WYOMING STATE GEOLOGICAL SURVEY
Gary B. Glass, State Geologist

SIXTY-SECOND ANNUAL REPORT

of the

WYOMING STATE GEOLOGICAL SURVEY

For Fiscal Year 1995
July 1, 1994 to June 30, 1995

by

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INTRODUCTION

STATUTORY AUTHORITY

The history of the Geological Survey begins in Territorial times with the Office of the Territorial Assayer in 1878. This short-lived office was followed by the Office of the Territorial Geologist and Mining Engineer (1881-1890). At Statehood, the Constitution defined a State Geologist (1890), and later an Office of the State Geologist (1897-1932) was created. These beginnings evolved into the Geological Survey as it is today.

The Wyoming State Geological Survey was created by the Legislature in 1933. Its statutes have since been modified by legislative enactment in 1957, 1969, 1977, 1979, 1982, 1987, and most recently, 1991 (Chapter 122 and 203 of the Session Laws). The current statutes for the State Geologist and Geological Survey are W.S. 9-2-801 through 9-2-810 in Title 9, Ch. 2, Art. 8. In addition, the Constitutional position of State Geologist, which was established in 1890 (Art. 9, Sec. 6), was repealed by an amendment to the Wyoming State Constitution in 1990. Also, W.S. 30-5-103, 33-41-107, and 36-6-102 pertain to duties and responsibilities of the State Geologist.

AGENCY PURPOSES

The purposes of the Geological Survey are (1) to study, examine, and seek an understanding of the geology, mineral and energy resources, and physical features of the State, (2) to prepare, publish, and distribute relevant reports and maps on the geology and mineral resources of the State, and (3) to provide information, advice, and assistance related to the State's geologic, mineral, and energy resources.

AGENCY GOALS

The following eight goals of the Geological Survey link the Survey's purposes, activities, and programs to the needs of the State:

1. Dissemination of Information — PROVIDE TIMELY, ACCURATE, AND ACCESSIBLE INFORMATION ABOUT THE STATE'S GEOLOGY, MINERAL AND ENERGY RESOURCES, AND PHYSICAL FEATURES THAT HAS A PRACTICAL BEARING ON WYOMING'S CITIZENRY AND ECONOMY.

This goal is achieved by providing geologic and topographic maps and general interest, scientific, and technical reports on geologic, mineral, and energy resources; by making technical files and data bases available to the public; and by operating a public information service that provides answers to inquiries or enables inquirers to readily identify and obtain existing information.

2. Geologic Framework — INCREASE KNOWLEDGE OF THE GEOLOGIC STRUCTURE AND GEOLOGIC FORMATIONS IN THE STATE TO PROVIDE THE SCIENTIFIC FRAMEWORK FOR INVESTIGATIONS OF MINERAL AND ENERGY RESOURCES AND GEOLOGIC HAZARDS AND TO MEET ANTICIPATED FUTURE RESPONSIBILITIES.

This goal is achieved through geologic mapping; through structural, stratigraphic, and paleontologic field studies; through the testing of conceptual models; and through laboratory investigations of the petrographic, chemical, and physical properties of rocks and minerals.

3. Assessments of Mineral and Energy Resources — INCREASE KNOWLEDGE OF THE DISTRIBUTION, RESERVES, AND QUALITY (PETROGRAPHIC, CHEMICAL, AND PHYSICAL CHARACTERISTICS) OF THE STATE'S MINERAL AND ENERGY RESOURCES TO PROMOTE THEIR DEVELOPMENT AS WELL AS TO PROVIDE FACTUAL INFORMATION FOR POLICY DECISIONS AFFECTING THE AVAILABILITY AND USE OF THE STATE'S LAND, MINERAL, AND ENERGY RESOURCES.

This goal is achieved by using techniques of resource evaluation including geologic mapping, reconnaissance exploration, and field and laboratory studies of rocks and minerals, as well as the entry of this information into interactive data bases.

4. Origins of Mineral and Energy Resources — ENHANCE THE ABILITY TO DISCOVER HIDDEN OR AS YET UNRECOGNIZED MINERAL AND ENERGY RESOURCES BY DEVELOPING INFORMATION ON THE NATURAL PROCESSES BY WHICH MATERIALS IN THE EARTH ARE FORMED, TRANSPORTED, AND CONCENTRATED.

This goal is achieved through field investigations, laboratory analysis, and the formulation and testing of conceptual models.

5. Identification and Mitigation of Potential Geologic Hazards — IDENTIFY POTENTIAL GEOLOGIC HAZARDS AND IMPROVE THE SURVEY'S ABILITY TO PREDICT THE LOCATION, TIME, AND SEVERITY OF NATURAL AND MAN-MADE HAZARDS SO THAT LOSS OF LIFE AND PROPERTY IS MINIMIZED IF NOT ELIMINATED.

This goal is achieved through geologic mapping, field investigations, aerial photographic interpretation, and the application of geologic principles related to dynamic Earth processes.

6. Timely Reporting of Events and Conditions — PROVIDE FORECASTS OF MINERAL PRODUCTION AND PRICES AS WELL AS TIMELY REPORTS ON IMPORTANT HYDROLOGIC AND GEOLOGIC EVENTS AND CONDITIONS OF IMMEDIATE CONCERN TO THE PUBLIC AND TO STATE AND LOCAL GOVERNMENTAL ENTITIES.

This goal is accomplished by ongoing analysis of mineral- and energy-related activities, including man-related projects and the geologic conditions surrounding those projects, and the timely dissemination of relevant information to include warnings. Similarly, natural events are also monitored, particularly in regard to how they might affect the State's citizenry.

7. Coordination — IMPROVE THE COORDINATION OF EARTH-SCIENCE DATA COLLECTION, RESEARCH, AND MAPPING TO MINIMIZE DUPLICATION OF EFFORT, INCREASE DATA ACCESSIBILITY, AND REDUCE COSTS.

Coordination is carried out by sharing and(or) exchanging plans, technologies, and data bases with appropriate entities and by striving to standardize information formats.

8. Mission Support — IMPROVE THE GEOLOGICAL SURVEY'S ABILITY TO EFFECTIVELY CARRY OUT ITS MISSION.

This is accomplished by providing new training or continuing education opportunities for employees; by replacing and upgrading obsolete field, laboratory, and publication-related equipment; by acquiring computer software and(or) hardware to enhance the operations and management of the Geological Survey; and by implementing innovative ideas that increase output from available resources.

AGENCY ACCOMPLISHMENTS

In FY95, the Geological Survey's staff:

- Provided data, advice, and assistance to both in-state and out-of-state inquirers, responding to more than 14,830 inquiries. Of these, 8,795 were related to geology and mineral and energy resources; 666 to the effective use of earth-science techniques, products, and information; and 5,369 to requests for Survey publications and(or) information on publications.

- Prepared 31 new reports or maps that communicate information on the State's geologic, mineral, and energy resources for dissemination through the Publications Sales Unit.

- Prepared 19 additional articles on Wyoming geology and(or) mineral resources for publication by professional and scientific organizations.

- Gave 50 talks, field trips, or briefings on the State's geologic, mineral, and(or) energy resources.

- Maintained and expanded public files and data bases on the State's geologic, mineral, and energy resources.

- Identified and evaluated geologic hazards associated with earthquakes, landslides, aquifer vulnerability, and naturally-occurring toxic elements.

- Assessed mineral and energy resources, documented their occurrences, and determined their origins and manners of occurrence through at least 12 field, office, and(or) laboratory investigations in FY95.

- Increased knowledge of the State's geology or potential geologic hazards through at least seven ongoing activities or investigations in FY95.

ORGANIZATION

To accomplish its purposes and achieve its goals, the Geological Survey operates under eight functional programs, called Sections: Coal, Geologic Hazards, Geologic Mapping, Industrial Minerals and Uranium, Metals and Precious Stones, Oil and Gas, Publications, and Supportive Services (**Figure 1**). All these functional programs except the Publications Program are considered Administration programs.

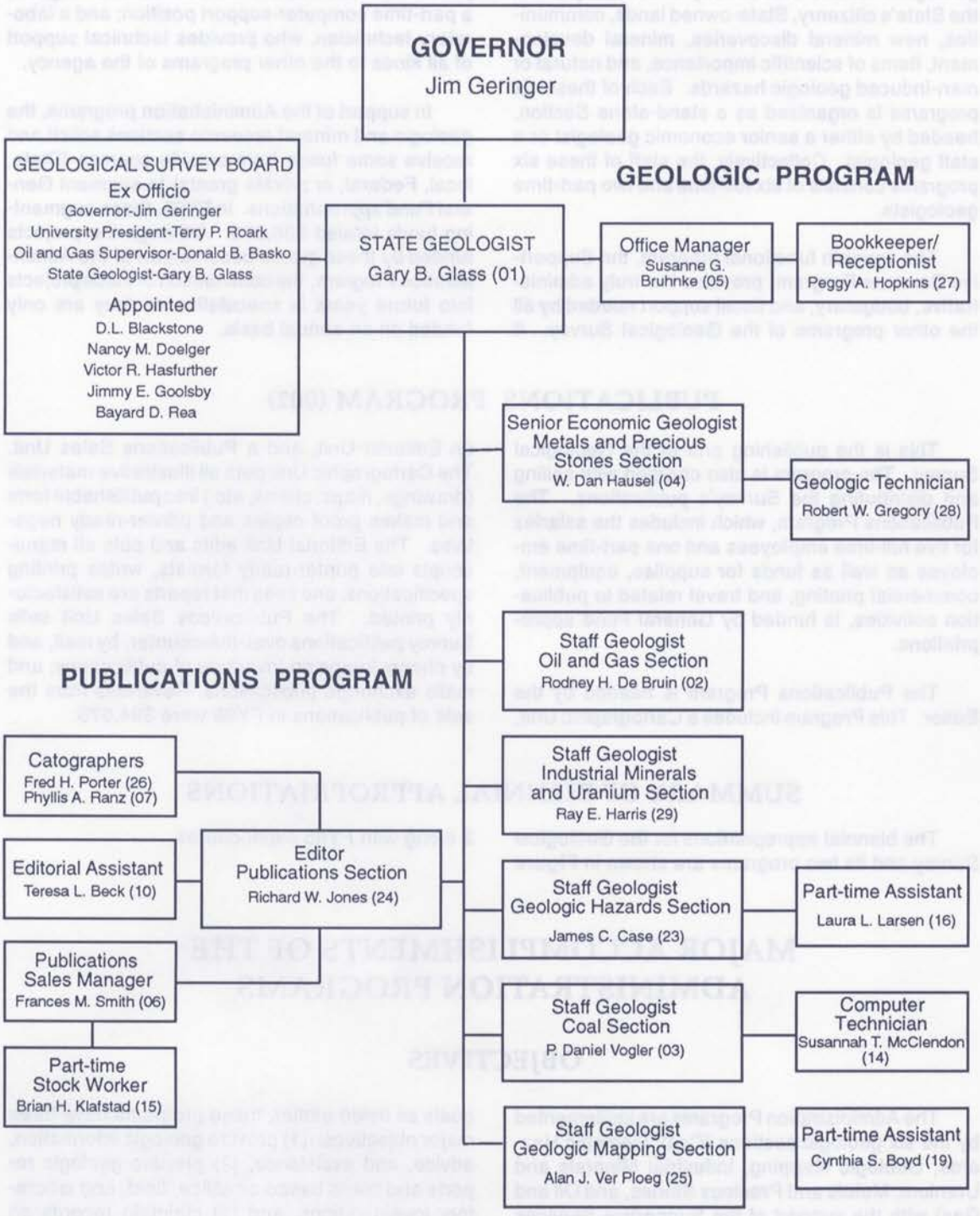

Figure 1. Organization chart for the Geological Survey in FY95.

ADMINISTRATION PROGRAMS (001)

Since 1969, when the Geological Survey was last reorganized and expanded, efforts by the Coal, Geologic Hazards, Geologic Mapping, Industrial Minerals and Uranium, Metals and Precious Stones, and Oil and Gas Programs have been directed at geological factors that directly or indirectly affect the State's citizenry, State-owned lands, communities, new mineral discoveries, mineral development, items of scientific importance, and natural or man-induced geologic hazards. Each of these six programs is organized as a stand-alone Section, headed by either a senior economic geologist or a staff geologist. Collectively, the staff of these six programs consists of six full-time and two part-time geologists.

The seventh functional program, the Supportive Services Program, provides the truly administrative, budgetary, and fiscal support needed by all the other programs of the Geological Survey. It consists of the State Geologist, who is the chief administrative officer of the agency; an office manager; an administrative secretary, who currently works half of the time as a secretary/receptionist for this program and the other half of the time as a publications assistant for the Publications Program; a part-time computer-support position; and a laboratory technician, who provides technical support of all kinds to the other programs of the agency.

In support of the Administration programs, the geologic and mineral resource sections solicit and receive some funds from outside sources (State, local, Federal, or private grants) to augment General Fund appropriations. In FY95, these augmenting funds totaled $36,573. Although the projects funded by these grants become part of the Administration Program, the continuation of these projects into future years is speculative as they are only funded on an annual basis.

PUBLICATIONS PROGRAM (002)

This is the publishing arm of the Geological Survey. The program is also charged with selling and distributing the Survey's publications. The Publications Program, which includes the salaries for five full-time employees and one part-time employee as well as funds for supplies, equipment, commercial printing, and travel related to publication activities, is funded by General Fund appropriations.

The Publications Program is headed by the Editor. This Program includes a Cartographic Unit, an Editorial Unit, and a Publications Sales Unit. The Cartographic Unit puts all illustrative materials (drawings, maps, charts, etc.) into publishable form and makes proof copies and printer-ready negatives. The Editorial Unit edits and puts all manuscripts into printer-ready formats, writes printing specifications, and sees that reports are satisfactorily printed. The Publications Sales Unit sells Survey publications over-the-counter, by mail, and by phone; keeps an inventory of publications; and mails exchange publications. Revenues from the sale of publications in FY95 were $94,575.

SUMMARY OF BIENNIAL APPROPRIATIONS

The biennial appropriations for the Geological Survey and its two programs are shown in **Figure 2** along with FY95 expenditures.

MAJOR ACCOMPLISHMENTS OF THE ADMINISTRATION PROGRAMS

OBJECTIVES

The Administration Programs are implemented by the six geologic sections (Coal, Geologic Hazards, Geologic Mapping, Industrial Minerals and Uranium, Metals and Precious Stones, and Oil and Gas) with the support of the Supportive Services Section. To accomplish the Survey's purposes and goals as listed earlier, these programs have three major objectives: (1) provide geologic information, advice, and assistance, (2) prepare geologic reports and maps based on office, field, and laboratory investigations, and (3) maintain records on geologic, mineral, and energy resources.

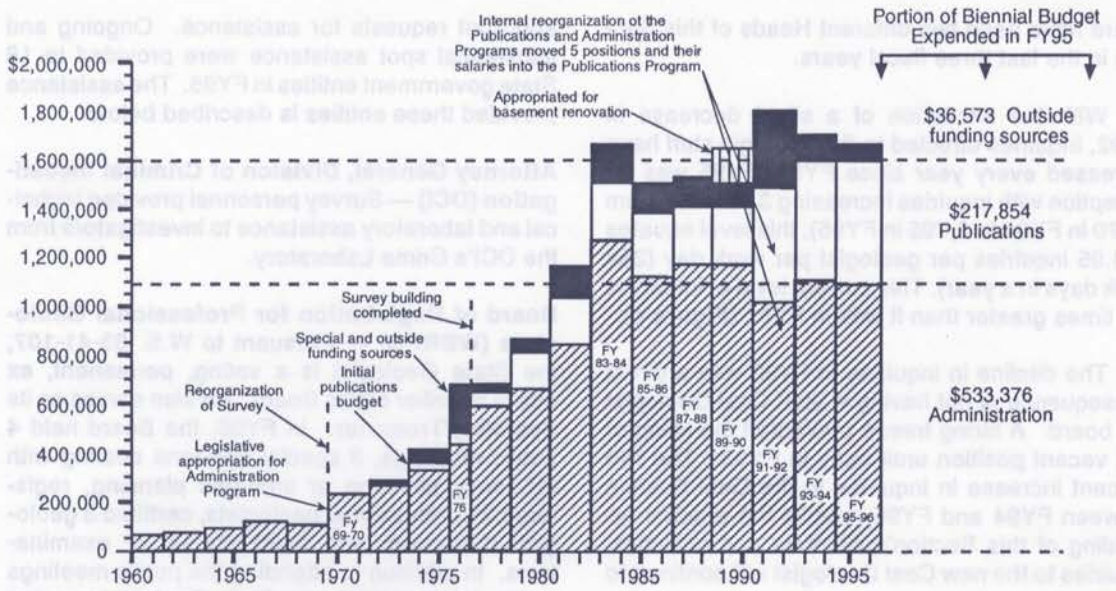

Figure 2. Biennial appropriations for the Geological Survey (expenditures for FY95 are annotated to the right of the biennial appropriations).

ACCOMPLISHMENTS

For each of these three major objectives, the activities and accomplishments of the Administration Programs in FY95 are described below:

SERVICES: Provide information, advice, and assistance for all inquiries on the State's geologic, mineral, and energy resources.

General

Because the Geological Survey is primarily a service-oriented organization, its geologic staff responds to many thousands of requests for information and assistance each year. **Figure 3** illustrates the percentages of these inquiries received by the different Geologic Sections of the Survey over the last three fiscal years. The Geologic Hazards Section again had the most inquiries in FY95. The rather significant number of inquiries directed to this Section in the last three years were in great measure related to the Section Head's chairmanship of the Western States Seismic Policy Council, the Section's coordination efforts following the 1994 earthquakes that occurred in the northwestern part of the State, and the 1995 earthquake in southwestern Wyoming, respectively. The relatively small number of inquiries directed to the Coal Section is related in part to recent changes in staff.

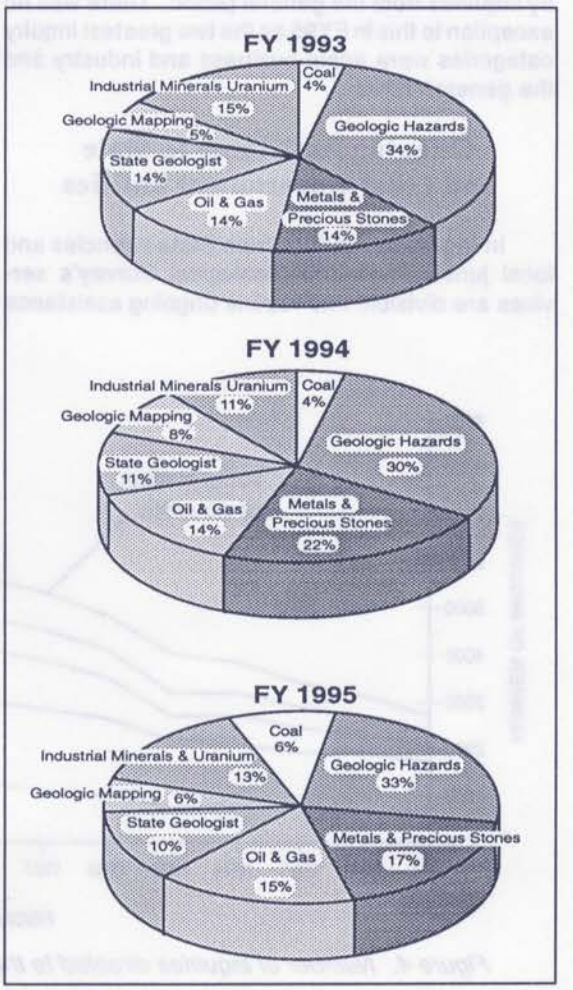

Figure 3. Percentage of inquiries directed to each of the Geologic Sections (FY93 through FY95).

There have been two different Heads of this Section in the last three fiscal years.

With the exception of a slight decrease in FY92, inquiries directed to the geologic staff have increased every year since FY81. FY95 was no exception with inquiries increasing 3 percent (from 8,570 in FY94 to 8,795 in FY95); this level equates to 4.95 inquiries per geologist per work day (254 work days in a year). This current level of inquiry is 3.2 times greater than it was in FY81 (**Figure 4**).

The decline in inquiries in FY92 was a direct consequence of not having a Staff Coal Geologist on board. A hiring freeze prevented the filling of this vacant position until early in FY93. The two percent increase in inquiries to the Coal Section between FY94 and FY95 reflects the gradual rebuilding of this Section's clientele and activities. Inquiries to the new Coal Geologist will continue to grow.

Figure 4 also shows the categories of inquirers requesting information and assistance from the geologic staff. Inquiries from business and industry are traditionally the largest category, followed by inquiries from the general public. There was no exception to this in FY95 as the two greatest inquiry categories were again business and industry and the general public.

Ongoing Assistance to State and Local Government Entities

In regard to inquiries from State agencies and local jurisdictions, the Geological Survey's services are divisible into routine ongoing assistance and spot requests for assistance. Ongoing and substantial spot assistance were provided to 18 State government entities in FY95. The assistance provided these entities is described below:

Attorney General, Division of Criminal Investigation (DCI) — Survey personnel provided technical and laboratory assistance to investigators from the DCI's Crime Laboratory.

Board of Registration for Professional Geologists (WBRPG) — Pursuant to W.S. 33-41-107, the State Geologist is a voting, permanent, ex officio member of this Board. He also serves as its Secretary/Treasurer. In FY95, the Board held 4 public meetings, 3 special sessions dealing with efficiency planning or strategic planning, registered 21 professional geologists, certified 3 geologists-in-training, and administered 22 examinations. In addition to attending the public meetings and special sessions, the State Geologist spent at least a day each month on Board-related matters, which included responses to 55 telephone and 10 visitor inquiries as well as writing 85 letters.

Consensus Revenue Estimating Group (CREG) — The State Geologist is a member of CREG, a group that makes revenue estimates for use by the Governor and the Legislature, prior to each Legislative Session. With advice and information provided by the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Sections, the State Geologist provided forecasts and continually apprised CREG of the minerals situation throughout FY95. This group met three times in FY95, once on mineral forecasts and twice as a whole.

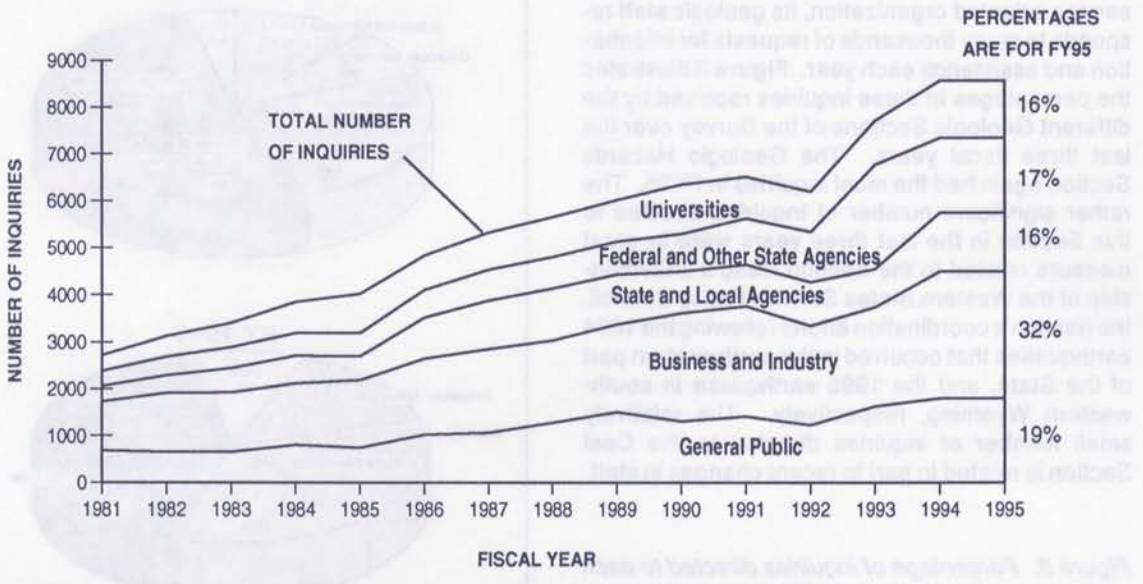

Figure 4. Number of inquiries directed to the Geologic Sections by category and fiscal year.

Department of Administration and Information, Computer Technology Division — The Head of the Geologic Mapping Section is a member of the multi-agency Wyoming Geographic Information Advisory Council (WGIAC).

Department of Administration and Information, Economic Analysis Division — The State Geologist and Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Sections provided information on prices and production of oil, natural gas, coal, uranium, and industrial minerals throughout the year for use in economic forecasting.

Department of Commerce, Division of Administration — The State Geologist served on a special team tasked with drafting an Efficiency Plan for the department. He also participated in a meeting to develop efficiencies in the State Archaeologists Office.

Department of Commerce, Division of Economic and Community Development (DECD) — The Head of the Industrial Minerals and Uranium Section continued working with the DECD staff in reviewing the development potential of several industrial minerals with emphasis on raw materials for the manufacture of glass; represented Wyoming at the 1995 Industrial Minerals Forum in El Paso, Texas, with funds provided by the DECD; and is coordinating with the DECD in regard to the 1996 Forum, which the Geological Survey is hosting in Laramie.

Department of Environmental Quality, Abandoned Mine Land Program (DEQ-AML) — (1) The Head of the Geologic Hazards Section remained a member of the Technical Review Committee (TRC) for the Abandoned Mined Land Research Program, reviewing 19 research proposals; and participated in the Sixth Project Review Seminar in Laramie, Wyoming; and (2) the Head of the Industrial Minerals and Uranium Section provided information on some abandoned mines.

Department of Environmental Quality, Industrial Siting Division — The Heads of the geologic sections and the State Geologist reviewed two siting applications in FY95.

Department of Environmental Quality, Land Quality Division (DEQ-LQD) — (1) The Head of the Industrial Minerals and Uranium Section reviewed the proposed reclamation plan for abandoned mines in the Sunrise area; and (2) under a Memorandum of Understanding with the DEQ-LQD, the Head of the Geologic Hazards Section and(or) the State Geologist review paleontologic surveys included in mining applications.

Department of Environmental Quality, Water Quality Division (DEQ-WQD) — (1) In a Federal-State cooperative effort with the U.S. Environmental Protection Agency, DEQ-WQD, the State Engineer, the University of Wyoming's Water Resources Center and Department of Geology and Geophysics, the Geologic Hazards Section continued its participation in a statewide study of aquifer vulnerability to contamination by completing thirty-five 1:100,000-scale surficial geology maps and beginning work on a statewide vadose zone analysis; and the Head of the Geologic Hazards Section is a member of the Wellhead Protection Plan Advisory Committee; and (2) the Head of the Coal Section is a member of the DEQ-WQD's Cumulative Hydrologic Impact Assessment (CHIA) Team.

Governor's Clearing House — The State Geologist and Heads of the six geologic sections reviewed 117 documents for the Governor's Clearing House in FY95 and submitted written comments on 39.

Governor's Office — (1) The State Geologist represented the Governor's Office on the U.S. Bureau of Land Management's Coal Lease Sale Review Group; (2) the State Geologist and the Head of the Industrial Minerals and Uranium Section are the State's representatives on the Policy and Technical Committees for the joint industry and government Trona/Oil and Gas Concurrent Development study in southwestern Wyoming, respectively; and (3) the Head of the Geologic Hazards Section served as a member of the Governor's Multi-hazard Mitigation Task Force.

Legislative Service Office — Throughout the year, the State Geologist and the Heads of the Coal, Industrial Minerals and Uranium, and Oil and Gas Sections provided information on production and prices for minerals produced in the State.

Oil and Gas Conservation Commission (OGCC) — (1) Wyoming Statute 30-5-103 makes the State Geologist one of the Commissioners of this regulatory agency. Monthly hearings were routinely 1.0-2.0 days long in FY95; and (2) the Geologic Mapping Section provided lithologic and stratigraphic information on 19 wells to assist the Commission's staff and field personnel in evaluating applications for injection or water disposal wells.

State Land and Farm Loan Office — (1) The Oil and Gas Section reviewed the locations of drilled or permitted well sites and provided the State Land Office with weekly reports, which showed the locations that were on or near State lands; (2) the State Geologist reviewed and made recommendations on 12 commercial or scientific fossil-collecting permits; (3) the Geologic Mapping Section conducted

field inspections of 7 commercial and 1 scientific fossil quarries on State lands; and (4) the Head of the Geologic Hazards Section and the State Geologist reviewed and recommended that proposals and bids received for a statewide study of the seismic susceptibility of school buildings be rejected; and in addition, they prepared alternative approaches to this kind of study for consideration by the Farm Loan Board.

University of Wyoming — (1) The Geologic Hazards Section continued its cooperative projects with the University of Wyoming's Water Resources Center; (2) the Head of the Coal Section continued his participation in the University of Wyoming's Teaching and Professional System Partnership (TIPS) by teaching three short courses on specialized geologic software; and (3) ongoing assistance, classroom lectures, and information were provided to faculty and students from many departments of the University as well as the Geology Museum.

Wyoming Emergency Management Agency (WEMA) — The Head of the Geologic Hazards Section is the Survey's liaison to WEMA as well as one of the State's representatives to the Western States Seismic Policy Council (WSSPC).

Spot Assistance to State and Local Government Entities

In addition, spot requests for information or other assistance were received from at least 77 other State and local government entities in FY95 as well as inquiries from at least 142 Federal, foreign, or government entities and universities in other states.

Talks and Briefings

As an extension of this service-related function, the State Geologist and Section Heads collectively presented 50 talks, field trips, or briefings on mineral resources, geology, or geologic hazards to the following 35 different entities:

31st Forum on the Geology of Industrial Minerals, El Paso, Texas
American Businesswoman's Annual Meeting, Laramie
American Institute of Professional Geologists, Wyoming Section, Casper
Bond Exploration, Laramie Mountains (field trip)
Boy Scouts of America, Laramie
Cheyenne Gem and Mineral Club, Cheyenne
Exploration 95 Conference, Lake Tahoe, California (2 talks)
First United Methodist Church, Laramie
Geologists of Jackson Hole Earthquake Seminar, Jackson (1 talk and 1 panel)
Indiana Geological Survey and Indiana University, Bloomington, Indiana
Kiwanis Club, Laramie
KOWB radio talk show, Laramie (2)
KUGR radio talk show, Green River (2)
KUWR radio talk show, Laramie
Laramie Economic Development Corporation, Laramie
Laramie High School, Laramie
Laramie Junior High School, Laramie (3 talks)
Laramie Plains Lions Club, Laramie (2 talks)
Pacific Northwest Mining Conference, Bellevue, Washington (2 talks)
Powder River Basin Technology Conference, Gillette
Society of Mining Engineers, Southwestern Wyoming Chapter, Rock Springs
Society of Organic Petrology, Jackson
State Gem and Mineral Show, Torrington (2 talks)
Sweetwater County Commissioners, Green River (briefing)
Texas Railroad Commission, Austin, Texas (short course)
U.S. Geological Survey, Coal Branch, Denver (short course)
University of Wyoming, Dept. of Geography & Recreation, Laramie
University of Wyoming, Dept. of Geology & Geophysics, (field trip; 3 lectures)
University of Wyoming, multi-department, Laramie (short course)
University of Wyoming, Math Science Initiative Project, Hanna (field trip)
University of Wyoming Senior Lyceum, Laramie
Washakie County Museum's 4th Annual Paleontology Symposium, Worland
Wyoming Department of Commerce, Cheyenne
Wyoming Geological Association (4 talks)
Wyoming Safety of Dams Conference, Kemmerer

INVESTIGATIONS: Conduct office, field, and laboratory investigations and prepare geologic reports and maps that (a) increase understanding of the geologic, mineral, and energy resources of the State and (b) have a practical bearing on Wyoming's communities and people.

Arranged by Geologic Section, the following 21 investigations, projects, or studies were ongoing or completed in FY95:

Coal Section

- **National Coal Resources Data System** (ongoing; this project is partially funded by a grant from the U.S. Geological Survey's Branch of Coal Resources; the Section is compiling coal data and

down-loading it into a computerized national data base).

• **Wyoming Coal Data Base** (ongoing; statewide data on the chemical composition and physical properties of coals were compiled and entered into an in-house computerized data base).

Geologic Hazards Section

• **Landslide mapping and classification** (ongoing; the Section completed mapping of landslides on four 1:24,000-scale quadrangles).

• **Earthquakes and seismicity** (ongoing; the Head of the Section served as one of the State's two representatives to the Western States Seismic Policy Council (WSSPC); the Section's earthquake awareness and response activities increased substantially following a mining-induced earthquake in southwestern Wyoming; and the Section began a campaign to raise funds for a new seismic station in southwestern Wyoming).

• **Mapping of surficial materials and features** (ongoing; this project was originally begun as a joint effort with the U.S. Geological Survey and the University of Wyoming's Department of Geology and Geophysics. The project expanded in response to needs of the State's Aquifer Vulnerability to Contamination Program. Thirty-five 1:100,000-scale surficial geology maps were completed in FY95. These and earlier maps were given to the Wyoming Water Resources Center and the Water Quality Division of the Wyoming Department of Environmental Quality as they were completed. The Wyoming Water Resources Center is digitizing them and incorporating them into a Geographic Information System for use by the project).

• **Earth Science Information Center** (ongoing; in cooperation with the U.S. Geological Survey, the Section continued to operate the publicly accessible Earth Science Information Center (ESIC) in Wyoming; this center provides information on cartographic, hydrologic, geologic, and remote sensing data to include microfiche indices for all Federal aerial and space imagery; and it now has some data on CD-ROM).

Geologic Mapping Section

• **Bibliographies of Wyoming geology** (ongoing; completed an index map of out-of-state dissertation and thesis maps available within the Section's files).

• **1:100,000-scale geologic maps** (ongoing; submitted the Cheyenne Quadrangle for publication; working on the Gillette Quadrangle).

• **1:24,000-scale geologic maps** (ongoing; finished revisions of the Tabletop, Tallon Springs, and Turk Springs Quadrangles in the southern Bighorn Mountains; and working on the Laramie, Red Buttes, and Howell Quadrangles as part of the STATEMAP initiative).

Industrial Minerals and Uranium Section

• **Geology, industrial minerals, and construction materials of the Guernsey 7 1/2-minute Quadrangle** (ongoing; mapping the geology, industrial minerals, and construction materials in this quadrangle).

• **Characterization of limestones in Wyoming** (ongoing; this project involves sampling and describing minable limestones throughout Wyoming and determining the variability and location of chemical-grade material).

• **Summary reports on Wyoming's industrial minerals and uranium resources** (ongoing; a report on talc and steatite was completed and published).

• **32nd Annual Forum on the Geology of Industrial Minerals** (ongoing; the Head of the Industrial Minerals and Uranium Section was on the Business and Steering Committees of the Forum and also assumed the duties of General Chairman for the 32nd Forum, which will be held May 19-21, 1996, in Laramie).

Metals and Precious Stones Section

• **Strategic minerals** (ongoing; completed an in-house mineral report on copper, molybdenum, lead, and zinc and submitted it for publication).

• **Kimberlite and lamproite diamond investigations** (ongoing; this is a continuing project building on earlier work completed over the last 13 years; a relatively small lamproite sample from the Leucite Hills was tested for diamonds, but yielded none).

• **Economic geology of the Rattlesnake Hills mining district** (ongoing; prepared a preliminary report for outside publication and worked on a final report for publication by the Survey).

• **Economic geology of the Tin Cup district**

(ongoing; began field mapping on this project).

• **Wyoming Geological Association's 1995 Annual Field Conference** (ongoing: The Head of the Metals and Precious Stones Section volunteered to be a co-chairman of the conference; authored or co-authored six papers for the guidebook; and prepared a portion of one field trip. The conference is scheduled for August 19-22, 1995, in Rock Springs).

Oil and Gas Section

• **Wyoming compositional data base for petroleum** (ongoing; analyses of oil and gas from the Thrust Belt and the Greater Green River Basin were entered into the Section's computerized data base, which already had data on northeastern Wyoming in it, as well as 1,699 analyses of produced water from across the State).

• **Wyoming data base of petroleum reservoirs** (ongoing; reservoirs in northeastern Wyoming were added to the data base, which already has data on the majority of the reservoirs in the Thrust Belt and the Greater Green River Basin).

• **Oil and gas map of Wyoming** (completed; a final draft of a new 1:500,000-scale oil and gas map was finished and submitted for publication).

• **Wyoming Geological Association's 1995 Annual Field Conference** (ongoing: The Head of the Oil and Gas Section volunteered to be a co-charirman of the conference and authored one paper for the guidebook. See the discussion under the Metals and Precious Stones Section for more details).

Miscellaneous

• **Rock and mineral identifications and analyses** (ongoing; more than 100 rock and mineral specimens were identified for the general public, mining companies, or the University of Wyoming's Geology Museum; the Laboratory Unit not only conducted 678 analyses, tests, or procedures on 170 samples in support of in-house geologic investigations, but it also acquired some equipment so that it could begin preparing some fossil specimens for examination or exhibit).

• **Articles written for publication by outside publishers.** In FY95, the Section Heads and the State Geologist collectively prepared 19 papers or articles for outside publication by one of the 10 entities listed below:

International California Mining Journal (3)
Keystone Coal Industry Manual (2)
Mineralogical Abstracts (2)
Mining Engineering (4)
Northern Miner
Pacific Northwest Mining Conference Proceedings (2)
Rocky Mountain Landman (2)
The Contact (Wyoming Geological Association)
Western States Seismic Policy Council Proceedings
Wyoming Safety of Dams Conference Proceedings

• **Additional activities** (ongoing; the Head of the Publications Section volunteered to edit the Wyoming Geological Association's annual field conference guidebook for 1995, and he volunteered to be the General Chairman for the annual meeting of the Association of Earth Science Editors, which will be meeting in Jackson. Both these conferences are scheduled for early in FY96).

PUBLIC FILES AND DATA BASES: Continuously update and maintain data bases, files, and libraries of all available reports, records, maps, and other information relating to the surface and subsurface geologic, mineral, and energy resources of the State.

In FY95, the Geological Survey (1) enlarged its geologic hazards files; (2) expanded its computerized data bases on oil and gas reservoir characteristics, on oil and gas composition, and on coal stratigraphy and coal composition; and (3)acquired additional downhole logs from uranium drilling within the State. The Survey also maintains a "Confidential" file of drilling records from holes drilled on State mineral leases, pursuant to Wyoming Statute 36-6-102.

With the exception of the "Confidential" drilling records mentioned above, files, data bases, and libraries of the Survey are for the most part available to the public. A public-use area is provided on the second floor of the Wyoming State Geological Survey Building. This area hosts microfiche, microfilm, and paper copies of many oil and gas well logs; aerial photographs; unpublished geologic and mineral reports; open file reports of the U.S. Geological Survey and the U.S. Bureau of Mines; the U.S. Department of Energy's uranium reports for Wyoming, and the Earth Science Information Center (ESIC). The Survey's extensive collection of Environmental Impact Statements, Industrial Siting Applications, and numerous other government documents are now kept in the Survey's reference library.

In a concerted effort, the Coal, Industrial Min-

erals and Uranium, and Oil and Gas Sections continued to enter mineral resource data into the Survey's personal computers for easier management and manipulation of data. While the initial goals of these computerization efforts were the input of mineral production, market, and price information, other resource data are now being added.

MAJOR ACCOMPLISHMENTS OF THE PUBLICATIONS PROGRAM

OBJECTIVES

Publications are an essential part of the Survey's overall service function as mandated by law (W.S. 9-2-805, part a, subsections iv and v). The Publications Program, which is synonymous with the Publications Section, is both the publishing and sales arm of the Survey and performs an essential role in the sale and distribution of information to the public. This program contains the funds for preparing and printing geological information collected and interpreted by Survey personnel or outside authors. There are five full-time positions and one part-time position in this program.

The major objectives of the Publications Program are three-fold: (1) to make information about Wyoming's geologic, mineral, and energy resources available in various publication formats, (2) to sell and distribute Survey publications, and (3) to provide technical support to the Section Heads, the State Geologist, other Survey staff, and occasionally to outside entities.

ACCOMPLISHMENTS

For each of these major objectives, the activities and accomplishments of the Publications Program in FY95 are described below:

PUBLISHING: Make information about Wyoming's geologic, mineral, and energy resources available in various publication formats.

The Editor and the State Geologist establish publishing priorities. The two graphs in **Figure 5** summarize the general subject matter of Survey publications and the number of new publications completed each decade. In FY95, the Editorial Unit prepared bid specifications for 14 printing jobs. The Editor also attended the press runs for 8 of those jobs to assure the printed quality of those publications met Survey standards.

The Publications Section formally published 11 new titles and reprinted 3 existing titles in FY95 (**Figure 6**). In addition, the Section prepared 7 reproducible-on-demand publications.

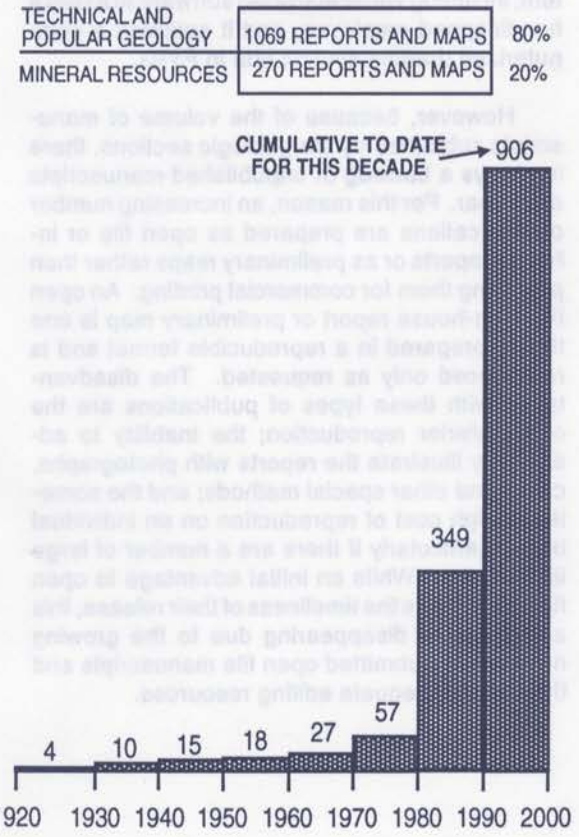

Figure 5. General content of Survey publications since FY20 and the number of new titles prepared by decade.

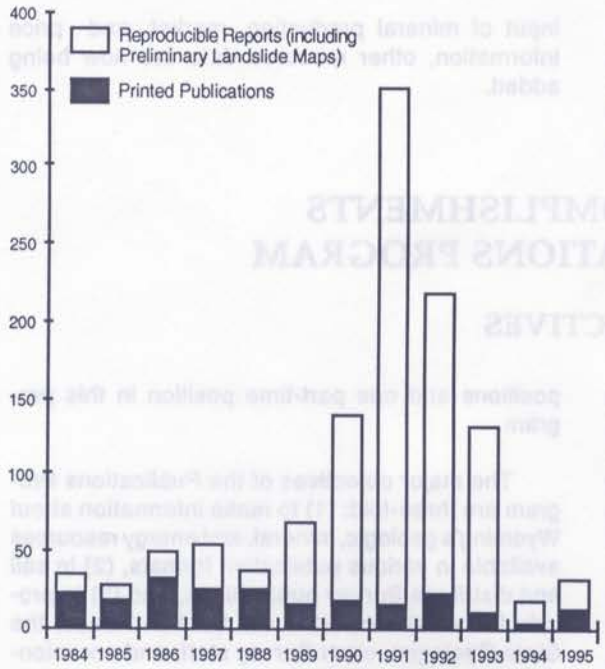

Figure 6. Number of new titles published each fiscal year (FY84 through FY94).

In recent years, the Section has upgraded its photographic and computer equipment. It currently has an excellent desk top publishing system, including voice-activated software to assist a handicapped employee, and it acquired a computerized drafting system late in FY93.

However, because of the volume of manuscripts submitted by the geologic sections, there is always a backlog of unpublished manuscripts each year. For this reason, an increasing number of publications are prepared as open file or in-house reports or as preliminary maps rather than preparing them for commercial printing. An open file or in-house report or preliminary map is one that is prepared in a reproducible format and is reproduced only as requested. The disadvantages with these types of publications are the often inferior reproduction; the inability to adequately illustrate the reports with photographs, color, and other special methods; and the sometimes high cost of reproduction on an individual basis, particularly if there are a number of large illustrations. While an initial advantage to open file reports was the timeliness of their release, this advantage is disappearing due to the growing numbers of submitted open file manuscripts and the lack of adequate editing resources.

The 21 publications listed below represent the combined efforts of the Publications Section and the geologic sections:

ANNUAL REPORT

Sixty-first annual report of the Wyoming State Geological Survey for Fiscal Year 1994, July 1, 1993, to June 30, 1994: by G.B. Glass and S.G. Bruhnke, (1995).

GEOLOGIC HAZARDS SECTION INTERIM REPORT

Earthquake epicenters and suspected active faults with surficial expression in Wyoming, by J.C. Case, L.L. Larsen, C.S. Boyd, and J.C. Cannia: Geologic Hazards Section Interim Report IR 95-1 (1995).

INFORMATION PAMPHLET

Bibliography and index of graduate theses and dissertations of the Department of Geology and Geophysics, University of Wyoming [revised edition]: IP-3, by C.S. Boyd and others, (1995).

MAP SERIES

Index to geologic mapping in Wyoming from out-of-state theses: MS-9S, by A.J Ver Ploeg and C.S. Boyd, [reproduced-on-demand], (1995).

Geologic map of the Monument Hill Quadrangle, Johnson and Washakie Counties, Wyoming: MS-44, by A.J. Ver Ploeg and P.L. Greer, (1995).

Geologic map of the Beartrap Meadows Quadrangle, Johnson County, Wyoming: MS-45, by A.J. Ver Ploeg and P.L. Greer, (1995).

MINERAL REPORTS

Diamonds, kimberlites, lamproites and related rocks in the United States, by W.D. Hausel: Mineral Report 94-2 (1994).

Copper, lead, zinc, and molybdenum in Wyoming, by W.D. Hausel: Mineral Report 95-1 (1995).

MISCELLANEOUS

Knightia postcard [3rd printing]: (1994).

Tyrannosaurus rex postcard [2nd printing]: (1994).

Geologic map of Wyoming postcard [2nd printing]: (1994).

OPEN FILE REPORTS

Study of metals and precious stones in southern Wyoming: OFR 94-2, by W.D. Hausel, [reproducible-on-demand], (1994).

Talc, including steatite, in Wyoming: OFR 95-1, by R.E. Harris, [reproducible-on-demand], (1995).

PRELIMINARY LANDSLIDE MAPS

Preliminary Landslide Map of the Rendle Hill 7 1/2-minute Quadrangle, by J.C. Case and L.L. Larsen (1994).

Preliminary Landslide Map of the TL Ranch 7 1/2-minute Quadrangle, by J.C. Case and L.L. Larsen (1994).

Preliminary Landslide Map of the Carbon 7 1/2-minute Quadrangle, by J.C. Case (1994).

Preliminary Landslide Map of the Bluenose Creek 7 1/2-minute Quadrangle, by J.C. Case (1994).

PRELIMINARY HAZARDS REPORTS

Draft directory of earthquake-related human resources for Wyoming, by J.C. Case: Preliminary Hazards Report 95-1 (1995).

Seismic network recommendations for the Wyoming trona mining area and the State of Wyoming, by J.C. Case: Preliminary Hazards Report 95-2 (1995).

PUBLIC INFORMATION CIRCULARS

Organics and the Rockies-field guide: PIC-33, R. M. Flores and others (editors), (1994).

Decorative stones of the Medicine Bow National Forest: PIC-34, by R.E. Harris, (1994).

REPORT OF INVESTIGATIONS

Economic geology of the Seminoe Mountains mining district, Carbon County, Wyoming: RI-50, by W.D. Hausel, (1994).

REPRINTS

Phosphate rock resources of the Wind River Indian Reservation, Wyoming: R-57, by R.P. Sheldon, [reproducible-on-demand], (1995).

Evaluation of bentonite and gold resources on the Wind River Indian Reservation, Wyoming: R-58, by C.A. Roberts and others, [reproducible-on-demand], (1995).

Evaluation of coal resources on the Wind River Indian Reservation, Wyoming: R-59, by J. Gersic and E.K. Peterson, [reproducible-on-demand], (1995).

Bentonite resources in the Winkleman Dome-Bighorn Ridge, Arapahoe Reservoir, and Blue Ridge areas on the Wind River Indian Reservation, Wyoming: R-60, by J. Gersi and J.B. Worthington, [reproducible-on-demand], (1995).

Sand/gravel, gypsum, and iron resources on the Wind River Indian Reservation, Wyoming: R-61, by J. Gersic and L.G. Nonini, [reproducible-on-demand], (1995).

WYOMING GEO-NOTES

No. 43 : by G.B. Glass, R.H. DeBruin, P.D. Vogler, R.E., Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (1994).

No. 44 : by G.B. Glass, R.H. DeBruin, P.D. Vogler, R.E. Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (1994).

No. 45: by G.B. Glass, R.H. DeBruin, P.D. Vogler, R.E. Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (1995).

No. 46 : by G.B. Glass, R.H. DeBruin, P.D. Vogler, R.E. Harris, W.D. Hausel, A.J. VerPloeg, and J.C. Case, (1995).

SALES AND DISTRIBUTION: Sell and distribute Survey publications.

In FY95, the Publications Section responded to about 6,035 inquiries about publications, including 3,748 receipted sales transactions for $94,575.20 in sales.

Figure 7 shows a percentage breakdown of revenues derived from the sale of publications over the last three fiscal years, arranged by customer category. The revenues from sales to the general public have exceeded 49 percent of the total since FY85.

The volume of receipted sales in each customer category and the revenues derived from that customer category are shown in **Table 1**.

The $94,575 received from the sale of publications and purchase for resale items in FY95 was the third highest sales ever receipted by the Survey (**Figure 8**). Only last fiscal year and FY81 surpassed the sales in FY95. The sales revenue in FY95 is an amount equal to about 12.6% of the Survey's total General Fund expenditures in FY95. In the record sales year of FY94, sales were a slightly lower percentage at 12.3%.

The revenues from the sale of the Geological Survey's publications and purchase for resale items, which are all deposited in the General Fund, included $2,271.84 in sales tax in FY95.

The Publications Program has continued to look for new and inexpensive ways to make the public aware of valuable earth-science publications available from the Geological Survey. In addition to the preparation of press releases describing new titles, new Survey publications are listed in each issue of the Survey's quarterly newsletter, *Wyoming Geo-notes*. Subscriptions to *Wyoming Geo-notes* have been increased through promotional mailings. Topographic map sales have continued to rise since FY90 because of increased public awareness of that service and because the Survey is selling maps by mail and phone orders as well as over-the-counter.

Publications of the Geological Survey are distributed free-of-charge to libraries and archives throughout the State. Limited numbers of each publication are also provided to other State agencies and branches of government and to elected officials on request. In addition, the Survey participates in publication exchange programs with many other state geological surveys, numerous foreign geological surveys, the U.S. Geological Survey, the U.S. Department of Energy,

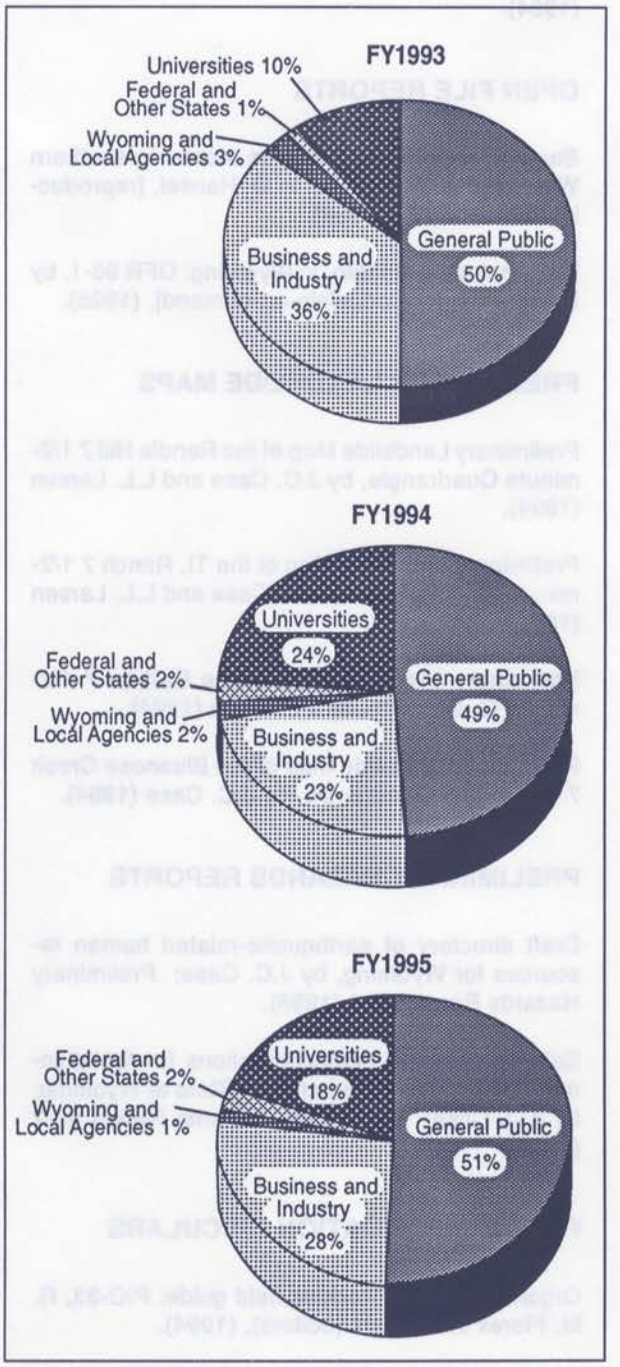

Figure 7. Percentage of publication revenue arranged by customer category (FY93 through FY95).

Table 1. Breakdown of publication sales by customer category and by sales revenue for FY95.

Category	Percent of Customers	Sales Revenue	Percent of Revenue
General public and(or) unidentified	63%	$48,077.25	51%
Business and industry	28%	26,562.88	28%
Universities	6%	16,602.06	18%
Wyoming and local agencies	2%	1,334.66	1%
Federal, other states and foreign	1%	1,998.35	2%
Totals	100%	$94,575.20	100%

the U.S. Bureau of Mines, and other entities. While the copies sent out on exchange agreements do not add directly to sales revenue, they provide an important service to the State by allowing acquisition of publications from out-of-state agencies without direct charge. The publications acquired through the Survey's exchange agreements are subsequently donated to the University of Wyoming's Geology Library. In FY95, more than 1,243 publications were received in exchange for Survey publications.

TECHNICAL SUPPORT: Provide technical advice and support to the State Geologist, Section Heads, other Survey staff, and occasionally to outside entities.

The Publications Section provides editing and drafting for maps and reports published by the Survey, creates illustrations for talks and displays, and generally assists in publication-related activities. The Editor also answers requests for information about the Survey's editing techniques, policies, and procedures from agencies, organizations, and consultants.

The cartographers frequently advise University of Wyoming faculty, staff, and students on drafting techniques. They also occasionally provide advice to consultants and members of the general public as well as other State and Federal agencies.

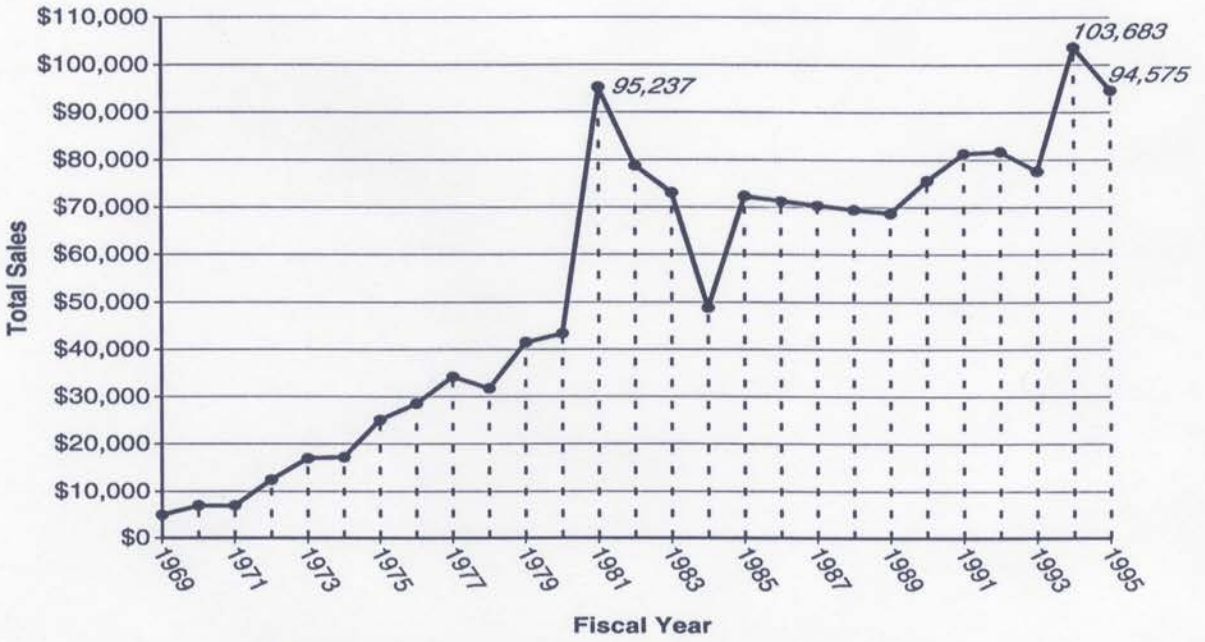

Figure 8. Fiscal year income to the General Fund from the sale of publications.

SUMMARY OF PERMANENTLY ASSIGNED VEHICLES

The following list of motor vehicles is provided in accordance with Section 9-2-1014 revised:

License Number	Assigned To	Reason For Assignments
S-528	Ray E. Harris	1990 pick-up for off-road field work. [odometer: 85,505]
S-656	W. Dan Hausel	1987 pick-up for off-road field work. [odometer: 73,000]
S-799	James C. Case	1981 station wagon for light field work. [odometer: 97,247]
S-1330	Richard W. Jones	1988 station wagon for press runs. [odometer: 89,069]