Annual Report

Kansas Geological Survey

2005

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Cover photo: Echo Cliff, Wabaunsee County, Kansas.

DIRECTOR'S REPORT

31 July 2006

In February of this year, I was named Director of the Kansas Geological Survey (KGS) and the Kansas State Geologist. This is the first KGS annual report that has been produced since I was named to this position. Many people use annual reports to learn what has transpired in an organization over 12 months without having to piece together information from news releases, meeting minutes, or routine internal correspondence. I hope this document serves that purpose. In addition, this annual report is an opportunity for me to highlight an issue that I believe has been seriously underappreciated or just plain neglected.

The issue is how the KGS contributes "added-value" to the State of Kansas.

The concept of adding value has been discussed in almost every setting imaginable. It has been considered in the boardrooms of Fortune 500 companies, in State and Federal agencies, in two-person start-up companies, and even in purely academic environments. It occurs when a product is given more value than was originally envisioned.

How does this apply to programmatic activities at the KGS? Our mission is to conduct geological surveys or studies of the natural resources of Kansas and to disseminate (through publications and reports) the results of such studies. We are funded with taxpayer dollars, and we are expected to generate products for the people of Kansas. For the KGS, much of the "added-value" may well be the result of transitioning a research product into a needed and useful service.

Several examples come to mind. In the early 1980's, the KGS conducted a series of relatively modest research projects designed to distinguish between the origins of brines. The scientific hypothesis being tested was this: "Is it possible to tell the difference between a brine that results from bedded salt layers coming in contact with freshwater and a brine associated with petroleum production?" The results indicated that such discrimination was possible. The findings were robust enough to produce the technology commonly employed today when Kansas agencies seek to identify possible sources of contamination.

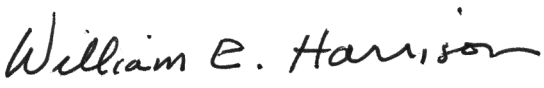
Another example concerns the use of geophysics to help identify areas where subsurface dissolution helps promote surface collapse and subsidence features. About 25 years ago, the KGS studied the collapse features along Interstate 70 in Russell County. With additional experience, enhanced computer software, and improvements in field-acquisition techniques, the KGS developed the capabilities to use selected geophysical properties to help assess whether subsurface conditions were likely to contribute to surface collapse. By virtue of this technology, the Kansas Department of Transportation recently relocated a planned multi-million dollar overpass in south-central Kansas 5 miles from the originally intended location.

Two recent joint projects between the KU Department of Geology and the KGS have resulted in technology that I am confident will make the research-to-service transition quickly. High-grade aggregate materials for construction and road-building purposes require material with certain physical properties, particularly related to clay content. However, the tests required to establish them as high-grade aggregate material take several months. While these tests are going forward, activities at the quarry are proceeding. If the material fails the physical properties tests, the material that has been quarried has significantly less value than it would if it had successfully passed. The KU Department of Geology-KGS projects have yielded a technique that has immense promise as a clay-content screening tool that can be deployed at the quarry in real-time. In fact, KU has acquired patent protection on the technology and is actively marketing it.

Finally, the cumulative efforts of the KGS energy research section over the years have yielded results that oil and gas operators routinely exploit in order to increase production. Selected results from past projects have yielded breakthroughs in the understanding of reservoir properties to the extent that development wells have been drilled on such new insight. To date, such wells have been productive and thus the relative percentage of dry (or non-productive) holes has been reduced. Results such as these contribute significantly to the annual tax revenue base of the State of Kansas.

From a global perspective, many research results are either negative or inconclusive. Bench-scale chemical or pharmaceutical research typically involve well-understood (and predictable) reagents and chemicals and thus lend themselves to reasonably well-constrained experiments. However, natural-resource research—like that undertaken at the KGS—involves whatever materials Nature provides. That makes outcomes much less predictable; moreover, results of this research are frequently negative. When one considers what is required for natural-resources research to be commercially successful, probabilities become extremely low. It is remarkable that the KGS can lay claim to a number of positive and successful research results that truly provide benefit to the State and society.

These are a few examples that illustrate the "added-value" from KGS research. I am proud of the people at the KGS and the work that they do. I am confident that we can achieve even more in the future. And I look forward to being a part of the KGS as we pursue new research and service objectives for the people of Kansas.



William E. Harrison
Director, Kansas Geological Survey
State Geologist

INTRODUCTION

Demographics and economic development in Kansas are greatly influenced by the state's natural resources. In 1889 the Kansas Geological Survey was permanently established at the University of Kansas in Lawrence with three employees and a mission to explore those resources. Today, with more than 80 geologists, geophysicists, geohydrologists, computer scientists, and technical support staff and approximately 70 student employees, the Survey has remained a non-regulatory research agency that oversees dozens of projects annually and continuously develops new techniques and equipment to analyze the state's physical attributes, both above and below the surface. To keep other scientists, agencies, and the public informed, the staff produces reports, maps, and databases about the state's rocks and minerals, energy resources, and water quality and quantity.

Over the past 116 years, the Survey has conducted research in every county in the state, published more than 140 maps and 650 technical and educational reports, and created numerous computer programs, databases, and a multi-faceted web page. This report highlights several of the many KGS research projects and programs and provides a list of the 2005 publications produced by the Survey staff, a list of grants and contracts, and a financial statement for FY2005.

SURVEY PROGRAMS AND PROJECTS

The Kansas Geological Survey has four research sections: Geohydrology, Energy Research, Exploration Services, and Stratigraphic Research. Several service sections provide assistance to the research sections and the public. They include public outreach and geology extension, publication sales, a library and archives, a data library of petroleum and water-well records, editing and publishing, graphic design, web design, cartography, computer services, and administration.

Although each research and service section has a particular focus, their endeavors overlap. Geophysicists use seismic techniques to explore energy sources and underground rock units, computer scientists provide central design and support services for databases and internet-based systems to display data collected on water quality and quantity, cartographers help create maps collected by geologists in the field. As a result, projects cannot always easily be attributed to one section or another so in this report, projects and resources are divided into the following categories: Energy, Subsurface Imaging Techniques, Water, Geology and Stratigraphy, Mapping, and Information Dissemination.

The following descriptions highlight a project or two in each of these categories and then list other research projects in each area.

ENERGY

Hugoton Asset Management Project. The Hugoton Asset Management Project (HAMP) was initiated in January 2004 as a two-year project. Its primary goals are to model the Permian gas systems of the Hugoton and Panoma fields in southwest Kansas and the Oklahoma Panhandle and to build a digital pools catalogue for the pre-Permian fields in southwest Kansas. The project is a collaboration between the Kansas Geological Survey and 10 industry partners with assets in the area. The Hugoton and Panoma fields constitute the largest gas-producing area in North America. Since 1928, the gas fields of southwestern Kansas, including Hugoton and Panoma, have produced 27 trillion cubic feet of gas. These reservoirs are economically important to the State of Kansas and major gas producers. Even with a long history of substantial production, no publicly available field-wide study of how best to explore, produce, and regulate the Permian gas reservoirs has been available previously.

Coalbed methane recovery and sequestration. Production of coalbed methane is a relatively new industry. A natural gas found in coal beds, coalbed methane has been recovered and sold since the early 1980's. The KGS is developing reservoir models and simulations by exploring the coalbed methane potential in eastern Kansas, including the Pennsylvanian rocks in the Cherokee basin, Bourbon arch, and Forest City basin. Survey scientists also are studying the behavior of CO_2 in the coal beds to determine the potential for storing CO_2-rich emissions in underground rock formations.

Other projects:

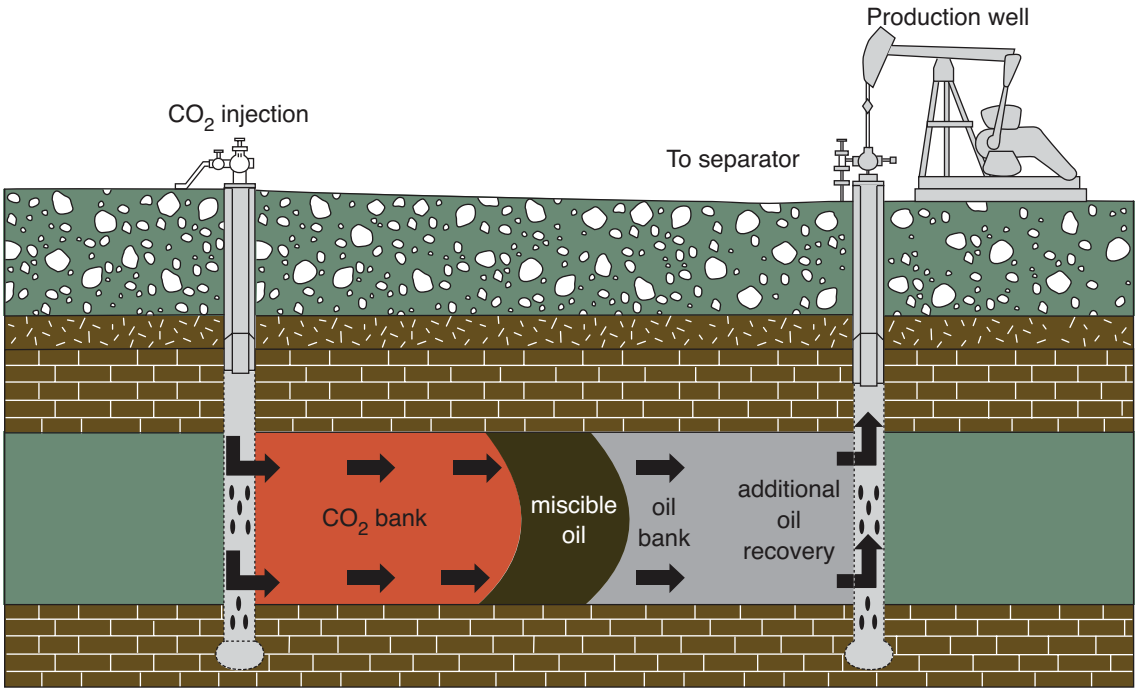
- Field demonstration of horizontal infill drilling using cost-effective integrated reservoir modeling - Mississippian carbonates, central Kansas
- Evaluating the influence of pore architecture and initial saturation on wettability and relative permeability in heterogenous, shallow-shelf carbonates
- Niobrara Chalk characterization
- Improving geologic and engineering models of midcontinent fracture and Kansas
- Simplified online automated reporting
- Kansas gas compositions study
- Pen field petrophysical study
- Wireline petrophysics of Kansas oil and gas reservoirs
- Log analysis applied to subsurface geology studies
- Mississippian and Pennsylvanian carbonate reservoir characterization
- Geological and engineering models of fracture/karst reservoirs
- Geo-enginering modeling of incised valley system
- Role of shallow evaporite dissolution on 3D seismic interpretation
- Web-based geo-engineering modeling
- Investigation of integrated subsurface processing of landfill gas and carbon sequestration, Johnson County, Kansas
- Investigation of the potential of integrated subsurface carbon sequestration and enhanced coalbed methane recovery using cement kiln emissions
- Collection, organization, and evaluation of point-source coal data in Kansas
- Log interpretation of coalbed methane
- Application of mathematical and statistical methodologies of geological data to Kansas geology

SUBSURFACE IMAGING TECHNIQUES

4D high-resolution seismic-reflection monitoring of miscible CO_2 injected into a carbonate reservoir. This six-year project is designed to create a time-lapse map of carbon dioxide (CO_2) movement and containment after it is injected into a carbonate reservoir. Research is being conducted in the Hall-Gurney oil field in Russell County. The CO_2 is used to recover oil still trapped underground after drilling and secondary water-flooding methods have been employed. Besides determining the effectiveness of CO_2 injections as a method to recover oil, the study provides insight into the ability of rocks, such as limestone, to effectively contain CO_2 once it is injected. In 2005 Survey scientists acquired the sixth and seventh 3D surveys. A refined 4D-time-lapse seismic data-processing flow has been established and is being applied to all 4D-seismic datasets for quantitative analysis. The project is to be completed in 2009.

Other projects:

- Seismic investigation of subsidence
- High-resolution magnetic survey and eletromagnetic methods used in searching for buried brine wells in Hutchinson
- Seismic characterization of dams
- MASW-passive method
- Surface-wave scattering
- Detection of near-surface anomalies by detecting scattered surface waves
- Estimation of elastic moduli in a compressible Gibson half-space by inverting Rayleigh wave phase velocity
- Discussion on some practical equations with implications to high-frequency surface-wave techniques
- Generating image of dispersive energy by slant stacking
- Orthogonal vibroseis sweeps
- A moving hum filter to suppress rotor noise in high-resolution airborne magnetic data
- Resolution of high-frequency Rayleigh-wave data
- Earthen-levee characterization
- Near-surface seismic characterization of wind-turbine foundations
- Shallow Evaporite Imaging Solutions (SEIS) Consortium
- Improving geologic and engineering models of midcontinent fracture and karst-modified reservoirs using new 3D seismic attributes



Carbon dioxide miscible flooding.

WATER

Annual water-level measurements. The Division of Water Resources of the Kansas Department of Agriculture and the KGS operate the statewide cooperative annual water-level measurement program. The program is designed to regionally sample the High Plains aquifer in Kansas and establish trends and evaluate water-resource management strategies. Water levels were measured in January for about 1,333 wells in 47 central and western Kansas counties. The wells measured are used for stock, irrigation, and monitoring (and some abandoned agricultural or domestic wells). In 2005, KGS was responsible for 564 wells, an increase of 72 wells over 2004. The field-measurement phase of the program was completed by February 1. Water levels were recorded in 96.6% of the 1,333 network wells with data-quality evaluations completed on the 564 wells for which the KGS was responsible. Approximately half of these measurements (45.2%) encountered water at depths of less than 100 ft. About 2.6% of network wells have depths to water greater than 300 ft (up from 2.15% in 2004). Digital and analog 2005 annual raw water-level data are available.

WIZARD (Kansas water-well database). Development of a Kansas water-well database was undertaken by the KGS in an attempt to make information quickly and easily accessible to the general public about water wells, both those that are part of the annual network and many that are not. The database, by design, includes all significant information contained in the USGS's GWSI database, the KGS's KIWI database, and the KGS's WaterWitch database. It is the intent of the database's designers to incorporate portions of Department of Water Resources's WRIS, Kansas Department of Health and Environment's WWC5, City of Wichita, and each of the five Groundwater Management District's water-well databases. Once this database, named WIZARD, is complete, it will contain the most inclusive listing available of information on water wells in Kansas.

WIMAS (Water Management and Analysis System). An interactive web site to retrieve, analyze, and map Kansas water-rights and water-use data was developed by the Kansas Department of Agriculture and the KGS and became available to the public in November 2005. The data are collected by the Kansas Department of Agriculture's Division of Water Resources. The database, called the Water Information Management and Analysis System (WIMAS), is maintained by the KGS and is accessible online at http://hercules.kgs.ku.edu/geohydro/wimas/index.cfm. For each water right, the database provides information about the location including the source of the diverted water, the amount of water authorized for use, and the amount of water reported as used.

Quantitative assessment of stream-aquifer interactions in central and western Kansas. Low flows are an increasing problem in streams and rivers in central and western Kansas. During 2005, KGS scientists conducted research on the major fluxes in stream-aquifer systems with particular emphasis on the role of irrigation pumping and riparian-zone phreatophytes. Phreatophytes are plants that tap ground water when other sources are not available. These include native cottonwoods and willows and non-native plants, such as salt cedars and Russian olive trees. A cooperative KGS-KSU research project is ongoing at the Larned Research Site, which is located along a stretch of the Arkansas River riparian zone. The major objectives of the KGS-KSU team are to develop field methods for identifying and quantifying phreatophyte consumption of ground water and for assessing the water savings gained by phreatophyte control.

Kansas karst map. Karst topography is characterized by sinkholes, depressions, caves, and underground drainage created when ground water dissolves soluble subsurface rocks such as limestone, gypsum, and dolomite. Karst features in these carbonate and evaporite-bearing rocks pose significant engineering hazards and challenges for the protection of water supplies from contamination in parts of Kansas. The Kansas Karst Map Project's two objectives are to revise and update the Kansas portion of a national karst map and to design and implement an online, user-driven database of karst and pseudo-karst features in Kansas with links to a GIS for display of their distribution.

Other projects:

- High Plains Aquifer Information Network (HIPLAIN)
- Ogallala bedrock mapping
- Contaminant transport in heterogeneous formations
- Pumping tests in heterogeneous aquifers
- Use of slug tests in site characterization
- Water-level declines in the Ozark aquifer in southeast Kansas
- The prototype Web-based Interactive Ground-water Tutor
- Pilot geologic lysimeter assessment
- Water-resources sustainability, ground-water recharge, and surface-water–ground-water interactions
- Ground-water numerical modeling in Middle Arkansas subbasin

- Fate of nitrate beneath fields irrigated with treated wastewater in Ford County, Kansas, using field data and preferential flow modeling

- Sources, fate, and transport of saline water

- Ogallala aquifer technical support study

- Collection of soil/stream sediment samples in support of the USGS Mineral Resources Program (National Geochemical Survey)

GEOLOGY AND STRATIGRAPHY

Stratigraphic Nomenclature Committee. In 2005, the KGS established the Stratigraphic Nomenclature Committee to address stratigraphic issues and establish formally accepted stratigraphic nomenclature for Kansas. Historically, formal stratigraphic guides, nomenclature, and charts for Kansas have been produced by the KGS, which is looked to for formal guidance by state, national, and international entities. The latest accepted stratigraphic guide and chart for Kansas (*The Stratigraphic Succession in Kansas*: KGS Bulletin 189) was published in 1968. Since then, several published and unpublished works have proposed changes to the classification and naming of the state's stratigraphic units. The Stratigraphic Nomenclature Committee's goal is to review, update, and standardize the Kansas nomenclature, develop and publish a new comprehensive formal stratigraphic guide and chart, and revise and update the *Lexicon of Geologic Names of Kansas* (KGS Bulletin 231).

Formation of the new Stratigraphic Research Section. Following a reorganization, the Survey's Stratigraphic Research Section was established in 2005. The purpose of the section is to explore the history of the state's rock layers at and below the earth's surface. The section's geologists explore the age, composition, distribution of fossils, and geophysical and geochemical properties of rock layers. Their findings can be used to enhance the study of the state's natural resources, including water, oil and gas, coal, and industrial minerals, such as crushed rock, sand and gravel, salt, and helium. The section also oversees the county geologic-mapping program.

Archeological dig in northwest Kansas. Researchers from the KGS and the Denver Museum of Science and Nature continued the search for early evidence of humans on the Great Plains in the summer of 2005. Investigations have turned up bones of now-extinct animals that may have been fractured by humans. Dated at 12,200 years before present, the bones could represent the oldest evidence of humans on the Great Plains. In addition to the bones, the site produced a rock fragment that could be a piece of a stone hammer. The site has also produced Clovis-age artifacts, including stone flakes and tools, from about 10,900 to 11,000 years old. The work is supported by the Odyssey Archaeological Research Fund, an endowed program at KU with a directive to search for the earliest evidence of humans in the Great Plains.

Geoarcheology dig site along I-70 near Kanorado.

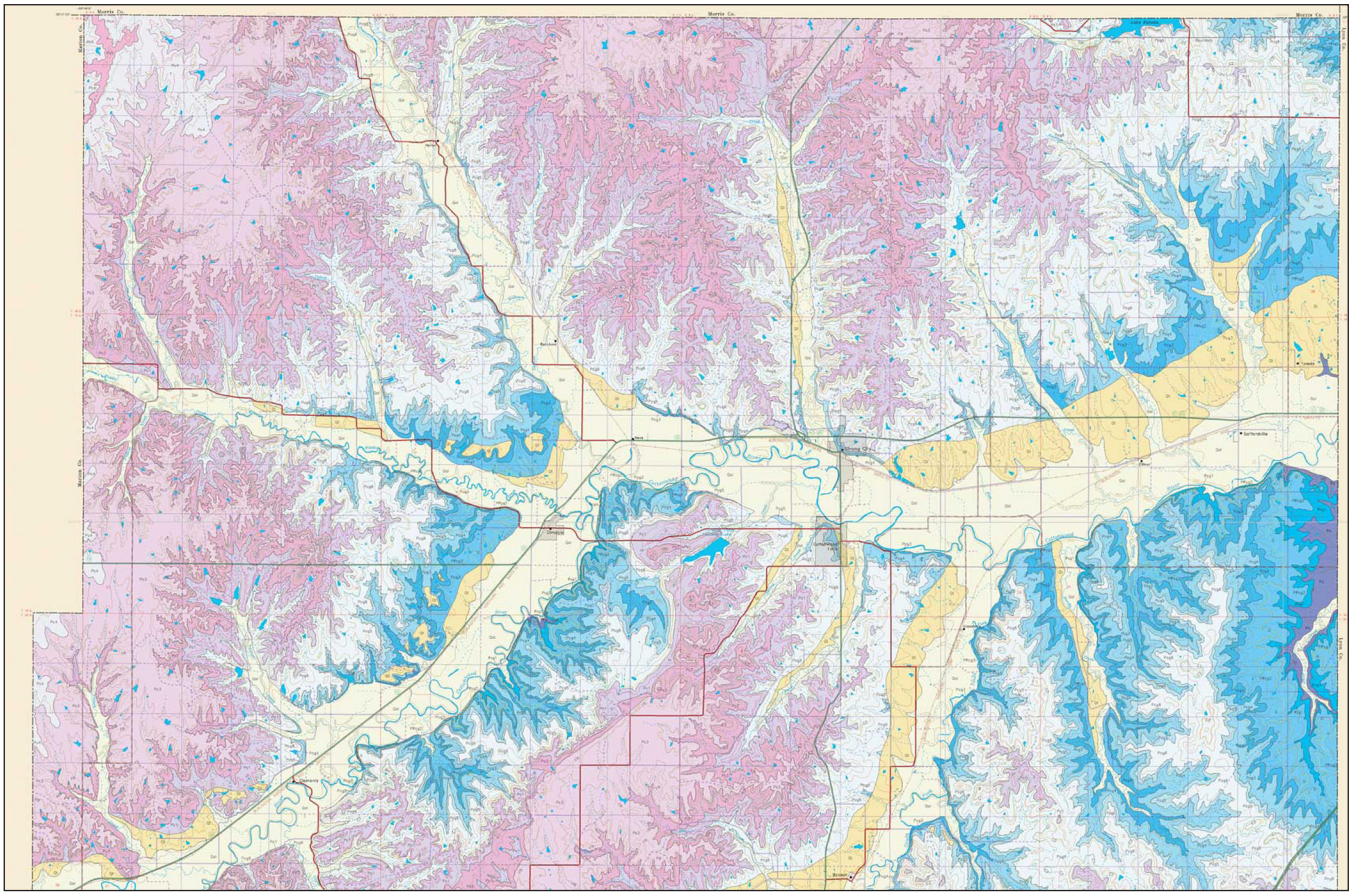
Other projects:

- Geologic controls on aggregate quality of carbonate strata in Kansas
- Integrative approaches for evaluating controls on sequence stratigraphic architecture in carbonate systems
- Research on Paleozoic carbonate reservoir strata in Kansas (Arbuckle, Mississippian, Pennsylvanian, Permian)
- Integrative research for new tools and approaches to understanding 3D geometries and heterogeneity in sedimentary strata (GPR; hydrostratigraphy)

MAPPING

Kansas geologic maps. Geologic maps depict the bedrock exposed at the earth's surface or, more commonly, located directly beneath overlying soil and vegetation. These maps are the principal source of information on near-surface geology and are essential for guiding public policy, evaluating earth resources, and making economic decisions. The KGS's objective is to create geologic maps and digitized county databases for unmapped counties and those with older maps. The digital format system makes possible accurate, up-to-date maps at several different scales and provides the latest stratigraphic and geologic interpretations without requiring extensive remapping or reprinting. The KGS has in-house facilities for processing, plotter printing, and distribution of geologic data. In 2005, the Survey published a new geologic map for Chase County. Geologic mapping is currently underway for Saline, Geary, Washington, Pawnee, and Edwards counties.

Other maps. In 2005, the KGS produced two maps showing past and potential future locations of landslides near Easton in Leavenworth and Jefferson counties as part of a project in the Kansas City area. Other ongoing mapping projects focus on karst topography characterized by sinkholes, depressions, and caves; the movement and containment of carbon dioxide (CO_2) injected into a carbonate reservoir in a Russell County oil field; structural geologic features that could affect tectonics and earthquakes; and the bedrock-surface elevation around the Bear Creek and Crooked Creek faults in the Ogallala bedrock of western Kansas. An online interactive database (WIMAS) is also being developed to retrieve, analyze, and map Kansas water-right data.



Portion of Chase County geologic map.

INFORMATION DISSEMINATION

Publications sales, editing, and library services. The KGS provides reports electronically and in traditional/hard-copy formats with publication production by the KGS editing group. KGS reports and maps as well as U.S. Geological Survey topographic maps are sold through the Publications Sales office in Lawrence and the Wichita Well Sample Library. Unpublished open-file reports are available through the Lawrence office and bibliographic, library, and archive services are located in Lawrence as well.

Geology extension. This program develops material and programs about geology and the KGS for the non-technical public. Each year Geology Extension conducts a field conference on natural-resource topics for the State's decision-makers, including legislators and State officials. The 2005 conference explored water, recreation, and economic development in the Central Great Plains and was cosponsored by the Kansas Department of Agriculture, Division of Water Resources; the Kansas Water Office; and the Kansas Department of Wildlife and Parks.

Data Resources Library. Records for more than 350,000 oil and gas wells and water wells are available in the Data Resources Library, and additional records are added as they become available. In 2004, a new ongoing program was implemented in cooperation with the Kansas Corporation Commission (KCC) to clean up records, scan all paper records, and enter information into a database that can be shared by the two agencies.

KGS web site. The Kansas Geological Survey web site (www.kgs.ku.edu) provides insight into the Survey's research; access to databases compiled from that research and from other sources, including oil-and-gas and water-well records; information on geologic, topographic and related maps and publications; and educational material, including online publications and *GeoKansas*, an information source focusing on rocks and minerals and interesting places to visit in the 11 different physiographic regions of Kansas. A photo library of hundreds of photographs taken throughout the state also can be accessed on the web site.

County bulletins on the web site. Online versions of 27 county bulletins covering 34 counties have been created because the published versions are out of print. In general, they contain the original texts as published. Plates and maps are not usually included, and the information has not been updated. Bulletin 79, *Geology and Ground-water Resources of a Part of South-central Kansas (with special reference to the Wichita municipal water supply)* by Charles C. Williams and Stanley W. Lohman, has recently become available. Work on the online version of bulletins that include Shawnee and several Flint Hills counties is currently underway.

Geology extension field trip stop at Arkansas River near Larned.

Data Access and Support Center (DASC). The Data Access and Support Center (DASC), housed at the Kansas Geological Survey, provides access to a core database of information on Kansas collected by a variety of State agencies. It was created by the State of Kansas, Geographic Information Systems (GIS) Policy Board to develop Kansas GIS technology-management policies and direct the Kansas GIS Initiative. The Kansas GeoDatabase, available on the DASC website, is a collection of various digital spatial information that is necessary to conduct spatial analysis.

Wichita Well Sample Library. The Well Sample Library provides access to more than 130,000 rotary-cutting samples from Kansas oil and gas wells and oil-well completion cards from Kansas and surrounding states. Also a retail outlet for KGS maps and publications and US. Geological Survey topographic maps, the Well Sample Library is located at 4150 Monroe Street, Wichita, Kansas 67209, (316) 943-2343.

2005 PUBLICATIONS

In 2005 Survey staff members produced nearly 200 publications, maps, journal articles, and abstracts and 50 KGS open-file reports. All KGS publications and open-file reports are available from the Survey. The published works and open-file reports are listed below in the following categories: Energy, Seismic and Other Non-invasive Techniques, Stratigraphy and Geology, and Water. Each category is subdivided into publications, abstracts and book reviews, and open-file reports.

ENERGY

Publications

Bhattacharya, S., Doveton, J. H., Carr, T. R., Guy, W. R., and Gerlach, P. M., 2005, Integrated core-log petrofacies analysis in the construction of a reservoir geomodel: A case study of a mature Mississippian carbonate reservoir using limited data: American Association of Petroleum Geologists, Bulletin, v. 89, no. 10 (Oct. 2005), p. 1,257-1,274.

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NEW GRANTS AND CONTRACTS - FY2005

Principal Investigator(s) / Agency / Title of Project

Allison, L.
Kansas Corporation Commission
Kansas Energy Council Fiscal Year 05 Budget

Allison, L.
Iowa State University
CHRONOS Network for Earth System History: Development of Integrated Databases and Toolkits Accessible through a Common Portal

Buchanan, R.
Kansas Department of Commerce
Flint Hills Interpretive Signs and Brochures

Brady L.
U.S. Geological Survey
The Collection, Organization, Interpretation, and Evaluation of Point-source Coal Data in Kansas

Buddemeier, R., Fautin, D.
University of Hawaii
Effects of Climate Change on Ecosystem Services Provided by Hawaiian Coral Reefs

Butler, J., Whittemore, D.
Kansas Water Office
Assessment of Changes in Ground-water Availability Associated with a Salt Cedar Control Project in Clark County, KS

Butler, J., Kluitenberg, G., Whittemore, D.
Kansas State University - KWRI
A Field Assessment of a Method for Estimation of Ground-Water Consumption By Phreatophytes: Methodology Refinement and Extension to Areas of Salt Cedar Infestation

Byrnes, A. Bhattacharya, S.
U.S. Department of Energy
Evaluating the Influence of Pore Architecture and Initial Saturation on Wettability and Relative Permeability in Heterogeneous, Shallow-Shelf Carbonates

Carr, T., Watney, L., Green, D., Reynolds, R., Wilhite, P.
Petroleum Technology Transfer Council
North Midcontinent Region Resource Center

Carr, T.
Lafarge Canada
Preliminary Investigation of the Potential of Integrated Subsurface Carbon Sequestration and Enhanced Coalbed Methane Recovery Using Cement Kiln Emissions, Wilson Co., KS

Carr, T.
KTEC
Preliminary Investigation of the Potential of Integrated Subsurface Carbon Sequestration and Enhanced Coalbed Methane Recovery Using Cement Kiln Emissions, Wilson Co., KS

Carr, T., Bartley, J.
U.S. Department of Energy
National Carbon Sequestration Database and Geographic Information System (NATCARB)

Carr, T.
Kansas Department of Revenue and Kansas Corporation Commission
Cooperative Oil and Gas Database Project Among the Kansas Corporation Commission, the Kansas Department of Revenue, the Grant County Appraiser, and the Kansas Geological Survey

Dubois, M., Carr, T., Byrnes, A., Bohling, G., Bhattacharya, S.
ConocoPhillips, EOG Resources, Inc., Osborn Heirs Company, Medicine Bowl Energy Corp., Cimarex Energy Company
Hugoton Asset Management Project: An Industry-University Study of Reservoir Systems in SW KS Hugoton Embayment

Fautin, D., Buddemeier, R.
U.S. Geological Survey
Scleractinian Corals of the Northwest Hawaiian Islands

Fautin, D.
Consortium for Oceanographic Research and Education
Funding for Student Clerical Assistant

Harrison, W.
KWO/KWA
Ogallala Aquifer Study - Year 4

Harrison, W.
Kansas Department of Administration, DISC
Large-scale 24K Surficial Geology

Macfarlane, P., Wilson, B., Townsend, M.
National Park Service
Revise the Kansas Portion of the USGS Karst Map and Establish a User-Driven Database for Karst Mapping

Macfarlane, P.
Kansas Water Office
Ozark Aquifer Monitoring Network - Phase II

Macfarlane, P., Wilson, B.
SW KS Groundwater Management District #3
Determination of the Practical Saturated Thickness of Two Areas of the Southwest Kansas Groundwater Management District #3

Mandel, R.
National Park Service
Geomorphological Investigations of Fox Creek Valley, Tallgrass Prairie National Preserve

McCauley, J., Johnson, W., Newell, K., West, R.
U.S. Geological Survey
Geologic Mapping and Compilation of Digitized County Data Bases in Geary, Washington, Norton and Dickinson Counties, KS

Miller, R.
U.S. Bureau of Reclamation
Seismic Study at East Canyon Dam, UT

Miller, R., Byrnes, A., Dubois, M., Bhattacharya, S., Watney, W. L., Harrison, W., Nissen, S.
U.S. Department of Energy
4-D High-Resolution Seismic Reflection Monitoring of Miscible CO2 Injected into a Carbonate Reservoir-Year 2

Miller, R., Steeples, D.
Mosaic Company
High Resolution Seismic Reflection Investigation of Sinkhole Over a Salt Dissolution Well in Hutchinson, KS

Miller, R., Ivanov, J.
U.S. Army Corps of Engineers
Continuation of Research in Seismic Techniques for Characterizing Levees

Nelson, K.
Kansas Department of Administration, DISC
GIS Data Access and Support Center

Nelson, K.
Kansas Water Office
Technical Assistance to Water Users: Public Water Supply Mapping

Nelson, K.
Kansas Information Technology Office
Implementing the National Map in Kansas

Nelson, K.
Kansas Water Office
Watershed Projects Coordination Database - Application Enhancement

Nelson, K.
KS Department of Agriculture
Maintenance and Hosting of the Web-based Water Use Filing System

Newell, K.D., Carr, T., Bhattacharya, S.
U.S. Department of Energy
Investigation of Integrated Subsurface Processing of Landfill Gas and Carbon Sequestration, Johnson Co., KS

Nissen, S., Bhattacharya, S., Byrnes, A., Doveton, J., Dubois, M., Franseen, E., Watney, L.
U.S. Department of Energy
Improving Geologic and Engineering Models of Midcontinent Fracture and Karst-Modified Reservoirs Using New 3-D Seismic Attributes

Park C., Miller, R.
Barr Engineering Company
Seismic Characterization of Wind Turbine Sites near Lawton, the MASW Method

Park C., Miller, R.
Barr Engineering Company
Seismic Characterization of Wind Turbine Sites in Kansas by the MASW Method

Sophocleous, M.
SW KS Groundwater Management District #3
Saturated Thickness Updated Maps with the Southwest Kansas Groundwater Management District # 3

Sophocleous, M., Townsend M.
Kansas State University - KWRI
Fate of Nitrate Beneath Fields Irrigated With Treated Wastewater in Ford Co., KS, Using Field Data and Preferential Flow Modeling

Xia, J., Miller, R.
City of Salina
Applications of Integrated Geophysical Survey in Mapping Subsurface to a Depth of 80 ft. at a Landfill in Salina, KS

White, S.
Kansas Corporation Commission
Kansas Energy Information Network

White, W.
Kansas Corporation Commission
Renewable Energy and Environmental and Pollution Trading Credits--Effect on Kansas Renewable Energy Development

Whittemore, D., Butler, J., Sophocleous, M., Townsend, M.
Kansas Department of Agriculture
Middle Arkansas River Subbasin Management Program

Wilhite, P., Burnes, A.
Department of Energy
Field Demonstration of Carbon Dioxide Miscible Flooding in the Lansing-Kansas City Formation, Central Kansas

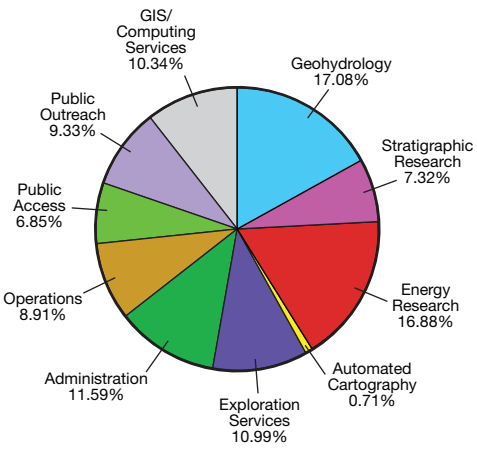
Wilson, B.
Kansas Department of Administration, DISC
Water Information Management and Analysis System (WIMAS)

Young, D.
U.S. Geological Survey
Collection of Soil/Stream Sediment Samples in Support of the USGS Mineral Resources Surveys Program

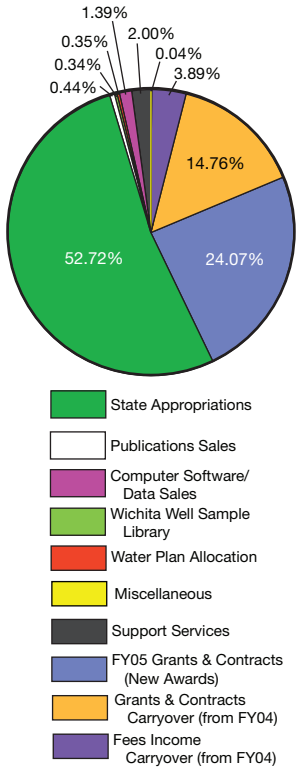
Young, D.
Kansas Water Office
Maintenance and Enhancement of the High Plains Aquifer Information Network

FINANCIAL STATEMENT FOR FISCAL YEAR 2005

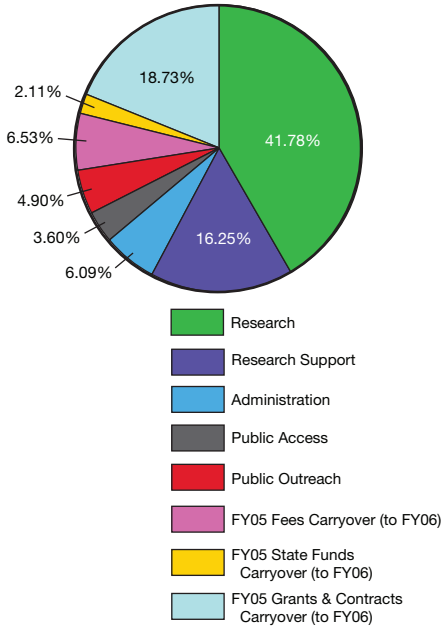
Total Expenditures by Section



Revenues (Total Budget)



Expenditures (Total Budget)



Statement of current expenditures for the fiscal year ended June 30, 2004
STATE APPROPRIATION AND MISCELLANEOUS INCOME

	Total Expenditures	Salaries	General Expenditures	Equipment
Geohydrology	1,036,930.17	975,125.55	29,760.26	32,044.36
Stratigraphic Research	444,233.93	433,000.19	6,759.72	4,474.02
Energy Research	1,024,664.53	984,817.95	24,064.09	15,782.49
Automated Cartography	43,372.37	43,372.37	0.00	0.00
Exploration Services	666,831.65	542,185.57	88,612.57	36,033.51
Administration	703,615.28	660,660.85	30,906.37	12,048.06
Operations	540,714.89	155,583.22	354,682.53	30,449.14
Public Access	415,936.28	362,937.08	41,017.80	11,981.40
Public Outreach	566,143.99	511,606.27	44,605.39	9,932.33
GIS/Computing Services	627,656.05	539,503.94	50,853.75	37,298.36
Subtotal	6,070,099.14	5,208,792.99	671,262.48	190,043.67

Comparative Statement of Current Revenues and Expenditures
Consolidated Summary for Lawrence and Wichita Branches

Revenues

State Appropriations	6,093,902.00	52.72%
Water Plan Allocation	40,000.00	0.35%
Publications Sales	51,429.84	0.44%
Wichita Well Sample Library	39,417.94	0.34%
Computer Software/Data Sales	160,818.05	1.39%
Support Services	231,068.75	2.00%
Miscellaneous	2,883.64	0.02%
Fees Income Carryover (from FY04)	449,837.90	3.89%
Grants & Contracts Carryover (from FY04)	1,706,117.12	14.76%
FY05 Grants & Contracts (New Awards)	2,782,597.34	24.07%
Total	11,558,072.58	100.00%

Expenditures

Research	4,830,288.19	41.78%
Research Support	1,878,574.96	16.25%
Administration	703,615.28	6.09%
Public Access	415,936.28	3.60%
Public Outreach	566,143.99	4.90%
FY05 Fees Carryover (to FY06)	754,881.96	6.53%
FY05 State Funds Carryover (to FY06)	244,377.02	2.11%
FY05 Grants & Contracts Carryover (to FY06)	2,164,254.90	18.73%
Total	11,558,072.58	100.00%

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Kansas Geological Survey