, providing data, making surveys, publishing results, cooperation with the Corporation Commission, and assisting agencies and organizations.

Following Governor Brewer’s proposal to consolidate the agencies, stakeholders of both agencies questioned whether the ‘promote’ and ‘advocate’ duties are compatible with the AZGS mandate to “Provide objective, scientific information about the geologic character of this state...” (ARS 27-152.01.2).

Can AZGS promote and advocate and be objective at the same time?

Our view is that the other duties following the ‘advocate’ and ‘promote’ functions actually delineate how the agency is to advocate and promote development. In this interpretation, the duties are similar and compatible to those of AZGS.

However, many stakeholders view the words ‘advocate’ and ‘promote’ to mean proselytizing and lobbying for industry activities and urge AZGS to abandon our role as objective, scientific sources of information.

We believe we can be most effective by providing unbiased, credible information that can be relied upon to make decisions. We think this is the intent of the legislation. If it were intended for ADMMR, and now AZGS, to serve more as a state-funded lobbyist for select businesses, the other duties would spell that out explicitly. ADMMR staff have traditionally been mining engineers and geologists, not lobbyists or economic development representatives.

The revised statutes (ARS 27-102.A) should be amended to either

1. Revise the words 'advocate' and 'promote' to match the language in the other AZGS statutes (ARS 27-152.01.2) about mineral resources, or
2. Clarify that sections 1 and 2 are meant to be carried out by the duties listed in items 3 through 12.

10. The extent to which the termination of the agency would significantly affect the public health, safety, or welfare.

The Arizona Geological Survey is a primary source of unbiased information about the geologic character of Arizona, including geologic processes and materials that have potential to cause loss of life, personal injury, or property damage. These processes and materials include earthquakes, flooding, landslides, rock falls, rock solution and collapse, land subsidence and Earth fissures, radon gas, and natural contamination of ground water.

Arizona Geological Survey geologists map and describe the processes and materials, with emphasis on practical and applied investigations. No other state agency has responsibility for doing geologic mapping, investigating geologic hazards and limitations, identifying and characterizing energy and mineral resources for their development, and providing objective information to the public. Private sector companies, which are hired largely to do site-specific studies, rely heavily on geologic maps and related information such as that produced by the Arizona Geological Survey. Information about hazards and limitations and energy and mineral resources is a factor in public health, safety, and welfare.

The Arizona Geological Survey assembles and archives geologic data, maps, and reports and maintains them for long-term public access. During the past 50 years a tremendous amount of geologic information has been released by agency geologists, graduate students and faculty, other governmental agencies, and professional societies. In addition, the agency archives rock cuttings and some cores from the drilling of oil wells or mineral tests. This priceless geologic information must be properly maintained, yet must be accessible to the public. Doing so is clearly a function of state government through its state geological survey.

Although new geologic information is released every year, much of it is academic research that is done by university faculty, graduate students, and the U.S. Geological Survey. There is an emphasis on "cutting edge" research. Most of this work is currently being done outside of Arizona and commonly in other parts of the world. This type of research is essential to expand the science of geology. Arizona Geological Survey and other professional geologists welcome and rely on some of the work done by the academic community. For this reason, AZGS is located in proximity to the University of Arizona, home to one of the nation's leading geoscience departments. Staff confer with faculty members, attend lectures or sit in on graduate classes, and have access to equipment and laboratories used to carry out the university research.

A major function of State Geological Surveys, however, and the one that distinguishes them from academic institutions, is the priority the State Geological Surveys give to applied geology within their respective states. Governmental land- and resource managers need applied geologic information to carry out their planning, management, and regulatory functions. Applied geologic information is used to help prudently manage federal, state trust, and private land in Arizona. It is used to site, construct, and maintain infrastructure, businesses, and residences; to find and exploit water, energy, and mineral resources; to locate places to safely dispose of waste, and to identify areas that may have potential for future discovery of water, energy, and mineral resources. At the local level it is used in the planning and zoning process. If the Arizona Geological Survey was terminated this information and assistance would not be readily available, if it was available at all.

The Arizona Geological Survey encourages exploration and possible discovery of energy and mineral resources by compiling and publicizing information about areas that might have potential. AZGS, especially now with the consolidation of ADMMR, is the sole non-regulatory agency for the wise development of mineral resources for Arizona, which is regularly the number one mineral producing state in the nation. Just one study released by AZGS (OFR-08-07- *Potash and Related Resources of the Holbrook Basin, Arizona*, 2008) launched a major mineral exploration program that may lead to new economic activity amounting to hundreds of billions of dollars.

When new resources, such as the Holbrook basin potash, are discovered and exploited, revenue is generated for state, county, and local governments. The Arizona Geological Survey is the only source for much of this information, which is readily available to elected officials and staff, land- and resource-management agencies, businesses and consultants, and the general public.

AZGS reviews and evaluates studies, conclusions, and proposals regarding natural resources and natural hazards on lands managed by federal agencies. We provide independent assessments to help ensure decisions and actions are considered from the State's point of view.

Governmental agencies, businesses, consultants, and university faculty and students use geologic maps, reports, data, and other information provided by the Arizona Geological Survey to carry out their operations.

11. The extent to which the level of regulation exercised by the agency compares to other states and is appropriate and whether less or more stringent levels of regulation would be appropriate.

NOT APPLICABLE

12. The extent to which the agency has used private contractors in the performance of its duties as compared to other states and how more effective use of private contractors could be accomplished.

The number of contractors used in State Geological Surveys (SGS) is not tracked by the Association of American State Geologists. Despite increasing total revenue to State Geological Surveys nationwide, total staff numbers have continued a generally declining trend since the early 1980s when the peak was close to 2,900 FTEs. In 2010, the total was 2,061 FTEs, and in 2011 it is projected to be 1,980 FTEs – a decrease of about 1000 FTEs in 30 years. The cause of this apparent discrepancy is suspected to be an increase in sub-contracts awarded by SGSs (which then outsource the work). This appears to be done by individual contractors, rather than SGS's contracting with companies for staff services.

The Arizona Geological Survey uses private companies to print maps and reports that are released in the Bulletin, Circular, Down-to-Earth, Map, and Special Paper publication series. The agency hires temporary employees to work on projects funded by contracts with other agencies and groups; permanent employees supervise the projects. Many of these employees are geology graduate students at the University of Arizona or Arizona State University who are working on advanced degrees under the tutelage of highly specialized faculty members. By working on applied geology projects at the Arizona Geological Survey these students gain practical experience, commonly complete their very first geologic map or report, and become better prepared for the “real-world” jobs most of them will take after graduation.

AZGS uses private laboratories for analytical work rather than trying to maintain those specialized facilities ourselves. Similarly, we turn to private contractors for geophysical surveys. The 9 web sites maintained by AZGS are hosted by a private contractor as well.

Since its conversion to a state agency in 1988, AZGS has turned to individual consultants and contractors with specialized expertise to assist on projects. These come from the fields of geology, geophysics, hydrology, archeology, and information technology/computer sciences.

AZGS monitors practices at other SGS's to look for better or more efficient ways of operating. The State Geologist is in constant contact with his colleagues nationwide, sharing ideas.

Rather than privatizing the AZGS, we could consider an alternative where the agency could be chartered to act as the geological survey but be moved out from under the state system. Such arrangements exist at the national level. The percentage of the AZGS budget coming from the state is a minor part of the overall budget and may reasonably be expected to continue to shrink. Thus transitioning from the state system may give the agency greater flexibility to carry out its duties

13. The extent to which the agency potentially creates unexpected negative consequences that might require additional review by the committee of reference, including increasing the price of goods, affecting the availability of services, limiting the abilities of individuals and businesses to operate efficiently and increasing the cost of government.

Regulation by the Arizona Oil & Gas Conservation Commission

The operative word in the question is “unexpected” but to be comprehensive, we note that AZGS carries out the regulatory duties on behalf of the Arizona Oil & Gas Conservation Commission. State regulations imposed by the Commission require that drilling operations take steps to protect life, property, and natural resources, especially ground water resources penetrated by well bores. These are not unexpected, nor is any rule or statute in Arizona unusual or burdensome compared to rules in other states. The AZGS pays the Commissions dues to be a member of the Interstate Oil & Gas Compact Commission, where state regulators collaborate to keep regulation of drilling and production in the hands of the states, and away from federal jurisdiction.

Disclosure of geologic hazards

In North Carolina recently, the State Geological Survey’s landslide mapping program was eliminated nominally for budgetary reasons, but newspaper reports describe publicly stated concerns from landowners and real estate interests that such maps could lower the value of their lands and called for shutting down the mapping program. Opponents to the state mapping program argued that it is a ‘buyer beware’ situation, effectively transferring the landslide risks from sellers to buyers.

In contrast, Arizona created the Earth fissure mapping program at the urging of real estate and home building interests. The intent is that having knowledge of these hazards allows buyers, sellers, developers, agents, and planners to make informed land use decisions and prevents lawsuits.

It is recognized however, that the discovery and documentation of Earth fissures on a property could lead to a lessening of its value. A homeowner in Pinal County realized on her own that her house was underlain by at least one Earth fissure. She appealed her property tax valuation on this basis and it was subsequently reduced 60%.

Thus far, the responses to the AZGS Earth fissure reports and maps have been positive. However, there are anecdotal reports over the years of a few landowners plowing over or dumping fill on Earth fissures, prior to the plots being put up for sale.

Land use planning for aggregate resources

Legislation passed in 2011 adds preservation of aggregate resources to local governments land use planning requirements. ARS 9-461.05.g says a land use plan “Includes sources of currently identified aggregates from maps that are available from state agencies, policies to preserve currently identified aggregates sufficient for future development and policies to avoid

incompatible land uses...” It was intended that AZGS is the agency to supply those aggregate resource maps.

This is a new mandate and we are still trying to gather the appropriate maps to provide to county planners. We can envision however, the possibility that lands identified with aggregate resources could be intended for other, incompatible uses by the owners or planners, for example, housing developments rather than mining potential.

INFORMATION FROM THE ARIZONA GEOLOGICAL SURVEY TO BE INCLUDED IN THE FINAL SUNSET REVIEW REPORT

1. Identify the problem or the needs that the agency is intended to address.

The Arizona Geological Survey meets three key needs of the citizens of Arizona:

1. Help protect people and property from geologic hazards, including floods, landslides, debris flows, earthquakes, Earth fissures and cracks, subsidence, rock falls, karst or solution collapse, and natural contamination of ground waters.
2. Encouraging the wise use and development of the state's mineral and energy resources, including staffing the Oil and Gas Conservation Commission.
3. Informing the public, industry, government, and academia about the geologic character of the state in order to foster informed decision making about natural hazards and natural resources, including enjoyment of the state's natural recreational resources.

2. State, to the extent practicable, in quantitative and qualitative terms, the objectives of the agency and its anticipated accomplishments.

Objectives and Accomplishments, FY01-FY11

As part of the Survey's previous Sunset Review in 2001, a number of objectives were proposed for the subsequent decade-long review period. The goals and our resulting accomplishments are delineated below.

2001-2010 Objective 1: Continue geologic mapping of the state, with emphasis on population growth and development areas.

Accomplishments:

Most geologic maps produced by AZGS during the past decade were released as digital products (see Objectives 2 below). In addition to the 105 digital products, we also released 13 Contributed Maps. We have successfully competed for annual funding under the USGS National Cooperative Geologic Mapping Program, additionally we have obtained mapping support from the National Park Service, Arizona Department of Transportation, and the Arizona Department of Water Resources. The AZGS Geologic Mapping Advisory Committee began emphasizing more mapping in areas of mineral resource potential, starting in 2009.

2001-2010 Objective 2: Increase the availability of digital geologic maps and related data.

Accomplishments:

AZGS published the following digital products in the past decade:

- 66 Digital Geologic Maps
- 26 Digital Maps
- 13 Digital Information reports

A single publication may include multiple map sheets (e.g., DM-DF-01 contains 11 map sheets). AZGS adopted a policy of “Everything digital, online, and interoperable.” We implemented an Enterprise Geodatabase to inventory and catalog over 600 internal databases and collections, with support from the USGS Data Preservation program. AZGS is the designated lead institution for the U.S. Geological Survey – Association of American State Geologists Geoscience Information Network, a national, distributed, data network in the geosciences.

2001-2010 Objective 3: Define and characterize potential geologic hazards and limitations and prepare reports about them

Accomplishments:

Earth Fissures - In 2006, new legislation (Arizona Revised Statute 27-152.01 created by HB2639) tasked AZGS to map all Earth fissures in the state and make the results easily accessible online to the public. Since then, we identified 24 Earth fissure “study areas” and completed initial mapping of fissures in 22 of them, with both digital and hard copies available. There are county-wide Earth fissure maps for all four counties where fissures have been discovered – Maricopa, Pinal, Pima, and Cochise. AZGS developed an online interactive Earth fissure map viewer that allows the public to easily find fissures by address or map area. We estimate over 125,000 copies of digital maps, reports, and educational materials have been downloaded. We do not track the number of visitors to the online viewer, but anecdotally, we know it is widely used by real estate agents, home buyers, and local governments and businesses. In 2010, budget cuts to the State Land Department led to AZGS taking over operation of the official web site for making Earth fissure maps public. Revision of the statute is recommended to address this reality.

Flooding, landslides, and debris flow hazards – Selected examples of AZGS responses to geologic hazards:

- An Easter weekend **landslide** in 2008 closed State Highway 87 between Phoenix and Payson for six days. AZGS identified the source and extent of the slide mass needing to be stabilized before the road could reopen.
- The Santa Catalina Mountains north of Tucson experienced hundreds of **landslides and debris flows** in July 2006. As a result, the popular recreation area in Sabino Canyon was closed for months. AZGS assessed the nature of the damage in Sabino Canyon and recommended appropriate remediation. In addition, the AZGS was funded by the

Pima County Regional Flood Control District to map young debris flow deposits near canyon mouths along the mountain front.

- The 2008 Havasu Creek **flood** closed a world-class Grand Canyon tourist destination, causing several million dollars' worth of damage, and destroying the Havasupai Tribe's primary income from tourist dollars. AZGS assisted the Tribe in mitigating landslides, reopening trails, and slowing erosion in time for tourist season.
- In 2010, Havasu Creek **flooded** once more, again destroying much of the tourism infrastructure. AZGS's long term relationship with and support for the Havasupai Tribe came to fruition in the Tribe being the first ever in the U.S. to receive federal disaster declaration and funding on their own, without a state or county sponsoring body.
- **Debris flows** at Coronado National Memorial Park in 2006 badly damaged the park's facilities. AZGS identified unstable areas and recommended relocating key facilities.
- Significant **debris flows** at Oak Creek Canyon in 2006 resulted from post-fire conditions in the area. Responding to this event, AZGS identified unstable areas subject to failure from rainstorms and assisted deploying an emergency warning system for residents along Sedona Highway.
- The Schultz wildfire northeast of Flagstaff caused extensive **flooding** to alluvial fan located communities that were unprepared for it. AZGS worked with Coconino County and the U.S. Forest Service to identify debris flow hazards and recommend mitigation measures.
- An AZGS geologist was the only non-federal member of the 2011 Horseshoe 2 fires Burn Area Emergency Response (BAER) Team, assessing **flood and debris flow** hazards.
- In response to the large Willow Fire in central Arizona in 2004, AZGS geologists prepared a report evaluating the potential for **debris flows** along State Highway 87 south of Payson as part of the Burned Area Emergency Response Team. Debris flows occurred shortly after the fire in several watersheds identified as potentially hazardous.

Seismic Hazards – AZGS used FEMA funds to acquire 8 state-of-the-art broadband seismic stations in 2007 that had been installed temporarily in Arizona as part of the USArray research study, and continues to operate them in cooperation with our three state universities. These now constitute Arizona's first statewide earthquake monitoring network ensuring that we can detect a magnitude 2.5 or larger earthquake anywhere in the state. Such monitoring is critical to evaluate seismic hazards for disaster planning and critical facilities such as the Palo Verde Nuclear Generating Station.

AZGS geologists mapping in Chino Valley discovered a potentially active fault system and continue to characterize it.

Geologists from the Utah Geological Survey, Arizona State University, and the AZGS collaborated on an investigation of the recent history of the Hurricane fault in northern Arizona for several years. The Hurricane fault in Arizona, which has produced several magnitude 6.5 to 7 earthquakes in the past 15,000 years, definitely has potential to cause damage between the western Grand Canyon and Cedar City, Utah.

Reports – AZGS published 18 open-file reports on flooding, landslides, debris flows, naturally-occurring radioactive materials, earthquakes, earth fissures, earth cracks, subsidence, and asbestos during the past decade.

2001-2010 Objective 4: Prepare county reports on areas interpreted to have potential for energy and mineral resource discoveries, with emphasis on rural Arizona

Accomplishments:

AZGS focused on specific mineral or energy resources and localities rather than broader and less focused county-based studies.

Reports and Maps - We published 8 open file reports:

- OFR-02-01-Geologic Description, Sampling, and Petroleum Source Rock Potential of the Awatubi and Walcott Members, Kwagunt Formation, Chuar Group of the Sixtymile Canyon Section, Grand Canyon, Arizona, 2002, 84 p., vertical scale 1" = 100
- OFR-02-13-Naturally Occurring Radioactive Materials (NORM) in Arizona, 2002, 11 p., scale 1:2,500,000.
- OFR-03-01-Correlation of Pennsylvanian and Permian Strata in Coconino County, Arizona, 2003, 4 p., 4 sheets.
- OFR-03-05-Review of Helium Production and Potential in Arizona, 2003, 29 p.
- OFR-08-07- Potash and Related Resources of the Holbrook Basin, Arizona, 2008, 23 p.
- OFR-09-02 Carbon Sequestration Potential at the 1 Alpine-Federal Site in East-Central Arizona, 2009.
- OFR-11-04, Breccia-pipe uranium mining in the Grand Canyon region and implications for uranium levels in Colorado River water, 2011, 13 p
- OFR-11-05 Preliminary Evaluation of Cenozoic Basins in Arizona for CO2 Sequestration Potential, 16 p.
- OG-01, the oil and gas production report is compiled and published monthly. OG-02, the oil and gas annual production report; OG-15, Dineh-bi-Keyah field map; and OG-35, oil and natural gas occurrence chart are updated annually. These publications have been published online since January 2006.

AZGS published a detailed 1:12,000 scale geologic map of the proposed Rosemont copper mine in the Santa Rita Mountains, south of Tucson, to provide credible bases for evaluating issues raised in the U.S. Forest Service Environmental Impact Statement (EIS) to permit the mine. AZGS followed up with quadrangle maps (1:24,000) centered over the mine and affected areas.

We scanned dozens of out of print or classic AZGS mineral resource publications and posted them online for free downloading. Another dozen gold publications are extremely popular with the weekend prospectors as well as the professionals.

Copper - AZGS carried out a detailed study of the geochemical origin of the giant Morenci copper mine in cooperation with Phelps Dodge Corp, now Freeport McMoRan Copper & Gold. For the past few years, we have been actively participating in the U.S. Forest Service EIS process for the Rosemont copper mine. We are also working with the proposed Resolution Copper mine to seek ways to use the high temperatures at the bottom of the 7,000 foot deep mine to generate geothermal energy.

Uranium – AZGS is a cooperating agency in the US Bureau of Land Management EIS process on withdrawal of nearly 1 million acres in northern Arizona from mineral entry or exploration. As part of our work we found that 40-80 tons of uranium is carried down the Colorado River through the Grand Canyon every year by natural erosion of the uranium-bearing rocks in the watershed. In comparison, we modeled potential accidental spills from mining operations and found that in ‘worst-case’ situations, the amount of uranium added to the river would be undetectable against the naturally-occurring load. These results were subsequently published for wider distribution.

Potash - AZGS published a report on the Holbrook basin salt deposit in 2000 that showed the extent of a potash layer near the top of the unit. Potash is used as a fertilizers and the U.S. imports 85% of its demand. In 2003, a follow-up report included an isopach (thickness) map of the potash based on data from 100+ core holes drilled in the 1960-70s that AZGS maintained in our files. However, in 2007, the price of potash skyrocketed many-fold due to a global shortage. AZGS determined the volume and grade of the potash in the Holbrook basin and released a report in 2008 that revealed a resource of 682 million to 2.58 billion tons of potash at relatively shallow depths. At the upper end, this amounts to more than one-quarter of the potentially economically recoverable potash in the U.S. At today's price of over \$500 per ton, and 70% recovery, that could produce \$850 billion of potash.

The AZGS report triggered a land rush in the region with almost all state trust and private lands under lease. Three companies are currently carrying out aggressive exploration programs, with 85 core holes permitted and hundreds of miles of seismic lines shot.

One company has projected building a 2 million ton per year operation for 50 years, employing 400 in Holbrook at salaries averaging \$60,000 for miners, and an annual operational budget of \$400-500 million. Across the industry, the AZGS report is the definitive reference.

Geologic sequestration of carbon dioxide - AZGS is continuing multi-year projects to evaluate the potential to store CO₂ in underground reservoirs as a way to keep coal-fired power plants viable in anticipation of restrictions being placed on CO₂ emissions. AZGS is participating in three projects targeting 1. all basins in Arizona, 2. the Colorado Plateau, and 3. the Dakota, Entrada, and Supai formations in northern Arizona.

2001-2010 Objective 5: Use e-commerce to sell publications of the agency

Accomplishments:

AZGS was on hold for a number of years, waiting unsuccessfully for the state vendor to set up an e-commerce system for our retail sales. That restriction has been lifted and we are pursuing our own installation. In the meantime, we set up an online storefront with Amazon.com. We currently have 425 items for purchase. Our first e-book for Kindle was released at the end of FY11 as a test. More will be forthcoming.

2001-2010 Objective 6: Expand the amount of information displayed on the agency's website

Accomplishments:

Until 2006, AZGS limited its website to 10 Megabytes; anything added beyond that required an equal amount of content to be removed. Since then, we adopted a new philosophy of everything digital, online, and interoperable. The main www.azgs.az.gov website is the flagship of our outreach effort, with many Terabytes of content presented. We are aggressively adding digitized copies of old or out of print AZGS publications, along with most new publications, as free downloads from the document repository.

AZGS manages a total of 9 websites, having created a dedicated site for the Arizona Oil & Gas Commission, and hosting sites for our document repository, data integration projects, the Land Subsidence Group, the former ADMMR, and a new one for mineral education to support the planned Arizona Experience Centennial Museum education program.

- www.azgs.az.gov – The public face of the Arizona Geological Survey.
- repository.azgs.az.gov – Our online document repository providing high-quality, electronic copies of AZGS geologic reports and maps. Currently, more than 650 products are available.
- www.azogcc.az.gov – The Oil and Gas Conservation Commission site provides permit information, production reports and related forms to companies seeking to drill in Arizona.
- www.azmineraleducation.org – Created in June 2011 to share mineral and mining information of Arizona with students and teachers.
- www.azlandsubsidence.org – This is a workgroup site for the Arizona Land Subsidence Group.
- www.mines.az.gov – This is the website for the former Arizona Department of Mines and Mineral Resources. The site is currently unchanged (but hosted/maintained by the AZGS), but the content will be incorporated into the new www.azgs.az.gov site that will be live by October 2011.
- <http://usgin.org>, <http://lab.usgin.org> – Geoscience Information Network - An AZGS-led effort to build a national geoscience information framework.

- <http://www.stategeothermaldata.org/> – The home site of the State Geothermal Data project to bring digital data relevant to geothermal energy exploration and development from all 50 States into the National Geothermal Data System.

2001-2010 Objective 7: Expand the bibliographic and other computer databases

Accomplishments:

AZGS has made data and sample preservation one of our primary strategic goals and created the Geoinformatics Section within the Survey to oversee a coordinated, state-of-the-art approach to achieve this. One strength we bring to this effort is the agency's growing national and international leadership in data management, interoperability, and database exchange protocols.

The number of references in the online digital bibliography, AZGEOBIB, increased from about 12,500 to over 13,500.

The AZGS **Enterprise Geodatabase** initiative in FY07 identified 375 separate collections in 23 categories in AZGS. The comprehensive AZGS inventory breaks down collections also by format and storage location. The latter is important from a collection manager/librarian concern. The collection inventory is written up in a draft catalogue as a guide to the full range of materials and data held by AZGS.

The FY08 project completed a preliminary inventory of geoscience data and samples in Arizona, housed by organizations outside of the Arizona Geological Survey but that are used by AZGS or are at-risk; created an in-house metadata catalog that included geo-referencing locations for all core and cuttings in our repository, age date samples, and gravity base stations, and keywording all items in the catalog; and developed a process to output xml records for submission to the USGS National Data Catalog from our in-house metadata databases.

The FY09 project created metadata for 600 air photos, about 1,100 oil and gas well completion reports (all permitted Arizona oil and gas wells), and about 200 earth fissure locations that had been mapped during the previous year. Metadata records were submitted for inclusion in the National Digital Catalogue in xml format.

The FY2010 project goal was to migrate the AZGS' extensive collection of digital data developed for our Digital Information Series and digital Geological Maps publications from obsolete software formats and data schema into our current enterprise database and into open source, xml-based, standard formats for improved preservation and access via standard web services.

Under the U.S. Department of Energy funded State Geothermal Data project, AZGS is digitizing massive amounts of data in 8 categories for distribution through the National Geothermal Data

System. AZGS serves as the prime contractor on the project as well as a regional hub in the network, serving data from project sub recipients unable to do so.

2001-2010 Objective 8: Prepare non-technical reports on the geology of parks and monuments for those who have had little, if any, training in geology, with emphasis on those areas that have the highest visitor use. Increase the number of customers and number of publications sold without decreasing the quality of service.

Accomplishments:

The highly popular Down-To-Earth publication series added 9 volumes during the decade, with most aimed at geotourism audiences:

DTE-12 A Guide to the Geology of Catalina State Park and the Western Santa Catalina Mountains, 2002, 48p.

DTE-13 A Home Buyer's Guide to Geologic Hazards in Arizona, 2002, 36p. (*winner of the John C. Frye Memorial Award by the Geological Society of America for best environmental geology publication*)

DTE-14 A Guide to the Geology of the Flagstaff area, 2003, 56p.

DTE-15 Roadside Geology: Wupatki and Sunset Crater Volcano National Monument, 2003, 32p.

DTE-16 A Guide to the Geology of the White Mountains and the Springerville Volcanic Field, Arizona, 2003, 56p.

DTE-17 A Guide to the Geology of Sabino Canyon and the Catalina Highway, 45p.

DTE-18 A Guide to the Geology of Saguaro National Park, 2005, 36p.

DTE-19 A Geologic and Natural History Tour through Nevada and Arizona along U.S. Highway 93, 2010, 75p.

We converted over 700 Mylar publication films to digital format, eliminating the use of the ammonia-based ozalid printing system.

Objectives and Anticipated Accomplishments, FY12-FY22

Assuming AZGS is reauthorized, our goals until the next Sunset Review are to:

- Maintain our ability to carry out state mandates independent of the state's ability to fund them, including continuity of the former Department of Mines & Mineral Resources services.
- Define and characterize potential geologic hazards and limitations, prepare reports about them, and assist government and the public with emergency response and mitigation efforts.
 - Complete mapping of all known Earth fissures and investigate techniques to predict the locations and growth of fissures, and methods to mitigate them.
 - Attempt to map each of the geologic hazards statewide at an initial scale of 1:500,000.

- Renew the agency's emphasis on mineral resources, covering locatable, leasable, and industrial minerals, expand the ability to accept and preserve rock cores.
- Provide comprehensive services to the Phoenix metropolitan area through a full-service branch office.
- Continue to implement the policy of everything digital, online, and interoperable for free downloading.
- Deploy AZGS national expertise in data integration to other state agencies.
- Take advantage of new technologies for enhanced and cost-effective deployment of services and communication with stakeholders and customers.

3. Identify any other agencies having similar, conflicting, or duplicative objectives, and an explanation of the manner in which the agency avoids duplication or conflict with other such agencies.

Department of Mines & Mineral Resources

Concerns over real or perceived duplication of some efforts between AZGS and ADMMR have been expressed for decades by multiple governors and legislators. Numerous attempts were made to consolidate the agencies but failed previously due to stakeholders successfully arguing that there were enough significant differences to justify separate agencies. The two agencies were formally consolidated July 20, 2011, although effectively the consolidation began in January 2011 when AZGS assumed stewardship of ADMMR when they ran out of funding midway through the fiscal year.

Prior to the consolidation, the directors of the two agencies worked together closely to avoid duplication or conflicting efforts. One area that we recognized was duplicative was the requirement that each agency serve as a repository for data, reports, and files relevant to mineral resources. We regularly collaborated to avoid or minimize duplication of efforts.

U.S. Geological Survey

The USGS is a federal agency with a significant presence in Arizona, but primarily for hydrology and biology, programs that are not within the purview of the AZGS. However, they do have a geology program office in Tucson. In some other states, proposals have occasionally come along to abolish the State Geological Survey and rely on the USGS for their needs. After initial discussion, the suggestions were dropped. It would be tantamount to getting rid of state troopers and relying on the FBI for local law enforcement.

The USGS is not subject to state direction and pursues studies it deems of interest. When the USGS does do work for state agencies, we find their costs are roughly twice that of the AZGS doing the work.

AZGS collaborates with the USGS in a number of areas and projects. USGS has specialized expertise at the national level that no State Geological Survey can afford to maintain on its own.

For us, one of the most valuable partnerships has been with the debris flow experts in the USGS Denver office.

The USGS Mineral Resources program compiles mineral production and reserves data from all the State Geological Surveys or sister agencies, including in Arizona, to publish in annual national summaries.

AZGS has tried unsuccessfully to engage the USGS in support for the Arizona Broadband Seismic Network. The USGS runs or supports networks in the most earthquake-prone states and regions, but has no resources for lower priority states, such as Arizona.

4. Assess the consequences of eliminating the agency or of consolidating it with another agency.

Consequences of eliminating the Geological Survey

This is addressed to some degree in our response to Question 10 in the Sunset Review Factors. The elimination of the Arizona Geological Survey would result in:

- No more identification, characterization, and mitigation of geologic hazards (debris flows, landslides, earthquakes, etc.)
- Possible loss of irreplaceable files, records, and samples on mining and mineral resources critical to exploration and development. Even if the files were preserved in State Archives, there would be no one to analyze or interpret them.
- Reduced technical assistance to government and industry for discovery and development of mineral resources.
- No one able to review and critique federal agency plans or limitations on mining and mineral resources development on federal lands within the state.
- Loss of technical and administrative support for the Oil & Gas Conservation Commission.

Mines & Mineral Resources consolidation

The consolidation of the Department of Mines & Mineral Resources with AZGS provided no budget for the continued operation of the ADMMR duties or salaries for staff. There was only a one-time appropriation of \$100,000 for scanning and digitizing of ADMMR files. So, AZGS has absorbed all costs since January 2011 to sustain those operations. AZGS has been able to do this because of an influx of federal stimulus funds won through a national competitive proposal. Those funds are limited so we are already looking for sources of continuing funding.

Other consolidation options

The idea of consolidating a variety of state agencies into a Department of Natural Resources surfaces regularly but never advances beyond that. The majority of State Geological Surveys in state agencies are administratively housed in such DNRs or departments of environment, with a few buried deeper within bureaucracies. Our experience is that that many of those are much

more limited in their flexibility. One advantage to our current status as a state agency is our ability to be innovative and entrepreneurial. These factors help us recruit talented scientists who would be stifled in more rigid environments. They also allow us to move quickly to take advantage of funding opportunities and take our results out to our constituencies.

Proposals to eliminate the State Mine Inspector (SMI) office and transfer its duties to ADMMR or AZGS regularly appear in the Legislative session but fail to gain much traction. Merging the regulatory and safety functions of the SMI with the development duties of the combined AZGS/ADMMR would create potential internal conflicts. Consider the federal Minerals Management Service that oversaw oil and gas regulation in the Gulf of Mexico as well as promoting drilling for economic benefit. Following the BP oil spill, MMS was broken up into separate functions, similar to the division of duties between AZGS and SMI.

Similarly, merging AZGS and the Department of Environmental Quality (ADEQ) would put regulators together with an agency encouraging development.

A merger with the State Land Department would create conflicts with that agency's funding issues. There are currently challenges to them self-funding their trust duties; what could they do with the Geological Survey duties added to that burden? In addition, their primary duty is administering the trust lands. The AZGS duties could be seen as a distraction from those important responsibilities.

A merger with the Department of Water Resources would *de facto* be a step towards a Department of Natural Resources. It also links an applied science agency with one that has strong regulatory functions. Would the water duties of ADWR overwhelm and dominate the wider duties of AZGS in mineral resources and hazards?

AZGS could be moved into one of the state universities, although we left the University of Arizona in 1988 in order to better address the state's needs, rather than more academic studies. Over the past three decades, State Geological Surveys have preferentially moved out of universities into state agency status to be more accountable. However, the Illinois State Geological Survey recently moved into the University of Illinois. In that case, the Survey was already housed on campus, and employees received their benefits through the university system. They bring in large research grants that fit well in the university. Currently the Colorado Geological Survey is negotiating a move to the Colorado School of Mines if their state funding is removed, but that requires the Survey to provide all of their own funding, so they effectively become a self-funded research center.

Transfer of programs

Over the years, there have been casual questions about transferring sections in some agencies to other homes. Two such ideas involve AZGS. One is to move the State Cartographers office out of the State Land Department. The State Cartographer has a broader responsibility than just to trust lands, including overseeing the state GIS Clearinghouse. In Kansas, the state GIS clearinghouse is in the Kansas Geological Survey.

The second group is the data and geophysics sections of ADWR. The rationale for transferring them to AZGS is our leadership in digital data integration and management and the synergy of the ADWR geophysics unit's work on subsidence and basin analysis with the AZGS' Earth fissure mapping program and similar basin studies.

Summary

AZGS is not proposing any mergers of agencies or transfers of programs among agencies but is only trying to provide a frank assessment of possibilities.

Appendix A.

List of AZGS functions ranked for possible elimination due to budget cuts, September, 2009. Public ranking of the value of the programs was invited via an online survey. 183 responses were received.

Library: A publically available central repository and a computerized database for geologic and mineralogical reports, books, maps, and periodicals.

Bookstore: To manufacture and distribute publications of the Arizona Geological Survey; retail USGS topographic maps, geologic reports and maps, among other things.

Publications: Prepare and publish technical, and non-technical, geologic maps and reports on the geology, natural hazards, mineral resources of Arizona.

Public inquiries: Provide timely and objective scientific information to inquiries of Arizona geology, and to advise and assist government, industry, and the public in understanding the State's geology.

Education/Outreach Information: Give lectures and talks, conduct workshops, lead field trips and provide information and assistance to the public and educational and professional groups.

Websites: Host an internet website(s) with topical information on the geology of Arizona and on the products and services available through the Arizona Geological Survey - www.azgs.az.gov

Bibliography of Arizona Geology: Maintain a publically accessible computerized bibliographic database of maps and reports on Arizona geology.

Earth Fissure: Map earth fissures throughout Arizona and provide the maps and reports in a timely manner – via the internet - to the Arizona public.

Surficial Geologic Mapping: Map and describe surficial geology and related geologic materials: prepare geologic maps for publication.

Geohazards: Map, describe and monitor known and potential geologic hazards to people, structures, land, and resource management.

Geologic framework: Serve as a primary source of surface and subsurface geologic information for Arizona. Provide technical support to government, industry and the public.

AZ Oil and Gas Conservation Commission: Provide the primary technical and administrative support to the AZOGCC in administering and enforcing regulations regarding oil and gas exploitation. www.azogcc.az.gov

Bedrock Geologic Mapping: Map and describe the bedrock and related geologic materials and processes in Arizona. Prepare maps for publication.

Core and Sample Repository: Operate and maintain a publically available central repository for rock cores, well cuttings and related subsurface samples.

Energy and mineral resources: Map and characterize energy and mineral resources and identify areas that may have potential for future discoveries. Provide technical assistance to industry and government regarding the exploration and development of resources.

IT support: Provide technical – hardware and software -- support for AZGS staff and manage network servers. Maintain publically available internet map and product services.

Geographic Information System: Support geologic map production efforts.

Enterprise Geodatabase: Operate and maintain a public central repository and a computerized database for geologic/mineralogical reports, books, maps and other publications.

Data preservation: Digitize and preserve existing analog data (i.e., paper and samples), such as geologic/geophysical maps, reports, and illustrations for future public availability.

Phoenix branch: One-person office to respond to regional needs and projects and provide local responses to industry, government, and the public.

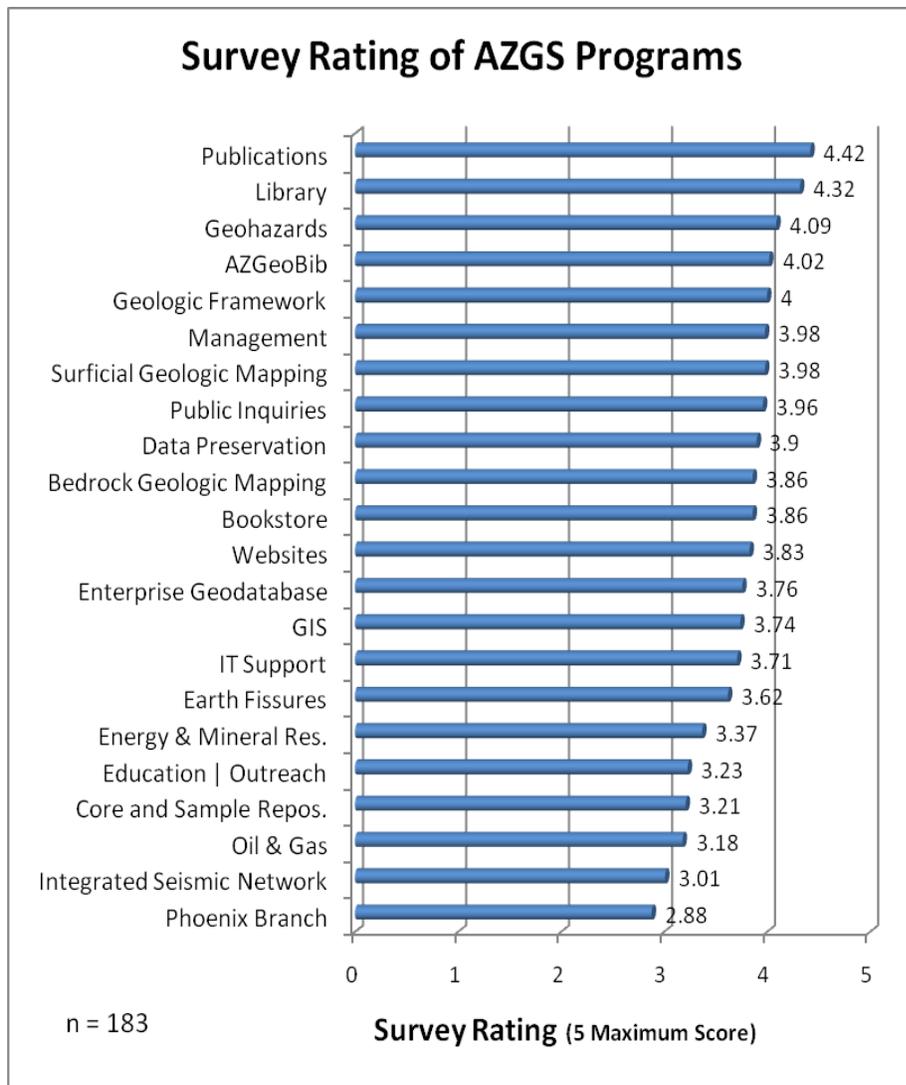
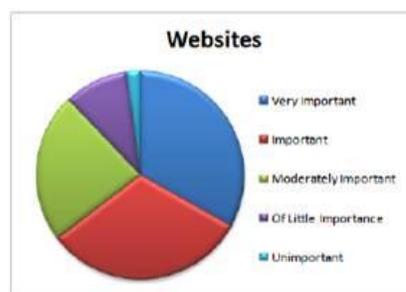
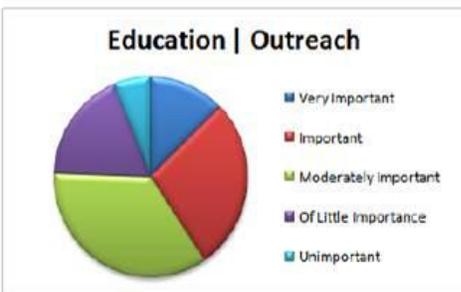
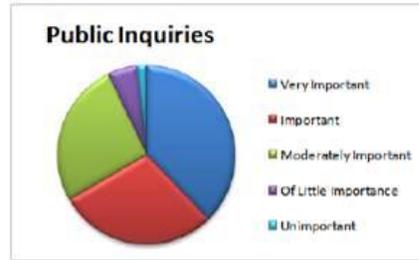
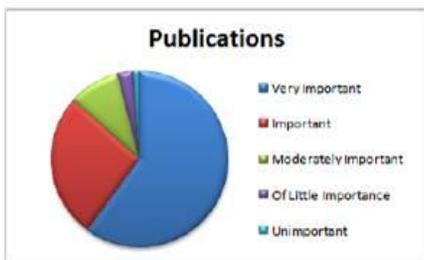
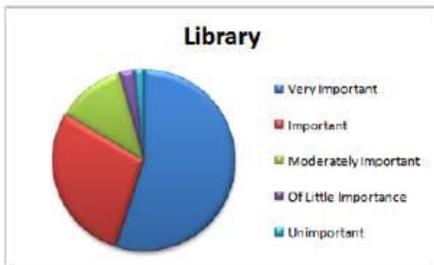


Figure 4. Rating of all 22 AZGS programs from public input to online survey, October 2009

AZ Integrated Seismic Network: A state-wide instrumental network for monitoring earthquakes and evaluating seismic hazard and risk.

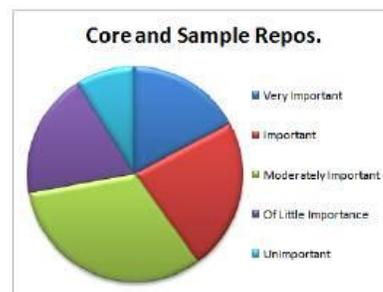
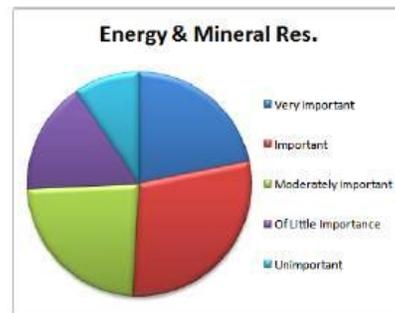
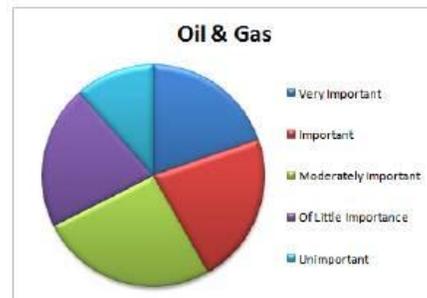
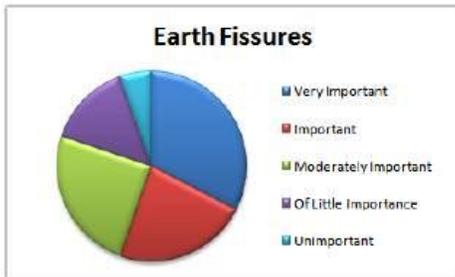
Management: The State Geologist shall direct the research and information functions of the Arizona Geological Survey.

Geologic Extension Service



Environmental Geology

Economic Geology



AZGS Survey September-October 2009: Respondents' Comments

Seventy-eight of the 183 survey participants elected to add a comment. Below are more than 20 comments that represent the breadth and diversity of survey participants and their opinions. With the exception of minor spelling or grammatical corrections the comments are unedited. If there is bias in our selection, it is towards longer more detailed responses.

The programs described are the core responsibilities of a viable Earth science agency. To eliminate any is to strike at the heart of what a public science agency is meant to be.

As an Exploration Geologist new basic bedrock geologic mapping and preservation of existing historic geologic records are my highest needs.

I see the data and report repository and the on-going mapping programs essential to the mission of the survey. During this economic down-turn, a few programs could be put on hold until the state's budget woes improve.

This is a difficult survey to fill out given that I believe the AZGS was underfunded before the budget cuts. I've rated all the categories as very important (as I believe they are) unless I found myself not qualified to rate a category. In this case I chose to leave the category unranked. As a registered geologist in the state of AZ working for an international earth science consulting firm, I've used the AGS on many occasions to support crucial aspects of professional projects. Obviously the state legislature does not understand the value added to the State of Arizona by the AZGS.

Do not see how you can cut much from your budget and still fulfill your mission. Good luck!

These are tough calls. Would suggest that we all focus on preserving information and our methods to distribute and use what we have, while scaling down the acquisition of new data..... then wait until the budget dust clears a bit....

Concentrate on what others won't do: geologic mapping, report writing, data preservation, sample preservation. Efforts to make material available online are possibly duplicated by others?

Obviously, the activities that directly benefit commercial enterprises or private groups should, to the extent possible, be funded by those beneficiaries (something AZGS is getting good at under Lee Allison's direction). The public outreach, bibliography, and data repository functions are critical to all in the state, but they are much harder to pass on the costs. The importance of these activities are what the state legislature needs to understand and support.

Geologic investigations are pivotal in environmental work, infrastructure, property transactions, and NEPA projects. The AZGS provides crucial information for numerous geologic applications.

This is a terrible task to have to judge! You guys are so important and have a relatively small budget compared to what you do. It won't really save a lot to gut you in the big picture, yet it will be a big intellectual loss of capital and talent.

AZGS Sunset Review Factors

I am a college student and having access to the information on this website is very helpful for my learning. Please consider this when making your final determination.

AZGS provides an invaluable and irreplaceable geologic service. There is simply no other resource in the state for updated geologic and hazard data. There is no private group that has these resources. SRP utilizes the many data bases for siting facilities and reducing the cost of power to Arizona's electric rate payers.

The AZGS is the ONLY agency to provide non-biased information to the public and advise decision makers on issues relating to geology and geologic hazards. Universities cannot fill the gap as they research what is of interest to them, not necessarily what is of interest to the public. The AZGS is critical to maintain public safety; please do not reduce its ability to protect the people of Arizona. As a geo-hazard consultant, publicly available maps and reports are extremely useful and valuable, please maintain online services!

The Arizona Geological Survey provides a crucial role in: (1) centralizing geologic reports, maps, and other data on the geology of Arizona; (2) conducting research on the geologic resources of the state; and (3) supplying crucial information on geologic hazards in the state. Any cuts in funding will compromise the mission of the AZGS, undermining its service to both the public and geoscience researchers, and so I hope cuts in funding can be minimized to the degree possible.

To whom it may concern: I am a research geologist at the U.S. Geological Survey, and much of my work is in Arizona. I make extensive use of many AZGS products and services. In the above list of programs, I consider every one of them to be "Very Important," and crucial to resource management in the state of Arizona. I would be very dismayed to see any of them scaled back or eliminated. It is my understanding that the AZGS budget is very modest (<\$1 million in state funding), but despite this, the agency performs many crucial functions related to resource management and science, which serve the state of Arizona and the nation. I understand they are facing a 30% budget cut, which would result in major loss of value for customers like myself. I also understand that much or most of the funding for AZGS comes from external funding sources, including the USGS. These sources count on leveraging work being funded by the state, and thus the real losses of the proposed budget cut could be even greater than the already extremely large 30% cut that is being proposed. I strongly urge the state to preserve funding for the AZGS, if at all possible. Please contact me if you would like more information. Sincerely, Daniel Malmon

I cannot think of a more critical component than the surficial mapping group. Especially given the current state of the climate, etc.

Try and stick with the core functions of mapping and document preservation. The outreach, education, and public accessible stuff should be where the cutbacks are. The basic data will still be available, but the public will have to come evaluate it themselves. Economic data may need to be developed by companies seeking to mine it. I hate to see any of these services cut back, and I am sorry for the stress and disruption this causes your staff. Keep up the good work that you do! Good luck.

AZGS provides an invaluable and irreplaceable geologic service. There is simply no other resource in the state for updated geologic and hazard data. There is no private group that has these resources. SRP utilizes the many data bases for siting facilities and reducing the cost of power to Arizona's electric rate payers.

There should be more emphasis on metals mining geological work.

AZGS Sunset Review Factors

The 15% of total value of non-federal and contracts and grants worries me. Depending upon the tax status of the party, this would amount to a steep double tax and could be a factor in negating future grants.

All of these functions are important. I have ranked programs highest if they cannot be easily or competently conducted by the private sector and if there will be a (possibly) irreversible loss of data/logs/samples/institutional memory if there is even a temporary curtailment.

Lee Allison, the AZ State Geologist, has done an outstanding job in increasing the public visibility and importance of the AZGS. Under his leadership, the AZGS has become one of the best state geological surveys in the Nation. Virtually all of the programs of the AZGS are vital to the well being of the people and/or economy of Arizona. Knowledge of the bedrock geology, surficial geology, geologic hazards, and maintaining data and rock samples are crucial. Unlike some other sciences, old data and reports commonly contain valuable information that is just as useful today as it was when it was written, sometimes over a century ago. If such geologic knowledge and data are lost or mishandled, this vital information and institutional knowledge would not be recoverable. Speaking as a research geologist with the US Geological Survey, it would be virtually impossible for the USGS to replace the functions and highly specialized knowledge of the AZGS. I would be happy to elaborate on any part of this survey and am willing to testify in person about my opinions and what I have written.

Need to separate mission-critical from nice-to-provide functions. It's okay to be "inconvenient" as long as the data is somehow available.

This is ridiculous. This is like asking which of your children you want to die first or what body organ is of less importance to you right now. I am at a loss for words and commend anyone who is going to have to make these decisions in the long run.

ALL of the AZGS programs are vital to the economic and environmental well-being of the residents of Arizona. The AZGS is already cut to the bone—cutting it more will severely restrict its reach and effectiveness.

Appendix B.

Programmatic Review Panel on FY10 budget reductions

AZGS convened an external Programmatic Review Panel under the auspices of the Arizona Chapter of the American Institute of Professional Geologists, to review all programs and make recommendations on priorities for a proposed 30% budget reduction in FY10. The panel met October 6, 2009 at the AZGS offices and submitted their recommendations at the end of the day.

Panel members and affiliations

Chair: William Greenslade, (Southwest Ground-Water Consultants), AIPG Arizona Section
Ken Ferguson (AMEC) or designee, Association of Engineering Geologists, Arizona Chapter
Kevin Horstman (consultant), Arizona Geological Society
Steve Trussell, Arizona Rock Products Association
Alan Dulaney (City of Peoria), Arizona Hydrological Society
Wesley Ward, retired, US Geological Survey
Eric Mears, Brown & Caldwell
Dick Ahearn, US Forest Service
Don Hammer, consultant

AZGS Programmatic Review Panel Recommendations and Comments (unedited)

The panel voted on the importance of each program. Ranking from high to low:

8 Mineral resources – We need to brag more about what we do and make sure the Legislature knows what we are accomplishing. An example is the potash report. That alone could bring hundreds of millions of dollars to the state.

8 Seismic hazards – The presentations convinced the skeptics on the panel

7 Web presence – The AZGS web site is our face to the community and the results are impressive. But we need to take advantage of e-commerce more. We should be doing more online sales of our products and data. Stakeholders will be willing to pay modest fees to get ready access to them.

7 Informatics – we should consider integrating IT, GIS, databases into a unified function. The world is going electronic and our efforts are impressive. However, there was concern about the need for 47 pc's for 26 staff and are we allocating resources correctly.

7 Geologic mapping – we should combine bedrock and surficial mapping programs. Our mapping program is “awesome” and one of our great strengths and assets. How can we make the mapping program a profit center? We should be charging for products or charging more for them.

6 Data preservation – [Intentionally left blank – no comments]

6 GIS – [Intentionally left blank – no comments]

6 Publications – [Intentionally left blank – no comments]

4 Library – this is a great resource, but if we are digitizing materials, we should be marketing them.

4 Education and outreach – AZGS does a great job in this, but it is a big cost and a time sink.

4 Enterprise Geodatabase – the group was split down the middle on this (in part because it may not have been clear to everyone just what is being done and the value to AZGS and the State.)

2.5 Bookstore – this is an underperforming asset.

0 Oil & Gas Conservation Commission – AZGS should turn this back to the Legislature and tell them someone else needs to handle it.

0 Core and sample repository – at most, move it to the patio [*i.e., covered patio below the AZGS offices*], and eliminate the costs of maintaining it.

0 Energy resources – the potential for oil, gas, and coal production is low. Uranium should be included in the Mineral Resources program.

0 Inquiries – “too many businesses want you to do their work for them. This is what consultants get paid to do.” We should put the basic information online and in FAQs, but otherwise refer inquiries elsewhere. This is a big time sink.

* Phoenix branch office – there was no consensus on this. Some people’s opinions were turned around after seeing the presentation and now see the high value of the office. AZGS should surrender the Phoenix office to the budget cuts, but fund it from other sources.

* Earth fissures & Geohazards – Geologic hazards programs is one of the highest if not highest priority of AZGS. It is a critical function. The Earth Fissures program should be rolled into the Geohazards program (in effect, eliminate the Fissures program but transfer the function to Geohazards, albeit at a reduced level). There are political implications in this but it sends the message that we cannot sustain the program.

Priorities

Geohazards

Mineral resources

Geologic mapping

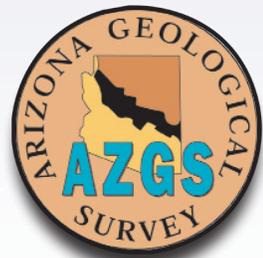
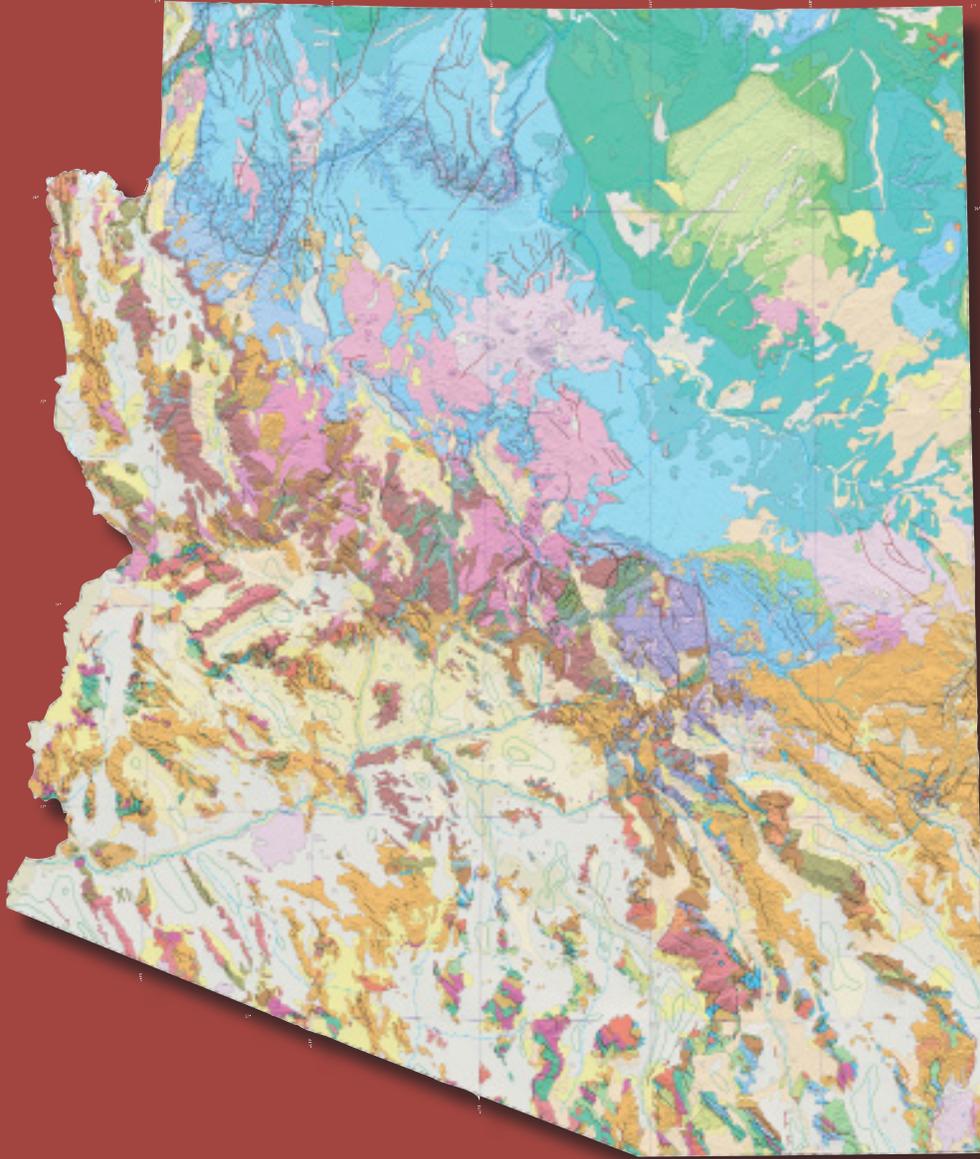
“Protect our federal funds potential” by preserving our technical expertise (as well as our physical assets). In other words, maintain cost-sharing programs.

Other comments

Find other groups to share our space and thus our rent.

Arizona Geological Survey

2011 ANNUAL REPORT



www.azgs.az.gov