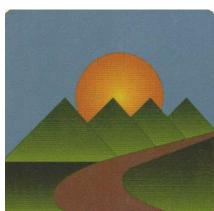


# West Virginia Geological and Economic Survey

# ANNUAL REPORT

Fiscal Year 2003



STATE OF WEST VIRGINIA  
Bob Wise, Governor

BUREAU OF COMMERCE  
Betty Carver, Chief

GEOLOGICAL & ECONOMIC SURVEY  
Carl J. Smith, Director & State Geologist

Publication AR-03  
June 30, 2003



**WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY**  
**Principal Staff Directory for 2003**

|  |  |
|--|--|
| Director and State Geologist                 | <i>Carl J. Smith</i>                           |
| Assistant State Geologist                    | <i>Michael Ed. Hohn</i>                        |
| Deputy Director Finance and Administration   | <i>John D. May</i>                             |
| Chief Geologist                              | <i>Douglas G. Patchen</i>                      |
| Advanced Geoscience Research                 | <i>Michael Ed. Hohn<br/>Ronald R. McDowell</i> |
| Applied Coal Resources Investigations        | <i>Nick Fedorko III</i>                        |
| Applied Oil and Gas Resources Investigations | <i>Katharine L. Avary</i>                      |
| Computing Services and Computer Upgrades     | <i>Mary C. Behling</i>                         |
| Earth Science Information Center             | <i>Paul R. Liston</i>                          |
| General Geoscience                           | <i>Jane S. McColloch</i>                       |
| Geoscience Education                         | <i>Thomas E. Repine, Jr.</i>                   |
| GIS Program and Statewide GIS Coordinator    | <i>Craig A. Neidig</i>                         |
| Public Service                               | <i>Steven W. McClelland</i>                    |
| Publications and Graphics                    | <i>Charles H. Gover, Jr.</i>                   |

**Address:** West Virginia Geological and Economic Survey  
Mont Chateau Research Center  
1 Mont Chateau Road  
Morgantown, WV 26508

**Phone:** 1-800-WVGEOLOGY (1-800-985-3656)  
(304) 594-2331  
On Net: 557-3170

**Fax:** (304) 594-2575

**Web Site:** <http://www.wvgs.wvnet.edu>

**E-mail:** [info@geosrv.wvnet.edu](mailto:info@geosrv.wvnet.edu)

**Hours:** 8:00 am to 5:00 pm Monday through Friday (closed holidays)

## CONTENTS

|  |    |
|--|----|
| Transmittal Letter .....                                   | 3  |
| The West Virginia Geological and Economic Survey .....     | 4  |
| Executive Summary .....                                    | 8  |
| Organization Chart .....                                   | 13 |
| Survey Staff .....   | 14 |
| Financial Summary .....                                    | 20 |
| Research .....   | 31 |
| Administrative and Facilities Maintenance Projects .....   | 40 |
| Advanced Geoscience Research Project.....                  | 43 |
| Applied Coal Resources Investigations Program .....        | 44 |
| Applied Oil and Gas Resources Investigations Program ..... | 46 |
| Computing Services and Computer Upgrades Projects .....    | 49 |
| General Geoscience Program .....                           | 53 |
| Geographic Information System Program .....                | 56 |
| Geoscience Education Program .....                         | 60 |
| Public Service Program .....                               | 63 |
| Publications and Graphics Project.....                     | 66 |
| Financial Information .....                                | 71 |



**West Virginia science teachers pause during a field trip conducted by the Geoscience Education Program's RockCamp teacher training workshop.**



**Governor Bob Wise discusses progress of the Mineral Lands Mapping Program with Survey staff during a January 2003 visit.**

## **TRANSMITTAL LETTER**

The Honorable Earl Ray Tomblin, President of the Senate  
and  
The Honorable Robert S. Kiss, Speaker of the House of Delegates  
Legislature of West Virginia  
The State Capitol  
Charleston, West Virginia 25305

Gentlemen:

I am pleased to submit the Annual Report of the Geological and Economic Survey for fiscal year 2003. This report summarizes our accomplishments over the past year, and our current operational and financial status.

This is the first Annual Report the Survey has produced digitally and distributed on CD in PDF format. As such, it is representative of the highly technical nature of the agency, and our constant efforts to serve West Virginians in the most efficient and effective ways.

Through the highly dedicated efforts of our excellent staff, we have, to date, met the challenge of providing the citizens of our State the high level of professionalism in applied geoscience research, public service, information, and outreach that they have come to expect from us.

Even under our current fiscal constraints, we are working on a number of major projects that will have a significant impact on the State and region. This in turn provides a sound foundation of geological knowledge for economic growth, general prosperity, and a quality environment in West Virginia.

Respectfully submitted,



Carl J. Smith  
Director and State Geologist

June 30, 2003

# **THE WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY**

## **Mission**

West Virginia has always been heavily dependent on its geology and natural resources for much of its way of life. Thus, the West Virginia Geological and Economic Survey was established by legislative act (chapter 29, article 2, sections 1-9, as amended) on February 26, 1897, and given the broad charge to carry out investigations of the geological formations and physical features of the State, with particular emphasis on their economic implications, and to prepare special reports and maps dealing with the State's geology and natural resources.



**Survey geologists examining maps of mining in Kanawha County.**

Today, the Survey is a dedicated, unique, compact agency characterized by a strong commitment to continuous improvement and service to the Mountain State. As West Virginia's principal agency concerned with applied geological science, the Survey continues to be responsible for systematic study and evaluation of the geology of the State. The Survey's greatest assets are over a century's accumulation of data and research findings, and the knowledge and skills of its professional geological staff. From these come sound scientific investigations and invaluable resource development data which are in the public domain through published reports and maps, computer media and database listings, files and records, and expert consultations. A wealth of knowledge has been learned about the State's geology and natural resources, but much work remains to be done in order to provide the detailed, publicly available geological information that is required for the future growth of West Virginia.

## **Organization**

The West Virginia Geological and Economic Survey, a division of the West Virginia Bureau of Commerce, uses an innovative organizational structure which prorates and assigns all resources (human, financial, equipment, etc.) to appropriate projects. This resource allocation is dynamic, changing as required to meet the challenges and opportunities present in the environment in which the agency operates. A project as defined here represents the smallest component in the agency's structure. Each of these sub-organizational units has a distinct mission, either temporary or ongoing, is adaptive, and has been aggregated with similar projects into programs of a more permanent nature. The distinguishing characteristic of this design is that there are no barriers to reallocation of resources between projects or programs. Current projects and programs are presented on the page following the "Goals" portion of this report section.

Funding for personal services, employee benefits, and annual increment is allocated at the program level, with sign-off authority remaining at the executive level of the agency. Non-personal services-related, or unclassified, funding from all sources (general, federal, and special revenue) is allocated at the project level. The principal investigator for each project is delegated responsibility for expenditure decision-making for all funds allocated to that project, utilizing information provided through monthly fund activity reports. Expenditures and performance are monitored at the project level while agency funding requests and performance measures are prepared at the program level. Executive override authority to direct or reverse expenditure decisions as required in the best interests of the agency rests with the Director.

Each approved project is financed through some combination of dedicated (restricted to specific, project-related expenditures under the terms and conditions of an enabling agreement, contract, or legislative intent) and non-dedicated (not restricted as to the nature of expenditure, such as unclassified general revenue appropriations or revenue-generating special revenue funds) funding sources. Unclassified general revenue funding not encumbered for agency operational expenses (utilities, telephone, etc.) is prorated among approved projects based on the number of general revenue positions assigned to each project. General revenue expenditure authority, as delegated, reverts to the executive level during the final two months of each fiscal year to ensure optimal and efficient utilization of expiring funds. Final responsibility for all funding allocation resides with the Director.

These major functions characterize the Survey's operations, programs, and projects:

1. Applied research;
2. Development of a geographic information system;
3. The archiving, interpretation, and public availability of basic data and information;
4. Public service;
5. Educational programs to develop better knowledge and understanding of geoscience;
6. Outreach to West Virginia's citizens and visitors.



**Survey geologists taking samples from a roadcut in Boone County.**

A critical balance among these functions is maintained as the Survey continues to effectively and efficiently carry out its broad charge, which is far more relevant today than it was in 1897.

The Survey operates in the knowledge that geology is a key factor to the State's economic prosperity, and that the exploitation of its geologic resources profoundly impacts the environment of all West Virginians. For informed decision-making, the Survey collects and archives vast amounts of geologic data; conducts detailed studies and research on the State's geology and mineral resources; and makes this information publicly available through numerous publications, and by making professional staff available to provide applied geological information, data, and interpretations. Areas of expertise include energy resources (coal, oil, natural gas), economic minerals (limestone, sandstone, sand and gravel, salt), geologic

hazards (landfill siting, subsidence, landslides, floods), geographic information (topographic maps, remote-sensing imagery), general geology (stratigraphy, geologic mapping), hydrogeology (ground water and surface water), computer applications in geology (computer mapping and analysis, databases), geochemical information, and geologic publishing.

## Functions

## Goals

Although the Survey's scientific instruments, methods, techniques, and procedures are vastly superior to those available in the past, its long-range goals remain the same as they have been throughout its history. These are to acquire and make publicly available a detailed knowledge of the geology, mineral, energy, and water resources of the State, for the benefit of all West Virginians. Through competent geological science and dedicated public service, the West Virginia Geological and Economic Survey does its part to promote responsible development of the State's mineral resources to insure the best future—economic and environmental—for West Virginia.



**Survey geologists prepare a core from a drill site in Monongalia County.**



# **Geological & Economic Survey**

## **Programs/Projects**

### **GENERAL MANAGEMENT & ADMINISTRATION**

Executive  
Administrative  
Facilities Maintenance

### **INFORMATION TRANSFER**

Computing Services  
Computer Upgrades  
Publications & Graphics

### **PUBLIC SERVICE**

Service  
Outreach  
ESIC

### **APPLIED COAL RESOURCES INVESTIGATIONS**

National Coal Resources Data System (NCRDS)  
Coal Availability Studies  
Coal Recoverability Study  
Coal Bed Mapping Maintenance  
MTRM Mapping

### **APPLIED OIL & GAS RESOURCES INVESTIGATIONS**

Oil & Gas Basic Data  
Coal Mine Methane  
PTTC  
Reservoir Characterization  
Secondary Natural Gas Recovery

### **GENERAL GEOSCIENCE**

Advanced Geoscience Research  
Economic Minerals Geoscience  
Environmental Geoscience  
Geologic Mapping

### **GEOSCIENCE EDUCATION**

Earth Science Teachers' Workshops

### **GEOGRAPHIC INFORMATION SYSTEM**

GIS Coordinator  
Coal Bed Mapping Project  
Mineral Parcel Mapping Project  
Statewide GIS Technical Support Center  
Digital Line Graph Development Project  
Reserve Coal Valuation Model

# EXECUTIVE SUMMARY

## Research Activities



Analyzing core samples at a drill site in Preston County.

The Survey supports its research activities with outside funding while providing the research benefit to West Virginia.

**Research Projects**—Nineteen research projects are in progress.

**Mineral Lands Mapping Program**—As part of the State's geographic information system (GIS) efforts, the Survey, along with the Department of Tax and Revenue and West Virginia University, is conducting the West Virginia Mineral Lands Mapping Program.

The goal is to develop layers of digital GIS information related to coal resources, coal land ownership, and topographical and cultural base maps. With this program, West Virginia takes a lead technological role in applying GIS to natural resource assessment in the United States. The program is unique in concept and vision, and represents one of the most complex and comprehensive data development effort ever attempted within the public sector of state government to map geological and natural resource holdings. With procedures and methodologies established by completion of mapping and GIS coverages for Fayette County, this massive undertaking involving the geologic reevaluation of all of West Virginia's minable coal resources has completed maps and GIS coverages for Monongalia, Marion, Harrison, Wetzel, Marshall, Ohio, Brooke, and Hancock counties; 20 Kanawha Formation coal

beds in western Raleigh County; and all Pocahontas 2 and 3 coal beds in Raleigh County. Mapping is progressing in Kanawha, Putnam, Boone, Logan, Wyoming, and Mingo counties.

**Publications**—Survey staff wrote and/or contributed to 15 geological articles, abstracts, or publications. Survey staff presented over 50 talks, exhibits, and classes for schools, colleges, civic groups, professional organizations, government agencies, and public events.

**Maps**—The U.S. Geological Survey-funded STATEMAP geologic mapping program continued with bedrock mapping and geochemical sampling of the Circleville and Thornwood 7.5-minute quadrangles, Pendleton, Pocahontas, and Randolph counties. Development of digital geological maps is an ongoing effort at the Survey. Compilation and conversion to digital form is in progress for high-priority analog geological maps of several topographic quadrangles in the State's high-growth eastern panhandle.



Examining coal geology in a Kanawha County mine.

## Fiscal Operations/ Funding Activities

The Geological and Economic Survey encompasses eight major programs supported through a combination of State, Federal, and other funding sources. In addition to funding for basic operations from general revenue appropriations, the Survey is supported by funds dedicated to specific areas of research from supplemental general revenue, federal cooperative agreements, contracts, and revenue-generating operations.

Most of the Survey's non-GIS general revenue appropriations are used to pay for personal services, annual increments, and employee benefits. Funds for agency operations are provided through an unclassified general revenue appropriation. This fiscal year, expenditures for operational costs were 14 percent of non-GIS general revenue expenditures; next fiscal year this appropriation will account for just 10.5 percent of total non-GIS general revenue.

Two programs, Geoscience Education and Coal-bed Mapping, have funding provided by the Legislature and accounted for 48 percent of unclassified expenditures this fiscal year. What balance remains is used to meet basic operational costs.

Due to a statewide budgetary deficit, agencies were directed to reduce fiscal year 2002-2003 expenditures by 3.4 percent. This was the third consecutive year that such action has had to be taken to ensure a balanced budget. This expenditure reserve required the elimination of part-time help and all non-essential operating expenditures.

Per the instructions of the Department of Administration, fiscal year 2003-2004 appropriation requests were submitted at 90 percent of fiscal year 2002-2003 general revenue funding. Subsequent to the submission of appropriation requests, an additional reduction, equaling 3 percent of personal services and corresponding employee benefits, was applied to general revenue appropriations of all State agencies. For the Geological and Economic Survey, these reductions equaled an 11.7-percent decrease from the fiscal year 2002-2003 funding level. The approved fiscal year 2003-2004 Budget Bill appropriated general revenue funding to the Geological and Economic Survey reflecting a funding reduction of just 3.5 percent from that of fiscal year 2002-2003.

General revenue funding has been requested by the Department of Administration for fiscal year 2004-2005 at 91 percent of the fiscal year 2003-2004 current level. If implemented, the budget contraction would result in funding inadequate to support operations and will adversely impact, to varying degrees, all agency programs and functions.

## Operational Improvements

Improving the agency's computer network is an ongoing effort. Upgrades of network software, including anti-virus and security software, were made. Recabling of the entire Survey office complex is in continues.

With the agency now being totally computerized, all functions, including cartography, data processing and manipulation, publications production, and agency administrative and research operations, are fully digital. Product output quality, research capabilities, and operational efficiencies for the agency are, as a result, at an all-time high.

## Service and Outreach



**Governor Bob Wise looks over a variety of maps and aerial photos at the Survey's ESIC office during a January 2003 visit.**

Service Requests—Through June 2003, the Survey responded to over 1,300 requests for information, publications, and other services this fiscal year.

Earth Science Information Center (ESIC)—One of 64 such affiliates the U.S. Geological Survey operates or sponsors throughout the nation, the West Virginia Geological and Economic Survey's ESIC effectively works with the public, industry, government, and education communities as a convenient, single point-of-service to the agency's large volume of map, aerial photograph, and geodetic information. The West Virginia ESIC responded to over 600 service requests this year, thus demonstrating a substantial public interest in this resource

RockCamp—The Survey's Geoscience Education Program continues its successes in conducting the agency's educational outreach. For the twelfth consecutive summer, 26 selected West Virginia teachers attended the well-received, State-funded RockCamp teacher training workshop, held at the Survey. Agency staff and faculty from West Virginia University conduct teachers through an advanced residency experience which includes study of the regional geology of Appalachia. From this, teachers prepare unit plans demonstrating how they share their knowledge and experiences with their students and peers. Now in its second decade, the program has surpassed 1,500 cumulative professional development teacher experiences.

One "teacher experience" represents outreach and assistance in the form of a time-intensive workshop, field trip, professional presentation and/or publication to a single West Virginia teacher. The cumulative number of direct educational contacts of all types in 11 years has exceeded 6,400.

## ***EXECUTIVE SUMMARY (CONTINUED)***

**Web Site**—The Survey's Web site (<http://www.wvgs.wvnet.edu>) is constantly being developed and expanded. Currently, the site includes section on West Virginia's geology; recreational and scenic geology; agency research, information services, and outreach programs; data and statistics; geoscience education; a "virtual" geology museum; frequently asked questions; downloadable county-based coal and oil and gas resource production data tables; feature articles; and links to other sites of interest. Recent additions include geochemical analyses data; downloadable page-size maps of West Virginia's geologic resources; and an interactive coal-bed mapping page allowing users to view GIS maps, turn on and off different map layers, pan and zoom, run queries, and print self-composed, page-size maps on their PCs.



**West Virginia teachers examine rock formations during a RockCamp field trip.**

**"pipeline" (Public Access to the Oil and Gas Data System)**—Subscribers to the Survey's menu-driven public-access on-line "pipeline" service receive access to the agency's comprehensive 135,000-well oil and gas database of well completion, location, geology, production, plugging, log, sample, and core data. Customers will also find county-based mineral resource data summaries. Users pay a modest fee to access the database at their convenience from their personal computer via the Internet.

**Visiting Geologists**—Once again, the Survey's Visiting Geologist Project operated during the 2002-2003 park season. Eleven parks were visited this year and nearly 400 visitors participated. Survey geologists provide one or more presentations and nature walks to park visitors and discuss the unique geologic setting of each park and the importance of geologic resources to the State. These presentations provide park visitors a better appreciation of what underlies the landscape, and the importance of geology to the beauty and economy of the Mountain State.

**Presentations**—Survey staff continue to present numerous talks, exhibits, and classes for schools, colleges, civic groups, professional organizations, government agencies, and public events.

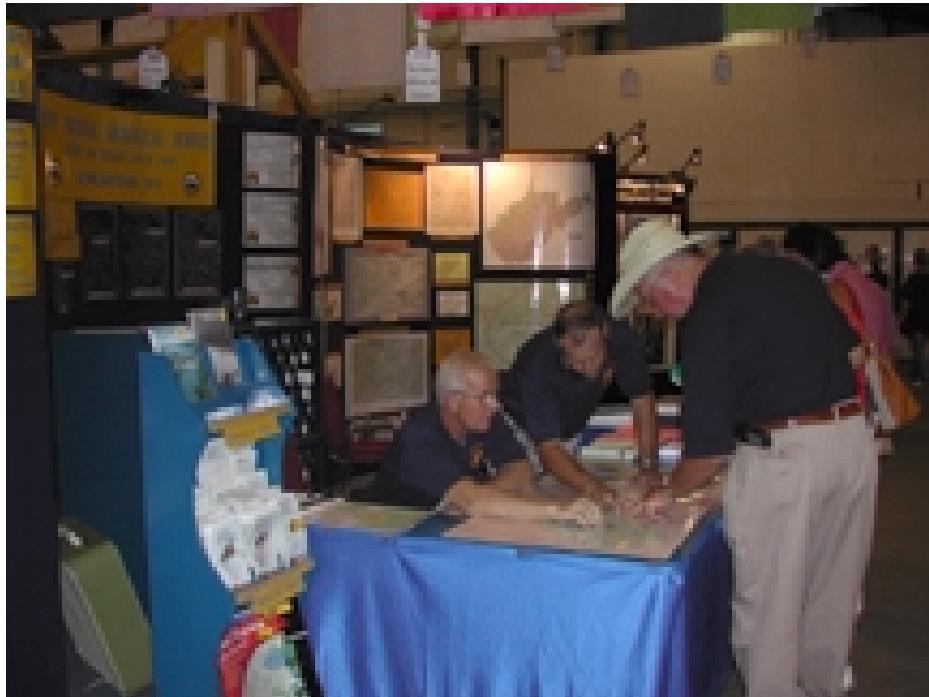
## Staff Development

To keep them knowledgeable and current, all staff members are encouraged to enroll in advanced courses and participate in professional activities to improve scientific and professional skills.

## Major Impediments/Potential Solutions

Although the Survey has made significant progress in applied geoscience research, service, and information/data collection, some major impediments still exist. These problems are:

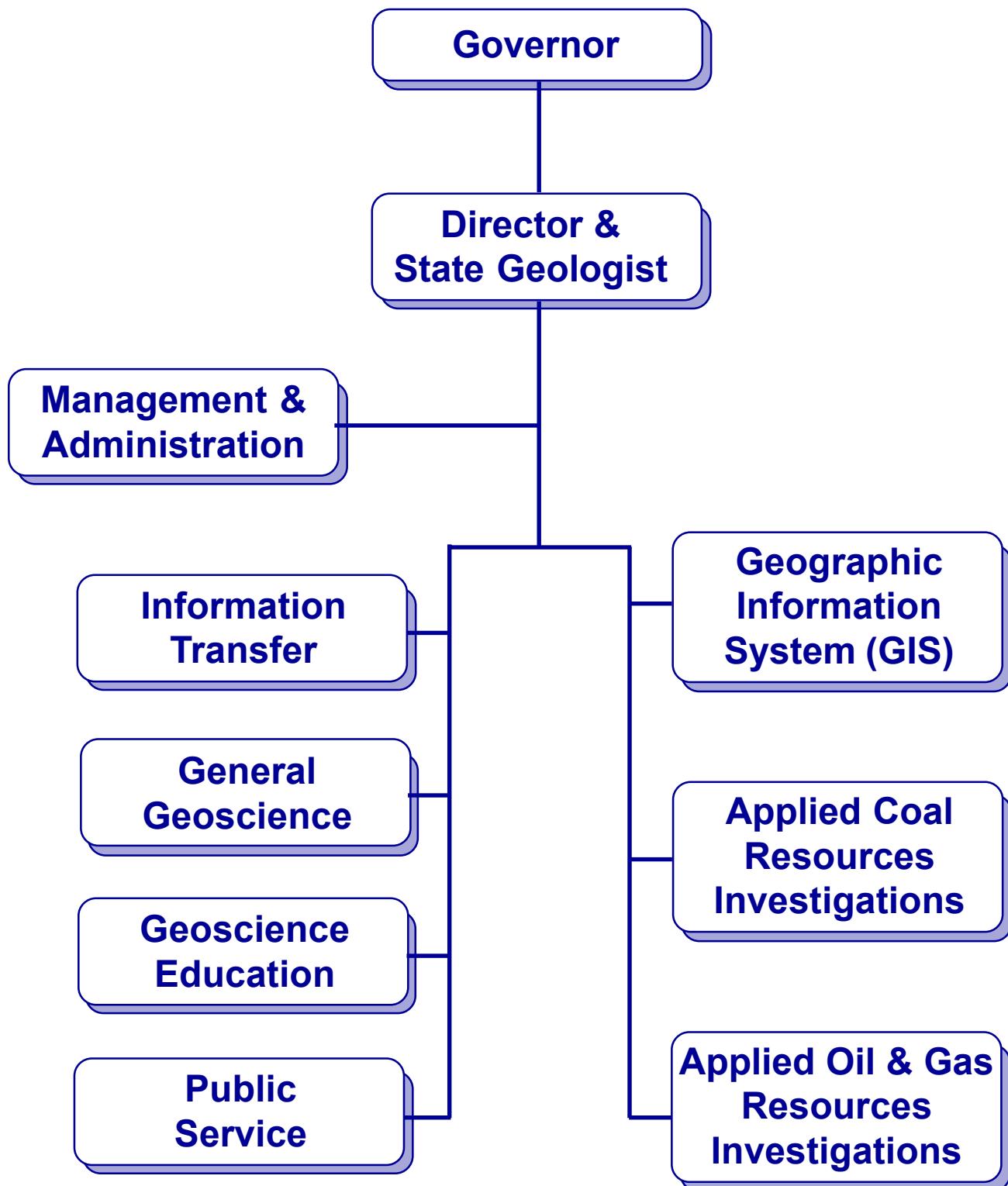
- Low salary levels for all staff, particularly professional staff salaries, which are well documented by the major geological associations to be below competitive levels, and also well demonstrated by the West Virginia Department of Personnel's southern region salary range for market value.
- Insufficient general operating funds for field work, travel, and services.



**Visitors to the Survey's display and sales booth at the West Virginia State Fair can inspect and purchase any of the thousands of maps and publications the agency produces. Displays are held at sports and outdoor shows around the State throughout the year.**

# West Virginia Geological & Economic Survey

## Organization Chart



**WEST VIRGINIA  
GEOLOGICAL AND ECONOMIC SURVEY STAFF  
Fiscal Year 2003**

Carl J. Smith, A.M., C.P.G..... *Director and State Geologist*  
Michael Ed Hohn, Ph.D. .... *Assistant State Geologist*  
John D. May, M.B.A ..... *Deputy Director Finance and Administration*

**ADMINISTRATIVE AND FACILITIES MAINTENANCE**

Gloria J. Rowan, B.S. .... *Administrative Service Manager*  
Linda C. Carlier ..... *Administrative Clerk*  
Judith A. Sparks ..... *Receptionist/Director's Secretary*  
Ronald D. Lane, M.S. .... *Purchasing Manager*  
Gary C. Rowan..... *Maintenance Man*  
Louis W. Curkendall ..... *Maintenance Worker*

**APPLIED COAL RESOURCES INVESTIGATIONS**

Nick Fedorko III, M.S. .... *Coal Geologist and Manager*  
Gayle H. McColloch, Jr., M.S., R.P.G. .... *Coal Geologist, Statistician, and Assistant Manager*  
Bascombe M. Blake, Jr., M.S. .... *Coal Geologist*  
Dwayne E. Bolyard\* ..... *Coal Technician*  
Frank L. Hutchinson, B.S. .... *GIS Technical System Administrator*  
William C. Grady, M.S. .... *Microscopist*  
Edward I. Loud, B.S. .... *Coal Geologist*  
Barnes L. Nugent, M.S. .... *Geologist III*

**GENERAL GEOSCIENCE**

Jane S. McColloch, M.S., R.P.G. .... *Hydrogeologist*

**GEOSCIENCE EDUCATION**

Thomas E. Repine, Jr., Ed.D., R.P.G. .... *Education Specialist and Manager*

\* Left during year.

\*\* Changed during year.

## **COMPUTING SERVICES AND COMPUTER UPGRADES**

|                            |                              |
|----------------------------|------------------------------|
| Mary C. Behling, M.S. .... | <i>Geologist and Manager</i> |
| Steven A. Munro, M.S. .... | <i>Network Administrator</i> |
| Susan C. Kite, B.S. ....   | <i>Programmer Trainee</i>    |
| John T. Saucer, B.S. ....  | <i>Programmer/Analyst</i>    |
| Susan E. Pool, B.S. ....   | <i>Programmer/Analyst</i>    |

## **GIS PROGRAM**

|                                   |  |
|-----------------------------------|--|
| Craig A. Neidig, M.S. ....        | <i>Statewide Coordinator</i>                               |
| Nick Fedorko III, M.S. ....       | <i>Coal Geologist and Coal-bed Mapping Project Manager</i> |
| James Q. Britton, M.S. ....       | <i>Geologist III</i>                                       |
| Todd Bowman ....                  | <i>Computer Technician</i>                                 |
| Leigh A. Cielensky ....           | <i>Executive Secretary</i>                                 |
| Sarah E. Gooding, B.S. ....       | <i>Geologist I</i>   |
| Kimberly J. Hutchinson, B.S. .... | <i>GIS Database Administrator</i>                          |
| Robert J. Johnson, B.S. ....      | <i>Geologist III</i>                                       |
| David A. Jones, B.S. ....         | <i>Geologist II</i>  |
| Dennis R. Pierson, B.S. ....      | <i>Geologist I</i>   |
| Erin M. Sturgill, B.S. ....       | <i>Geologist I</i>   |
| Jeanne M. Sutton, B.S. ....       | <i>Geologist II</i>  |
| Amanda G. Thomson, B.S. ....      | <i>Geologist I</i>   |
| Christopher E. Volk, B.S. ....    | <i>Geologist I</i>   |
| Brian J. Walker, M.A. ....        | <i>Assistant Editor</i>                                    |

## **APPLIED OIL AND GAS RESOURCES INVESTIGATIONS**

|                               |  |
|-------------------------------|--|
| Katharine L. Avary, M.S. .... | <i>Petroleum Geologist and Manager</i> |
| Patricia J. Johns ....        | <i>Records Manager</i>                 |
| David L. Matchen, M.S. ....   | <i>Geologist III</i>                   |
| John M. Bocan, B.A.,B.S. .... | <i>Information Systems Coordinator</i> |

## **PUBLICATIONS AND GRAPHICS**

|                                  |   |
|----------------------------------|---|
| Charles H. Gover, Jr., B.S. .... | <i>Editor</i>                           |
| Raymond L. Strawser, A.A.* ....  | <i>Technical Photographer/Draftsman</i> |
| J. Daniel Barker, A.A. ....      | <i>GIS Cartographer</i>                 |
| Betty L. Schleger ....           | <i>Editorial Assistant</i>              |
| Charles P. Bowman ....           | <i>Production Assistant</i>             |

\* Left during year.

\*\* Changed during year.

## **ADVANCED GEOSCIENCE RESEARCH**

Douglas G. Patchen, Ph.D. .... *Chief Geologist*  
Ronald R. McDowell, Ph.D. .... *Senior Research Geologist*

## **PUBLIC SERVICE**

Steven W. McClelland, M.S. .... *Coal Geologist and Manager*  
Kenneth C. Ashton, B.S. .... *Coal Geologist*  
Michael A. Kirk, B.S. .... *Publication Sales Manager*  
Paul R. Liston, A.A. .... *Engineering Technician/Surveyor*

## **COOPERATING PERSONNEL**

Phyllis Barnhart, M.A. .... *Educator*  
Robert E. Behling, Ph.D. .... *Geologist*  
Robert F. Fonner, M.S., C.P.G. .... *Geologist*  
E. Ray Garton, M.S. .... *Geologist/Curator*  
William H. Gillespie, M.S. .... *Geologist*  
Thomas W. Kammer, Ph.D. .... *Paleontologist*  
J. Steven Kite, Ph.D. .... *Geologist*  
Philip A. Martin, M.S. .... *Geologist*  
Ronald L. Martino, Ph.D. .... *Geologist*

\* Left during year.

\*\* Changed during year.

## PART-TIME EMPLOYEES

|                                 |   |
|---------------------------------|---|
| Edwin K. Berry .....            | <i>Geoscience Education</i>                         |
| John D. Beuthin, Ph.D. ....     | <i>Applied Coal Resources Investigations</i>        |
| Mary Sue Burns.....             | <i>Geoscience Education</i>                         |
| Simon L. Cole* .....            | <i>Applied Oil and Gas Resources Investigations</i> |
| Thomas H. DarbyII .....         | <i>Applied Coal Resources Investigations</i>        |
| Stuart L. Dean, Ph.D. ....      | <i>Applied Coal Resources Investigations</i>        |
| Richard J. Diecchio, Ph.D. .... | <i>Applied Oil and Gas Resources Investigations</i> |
| Amy L. Gross*.....              | <i>Applied Oil and Gas Resources Investigations</i> |
| Debra A. Hemler, Ph.D. ....     | <i>Geoscience Education</i>                         |
| Kelby E. Hicks .....            | <i>Applied Oil and Gas Resources Investigations</i> |
| Christopher L. Howton.....      | <i>Applied Oil and Gas Resources Investigations</i> |
| Byron R. Kulander, Ph.D. ....   | <i>Applied Coal Resources Investigations</i>        |
| Charity L. Liston .....         | <i>Public Service</i>                               |
| Patrick S. McBride .....        | <i>Applied Oil and Gas Resources Investigations</i> |
| Marie A. Patchen .....          | <i>Applied Coal Resources Investigations</i>        |
| Charles D. Renton .....         | <i>Applied Coal Resources Investigations</i>        |
| John J. Renton, Ph.D. ....      | <i>Applied Coal Resources Investigations</i>        |
| Leslie A. Rhodes.....           | <i>General Geoscience</i>                           |
| Laura R. Sheehan .....          | <i>Applied Oil and Gas Resources Investigations</i> |
| Paula J. Waggy .....            | <i>Geoscience Education</i>                         |
| Jennifer C. Walker .....        | <i>Applied Coal Resources Investigations</i>        |

\* Left during year.

\*\* Changed during year.

**DIGITAL LINE GRAPH DEVELOPMENT PROJECT**  
**West Virginia University Department of Geology and Geography**

|                         |  |
|-------------------------|--|
| Dr. Trevor Harris ..... | <i>Co-director</i>                       |
| Dr. Gregory Elmes ..... | <i>Co-director</i>                       |
| Kurt Donaldson .....    | <i>Senior Research Coordinator</i>       |
| Eric Hopkins .....      | <i>GIS Analyst</i>                       |
| Nichole Edwards .....   | <i>GIS Analyst</i>                       |
| Kevin R. Kuhn .....     | <i>Geographic Information Technician</i> |
| Scott Lamon .....       | <i>Geographic Information Technician</i> |
| Frank LaFone .....      | <i>Senior Internet Coordinator</i>       |

**MINERAL PARCEL MAPPING PROJECT**  
**West Virginia Property Tax Division, GIS Development Unit**

|                       |                                    |
|-----------------------|------------------------------------|
| Ed Maki .....         | <i>GIS Unit Supervisor</i>         |
| Dale Vanderlaan ..... | <i>GIS Analyst</i>                 |
| Robert Barker .....   | <i>Tax Map Technician—Office</i>   |
| Diane Leadmon .....   | <i>GIS Unit Office Assistant</i>   |
| Susan Bullock .....   | <i>Office Assistant, Map Sales</i> |
| Gary Farren .....     | <i>Tax Map Technician—Field</i>    |
| Wayne Hamlin .....    | <i>Tax Map Technician—Field</i>    |
| Randy Butler .....    | <i>Tax Map Technician—Field</i>    |
| Leo Muncy .....       | <i>Tax Map Technician—Field</i>    |
| Norbert Netzel .....  | <i>Tax Map Technician—Field</i>    |
| John Wright .....     | <i>Tax Map Technician—Field</i>    |
| Ron Oxley .....       | <i>Tax Map Technician—Field</i>    |
| Tom Stalnaker .....   | <i>Tax Map Technician—Field</i>    |
| Craig Wanless .....   | <i>Tax Map Technician—Field</i>    |
| Yi-Ning Chen .....    | <i>GIS Programmer/Analyst</i>      |



A nature walk at Cacapon State Park, part of the Survey's Visiting Geologist Project.



Survey geologists use a Logan County surface mine highwall to observe the local stratigraphy.



Examining coal seam stratigraphy in a Kanawha County mine.

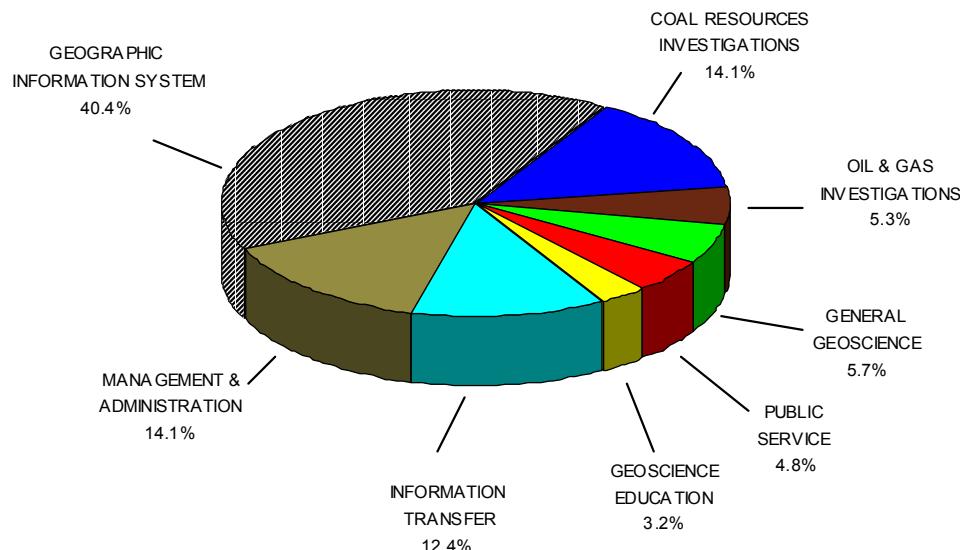
# **FINANCIAL SUMMARY**

## **Funding Overview**

The West Virginia Geological and Economic Survey encompasses eight major programs (Figure 1) that are supported through a combination of State, Federal and other funding sources (Figure 2). In addition to funding for basic operations from general revenue appropriations, the agency is supported by funds dedicated to specific areas of research from supplemental general revenue, Federal cooperative agreements, contracts, and revenue-generating operations.

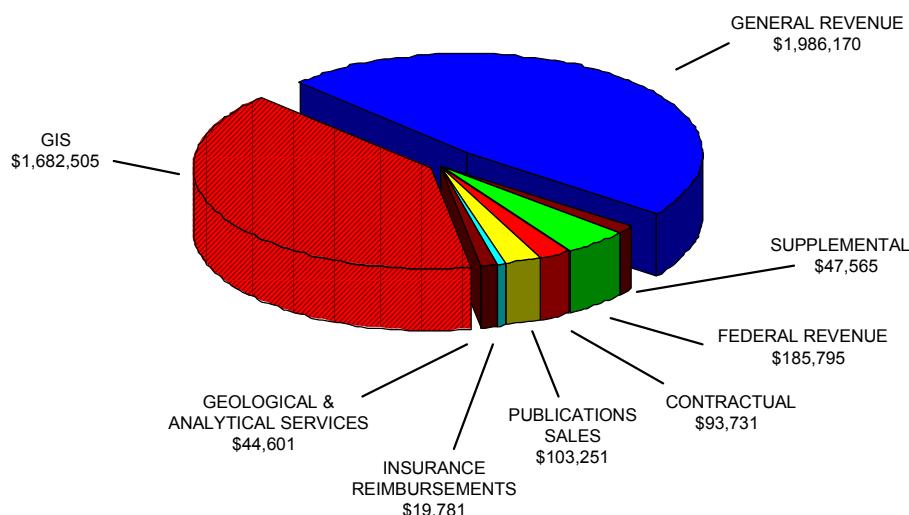
**Figure 1**

### **GEOLOGICAL SURVEY FY 2002-2003 PROGRAM EXPENDITURES**



**Figure 2**

### **EXPENDITURES BY SOURCE OF FUNDING FY 2002-2003**

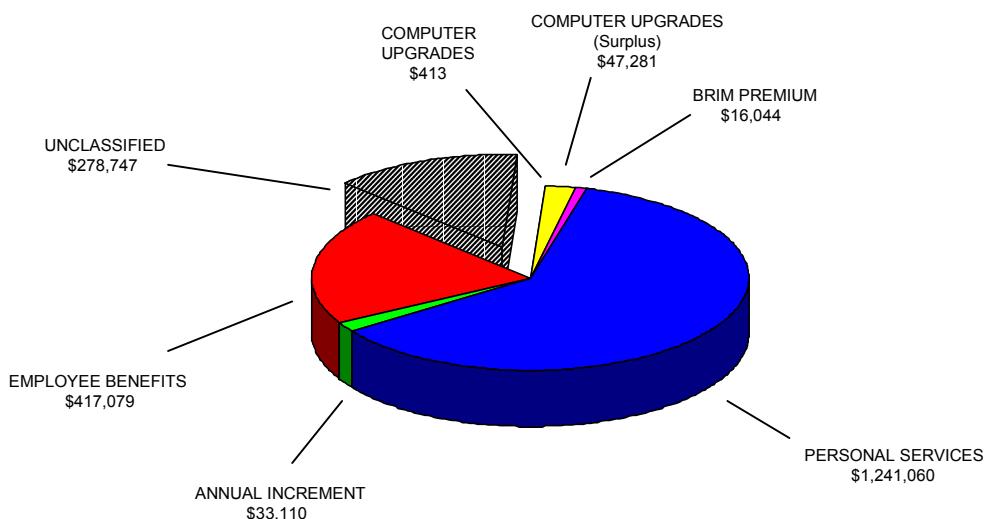


## Agency Operational Funding

As the Geological and Economic Survey is a human resources-intensive agency, most of its non-Geographic Information System (GIS) general revenue appropriations are employed to underwrite the costs of personal services, annual increments, and employee benefits. Funds with which to sustain agency operations are provided through an unclassified general revenue appropriation. In fiscal year 2002-2003, expenditures for operational costs totaled \$278,747, or 14 percent of non-GIS general revenue expenditures (Figure 3). For fiscal year 2003-2004, this appropriation will account for \$201,317, or just 10.5 percent, of total non-GIS general revenue.

## General Revenue

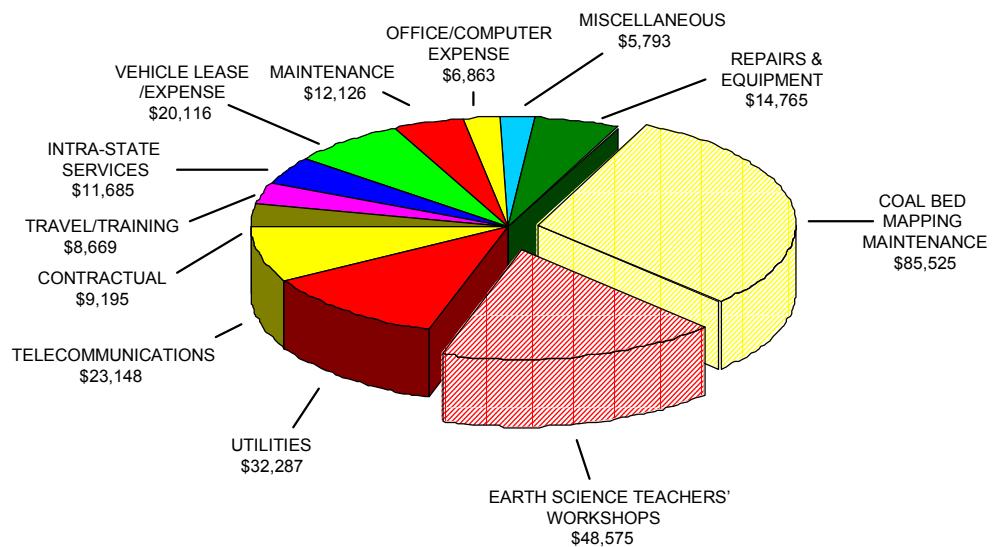
**FY 2002-2003 GENERAL REVENUE EXPENDITURES  
(Exclusive of GIS Appropriations)**



**Figure 3**

Two programs for which funding has been provided by the Legislature, Earth Geoscience Education and Coal-bed Mapping Maintenance, accounted for 48 percent of unclassified expenditures in fiscal year 2002-2003 (Figure 4). The remaining balance is used to meet non-discretionary basic costs of operation (utilities, telecommunications, vehicle rental, maintenance, intra-state services, etc.).

**Figure 4**      **GENERAL REVENUE UNCLASSIFIED EXPENDITURES  
FY 2002-2003**



### Geographic Information System

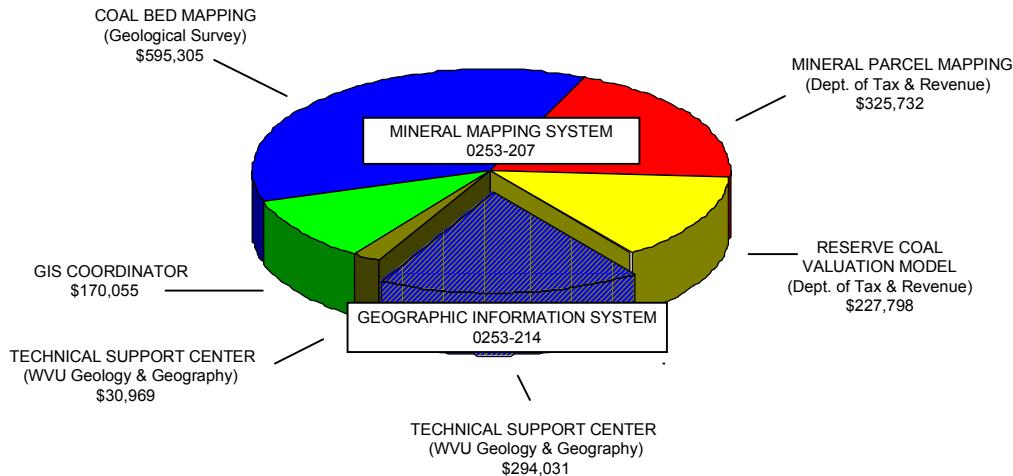
Expenditures for the Geographic Information System accounted for approximately 45 percent of total general revenue outlays in fiscal year 2002-2003. GIS is a unique collaborative effort of State agencies that was established by Executive Order 04-93 and House Bill 2222 during the 1995 Legislative session. The act authorized the Geological and Economic Survey to serve as lead and fiscal control agent in a joint program with the Department of Tax and Revenue and the West Virginia University (WVU) Department of Geology and Geography.

Approximately two-thirds of GIS appropriations are passed through to the other cooperating State agencies. The remaining one-third is allocated to the Geological and Economic Survey's participating GIS research group, the Coal-bed Mapping Project. Expenses incurred by the Coordinator's Office and the Coal-bed Mapping Project are paid directly by the Geological and Economic Survey. Expenses incurred by the Mineral Parcel Mapping and Reserve Coal Valuation projects (Tax and Revenue) and Digital Line Graph Development and Technical Center projects (WVU) are paid by the participating agencies. Appropriate reimbursement mechanisms have been established through memorandums of agreement with Tax and Revenue (by expense line item reimbursements) and WVU (by contractual payments upon receipt of itemized expenditure statements).

General revenue funding totaling \$1,643,890 has been appropriated for GIS operation in fiscal year 2003-2004: the Mineral Mapping System (\$1,349,859 Fund 0253-207) and the Geographic Information System (\$294,031, Fund 0253-214). These appropriations are allocated among the participating agencies as shown in Figure 5.

# **FINANCIAL SUMMARY (CONTINUED)**

## **ALLOCATION OF FY 2003-2004 GIS GENERAL REVENUE APPROPRIATION (\$1,643,890)**



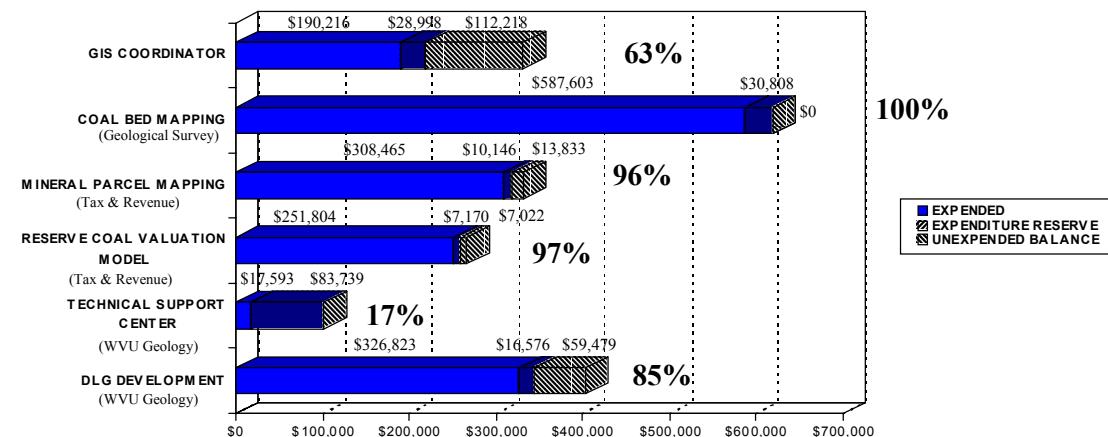
**Figure 5**

It is anticipated that all of the fiscal year 2003-2004 appropriations, as well as residual prior fiscal year balances, will be expended by the end of the current year.

Total composite expenditures and remaining balances by project through the end of fiscal year 2002-2003 are shown in Figure 6.

## **FY 2002-2003 GIS GENERAL REVENUE EXPENDITURES AND APPROPRIATION BALANCES Through June 30, 2003**

**(Bold Figures Represent Percentage of Available Funding Expended)**



**Figure 6**

Detailed summaries of GIS funding and expenditures are presented in Appendix B of this report.

### **Fiscal Year 2002-2003 Expenditure Reduction**

Due to a statewide budgetary deficit, agencies were directed to reduce fiscal year 2002-2003 expenditures by 3.4 percent. This was the third consecutive year that such action has had to be taken to ensure a balanced budget. This expenditure reserve (\$125,107 of the Geological and Economic Survey's fiscal year 2002-2003 general revenue appropriations) required the elimination of part-time help and all non-essential operating expenditures.

An insufficient appropriation for employee benefits necessitated funding transfers from personal services totaling \$9,000 to meet benefit obligations during the fiscal year. An additional \$16,000 was transferred to the unclassified appropriation from personal services late in the year to fund operational expenses. These transfers were made possible through timely reimbursements received from the WVU Research Corporation for staff time expended on subcontracts.

### **Fiscal Year 2003-2004 Budgeted Appropriations**

Per the instructions of the Department of Administration, fiscal year 2003-2004 appropriation requests were submitted at 90 percent of fiscal year 2002-2003 general revenue funding. Subsequent to the submission of appropriation requests, an additional reduction, equaling 3 percent of personal services and corresponding employee benefits, was applied to general revenue appropriations of all State agencies. For the Geological and Economic Survey, these reductions equaled \$367,992 and \$62,391 respectively for a total of \$430,383 (an 11.7-percent decrease from the fiscal year 2002-2003 funding level). The approved fiscal year 2003-2004 Budget Bill appropriated general revenue funding of \$3,552,295 to the Geological and Economic Survey, reflecting a funding reduction of just 3.5 percent from that of fiscal year 2002-2003. Included in this appropriation level was funding restoration of \$302,763 (or 94 percent of \$321,783; the equivalent value of 7 out of 8 improvement requests submitted with the original appropriation request).

**Fiscal Year 2004-2005 Current Level Appropriation Request Reduction**  
Per the instructions of the Department of Administration, general revenue funding has been requested for fiscal year 2004-2005 at 91 percent of the fiscal year 2003-2004 current level. If implemented, the budget contraction would result in an appropriation of \$319,401 less than that of the previous year. Funding will be inadequate to support operations and will adversely impact, to varying degrees, all agency programs and functions.

### **Improvement Level Requests**

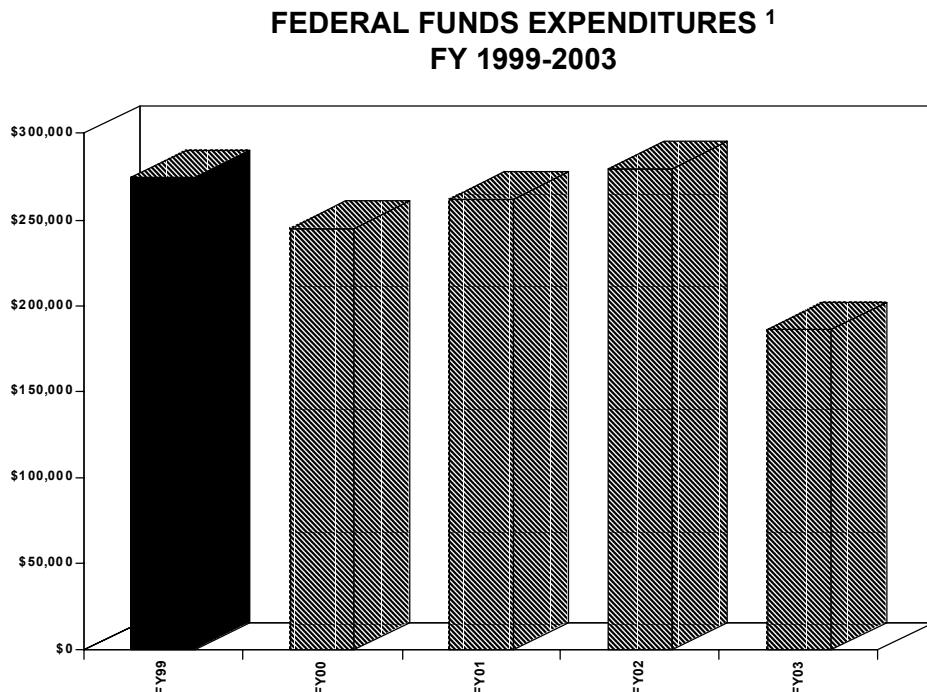
A series of six improvement level proposals has been submitted with the agency's fiscal year 2004-2005 appropriation request. These requests, totaling \$332,956, would sustain those agency programs most seriously damaged by appropriation reductions.

## ***FINANCIAL SUMMARY (CONTINUED)***

### **Current Cooperative Agreements**

Federal revenue continued to contribute a significant portion of the Geological and Economic Survey's operating support in fiscal year 2002-2003 (Figure 7) through cooperative agreements for coal research and mapping projects.

### **Federal Revenue**

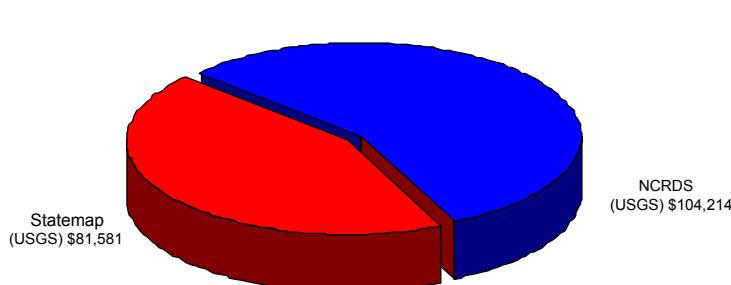


<sup>1</sup> Expenditure totals from Funds #3105 and #8704

**Figure 7**

The U.S. Geological Survey (USGS) is the West Virginia Geological and Economic Survey's principle Federal grantor. Disbursements for the National Coal Resources Data System (NCRDS) and STATEMAP projects accounted for all Federal program expenditures in fiscal year 2002-2003 (Figure 8).

### **Figure 8**



## Special Revenue

### Federal Funding Outlook

Most of the USGS-funded project agreements are of a continuing, long-term nature and are unlikely to be impacted by variations in Federal budget funding. It is difficult to assess the future impact on net USGS funding as a consequence of project completions (Coal Availability and Recoverability studies), increased project funding (NCRDS), and prospective new cooperative agreements. Pending new cooperative projects with the Mine Safety and Health Administration would provide a degree of diversification of Federal funding sources in fiscal year 2003-2004.

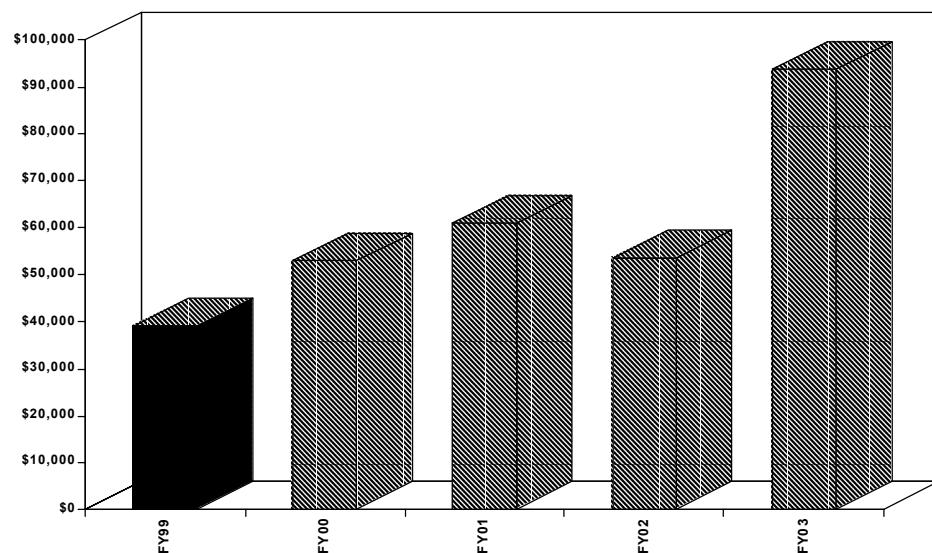
Future Federal funding variations would produce a ripple effect on the Geological and Economic Survey's total funding composition. Changes in the level of overall Federal funding would impact non-State funding as well. Several recent projects funded through WVU, for example, are in the form of subcontracts from the U.S. Department of Energy. Reimbursements to general revenue from the recovery of indirect costs and deposits to special revenue for fees generated from in-house services for both Federal and subcontractual-funded projects would decline correspondingly. Finally, uncertainty over Federal budgetary actions may further restrict funding opportunities by narrowing the number and scope of project solicitations by grantor agencies.

### Contracts

Increased cooperative project activity has resulted in a significant growth of contractual research funding over the past five years (Figure 9).

**Figure 9**

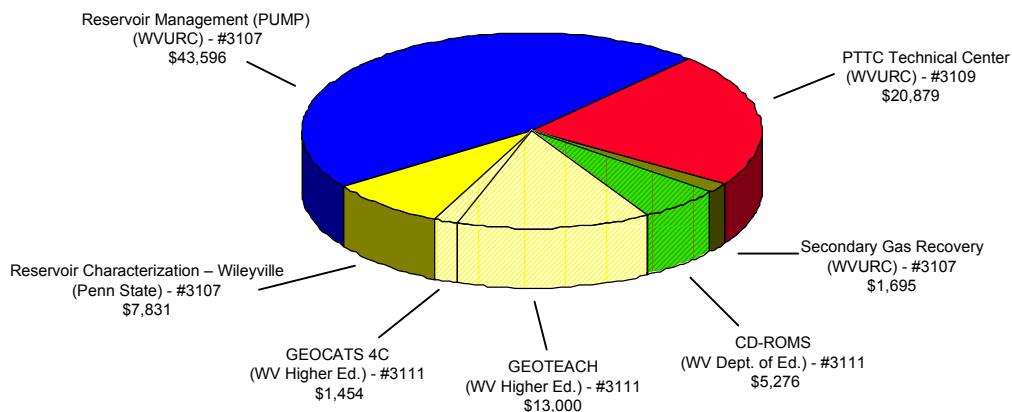
**CONTRACTUAL FUNDS EXPENDITURES  
FY 1999-2003**



## ***FINANCIAL SUMMARY (CONTINUED)***

Federally-funded subcontracts through the WVU Research Corporation (Funds 3107 & 3109) accounted for 71 percent of contractual expenditures in fiscal year 2002-2003. Other contractual funds were received from the West Virginia Department of Education, the West Virginia Higher Education Policy Commission (Fund 3111) and Penn State University (Fund 3107) (Figure 10). It is anticipated that contractual funding to support agency research efforts will continue to increase in fiscal year 2003-2004.

**CONTRACTUAL EXPENDITURES  
FY 2002-2003**



**Figure 10**

In recognition of the value of non-State funding to the continued viability of the Geological and Economic Survey, potential grant and contract opportunities have been continually investigated and aggressively pursued.

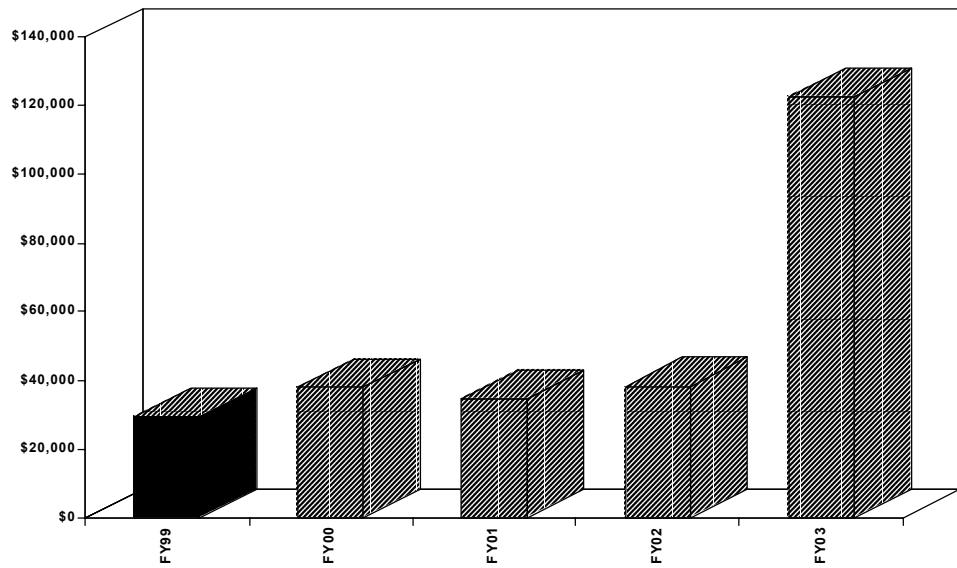
### **Revenue-Generating Operations**

Funds have been generated through the sales of publications and geologic services. Sufficient balances of sales receipts are maintained to defray agency operational costs associated with these revenue-producing activities.

The establishment of equitable fees to be charged to users for geological services has facilitated recovery of incremental costs associated with the performance of services. Optimal pricing, coupled with the introduction of proactive outreach efforts, has helped to produce significant increases in service revenues. Fiscal year 2002-2003 deposits to the agency's Geological and Analytical Services Fund (3100) totaled \$122,458; an increase of 219 percent from the prior year (Figure 11).

**Figure 11**

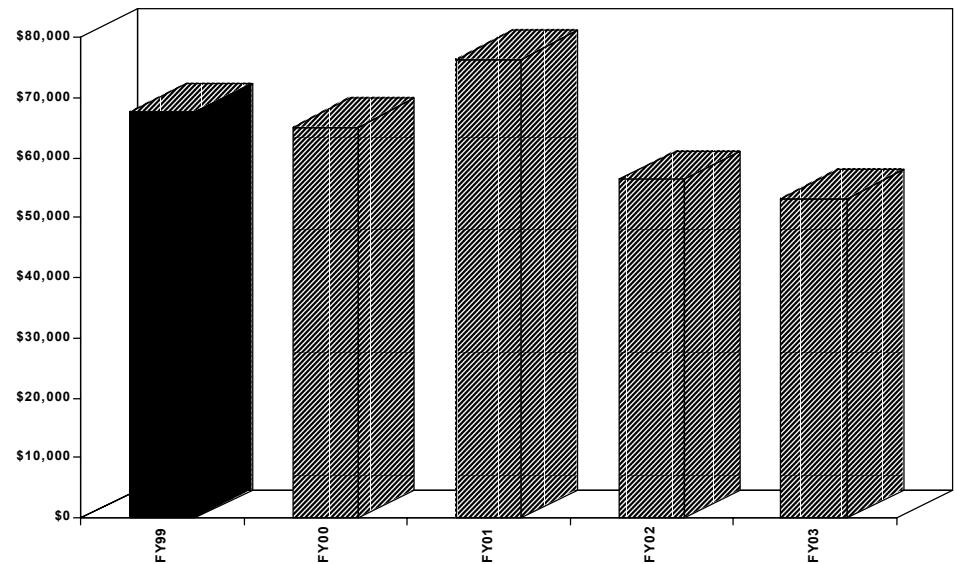
**SERVICE REVENUES  
FY 1999-2003**



Publication sales products include maps, books, reports and other agency documents reproduced on a variety of media (photocopy, black line and well-log copies, microfilm, pre-formatted diskettes, etc.). Fiscal year 2002-2003 net sales receipts deposited in the agency's Publications Sales Fund (3101) totaled \$53,238; a decrease of 5 percent from the prior year (Figure 12).

**Figure 12**

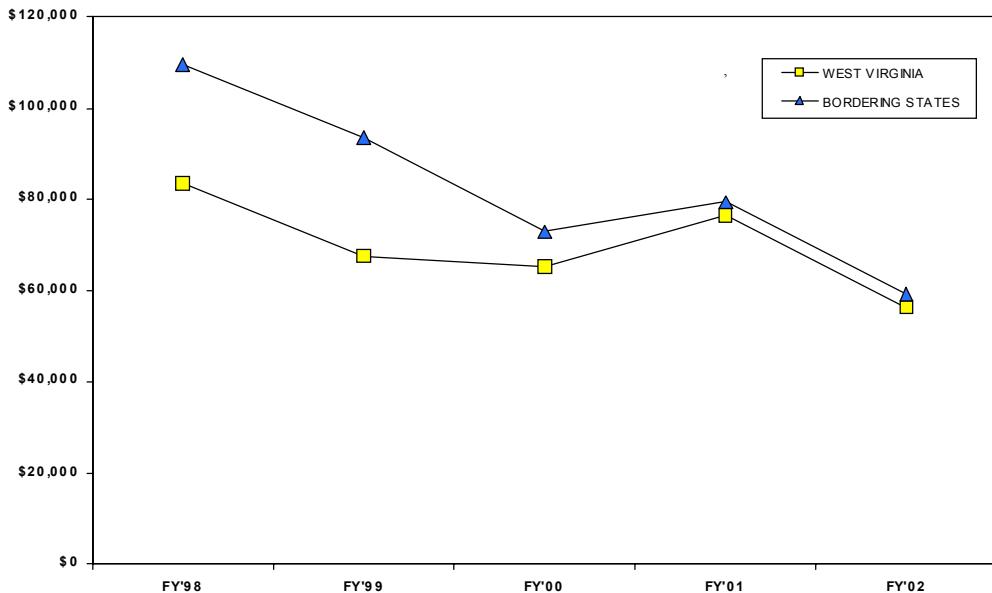
**PUBLICATIONS SALES REVENUES  
FY 1999-2003**



## ***FINANCIAL SUMMARY (CONTINUED)***

An evaluation of publications sales trends of the geological surveys of West Virginia and those of bordering states reveals a similar pattern of revenue decline (Figure 13) through fiscal year 2001-2002 (the most recent year for which comparison figures are available). West Virginia's receipts decreased by 32.7 percent over this period compared to a slightly larger loss of 40.1 percent for the composite. Some growth in revenues can be expected, assuming continued strong demand for agency information products and services by industry, government, and the public.

**PUBLICATIONS SALES REVENUE  
West Virginia vs. Bordering States<sup>1</sup>  
FY 1998-2002**



**Figure 13**

<sup>1</sup>Association of American State Geologists Statistician's Annual Reports, 1998-2002

### **Insurance Reimbursements**

Insurance proceeds in excess of \$34,000 were received from the Board of Risk and Insurance Management during the period fiscal year 2002 through fiscal year 2003 in payment of extensive building damage and content loss caused by flooding in January 2002. These funds (Fund 3113) have subsequently been applied to the costs of flood recovery, including off-site storage, asbestos abatement, and reconstruction.

### **Advance Funding**

All current Federal cooperative agreements and most contractual projects are expenditure-driven, requiring that expenses be incurred prior to reimbursement from funding sources. Authority granted in prior years to employ residual State appropriations as start-up funds has greatly enhanced the agency's capability to attract and maintain non-State support from agreements that stipulate an expense reimbursement mode of funding. Under this arrangement, reimbursements are ultimately returned to the general revenue fund and, consequently, no expense is incurred by the State. This funding mechanism has enabled the agency to utilize grantor-reimbursed funds in excess of \$200,000 in fiscal year 2002-2003.

# **RESEARCH**

• **Carbon Dioxide Sequestration**—The Survey was asked to be part of three different proposals submitted to the U.S. Department of Energy to participate in a regional partnership to compile data on potential geologic sinks which can be used to sequester carbon dioxide. The Survey's coal and oil and gas databases will be used extensively in this effort.

• **Coal Availability Study**—Although the U.S. has abundant coal resources, portions of this resource base are not minable. It is vital to West Virginia and the nation to learn how much of this resource can really be utilized. The Coal Availability Study, in which the Survey has participated since 1988, is a cooperative project funded by the U.S. Geological Survey through the National Coal Resources Data System program. The purpose of the study is to calculate how much of the remaining coal resources are available after considering regulatory, environmental, technological, land-use, coal quality, and geological restrictions to surface and underground mining. Detailed investigations are undertaken of the coal resources within 7.5-minute quadrangles representative of the geology and mining practices of larger areas.

Initially focusing on the coal resources of the central Appalachian basin (which includes southern West Virginia), the study expanded in 1991 to include northern West Virginia. Investigations have been completed on the Beckley, Sylvester, Mammoth, War, Crumpler, and Man quadrangles in southern West Virginia, and on the Rivesville, Glover Gap, Camden, Thornton, and Valley Point and Mt. Storm Lake quadrangles in northern West Virginia. Resources of the Weirton quadrangle, Hancock and Brooke counties, were completed this year, bringing this extensive and detailed project to a conclusion in West Virginia.

• **Coal-bed Mapping Project**—The geographic information system (GIS)-based Mineral Lands Mapping Program is a cooperative effort between the Survey, the West Virginia Department of Tax and Revenue, and the West Virginia University (WVU) Department of Geology and Geography. The Department of Tax and Revenue is responsible for creating GIS layers of mineral parcel ownership. WVU is charged with creating various GIS base map layers, or digital line graphs (DLGs).

The Survey is conducting the Coal-bed Mapping Project wherein a GIS-based inventory of coal in the State is being created. Coal-bed maps or layers being created include: structural contour maps; outcrop maps; surface, auger, and underground mined area maps; coal thickness maps; percent parting maps; and coal quality maps. Coal-bed coverages for Fayette County were completed in 1998 while maps and GIS coverages for 12 beds in Monongalia, Marion, and Harrison counties were completed in 1999. GIS coverages for all important coal beds in Wetzel, Marshall, Ohio, Brooke, and Hancock counties were completed in 2000. All coverages for 20 coal beds of the Kanawha Formation in western Raleigh County were completed in 2001.

All coverages for the Pocahontas 2 and 3 coal beds in Raleigh County have been completed, structure contours for other beds were worked on, and active mining was added to all compilations. Mapping efforts continued in Kanawha County and parts of Putnam County with underground mining compilations

(including active mines), stratigraphic correlations, and structure contour map construction. Mining compilation, including addition of active mines, was completed in Boone and northern Wyoming counties; stratigraphic correlations continued; and structure contour maps were initiated. Compilation of underground mining for the Fireclay coal in Logan County was completed. Annual deliverables were made to the Department of Tax and Revenue in autumn for fiscal 2002, and in spring for fiscal 2003. Deliverables included all underground mining compilations, completed mapping for the Pocahontas 2 and 3 beds, updated mining for nine and a half previously mapped counties, and numerous stratigraphic databases. Considerable stratigraphic database work was accomplished throughout the State with the addition of records from Department of Tax and Revenue files.

Work proceeded on migration of the stratigraphic database into a more robust network-capable hardware and software environment. Continued effort went into project design, improvement in procedures, acquisition of computer equipment and software, and training.

Recognition of the value of the underground mine compilations to mine safety issues, as highlighted by the Quecreek mine accident in Pennsylvania, resulted in closer cooperation and communication between the Survey and the West Virginia Department of Miners' Health, Safety, and Training. The two agencies are developing work plans to enhance the accuracy and completeness of the underground mine compilations.

• **Coal-bed Methane**—Another potential source of energy and revenue from West Virginia coal is the methane-rich natural gas held within the deeply buried beds. The Survey has actively promoted exploration, assessment, and utilization of coal-bed methane.

Geologist and Program Manager K.L. Avary continued to update a summary of data on coal-bed methane wells for the Survey's Web site, and presented talks summarizing West Virginia activity at "Coal Seam Natural Gas in the Northern Appalachian Basin: An Issue Conference," organized by the Interstate Oil and Gas Compact Commission for Governor Wise; for a meeting of the Appalachian Geological Society; and at the North American Coal-bed Methane Forum. Chief Geologist D.G. Patchen is on the steering committee for a workshop on coal-bed natural gas which is part of the Governor's Energy Task Force Energy Road Map Workshop series. K.L. Avary will make a presentation on West Virginia coal-bed methane activity.

• **Coal-bed Methane Potential**—Applied Coal Resources Investigations Program geologists worked cooperatively with the U.S. Department of Energy's National Energy Technology Laboratory to drill a core hole in the Morgantown area to explore for coal-bed methane and deeper, conventional sources of gas. The hole was drilled in Mylan Park, a growing recreational complex developed on reclaimed surface mined lands.

• **Coal Quality**—The Applied Coal Resources Investigations Program maintains and regularly enhances a computerized database of the chemical and physical

## **RESEARCH (CONTINUED)**

characteristics of West Virginia coals. It is one of the largest public databases of coal quality information in the nation.

Since coal is an incredibly variable substance, an understanding of its quality and makeup is highly important to many applications. This database is critical in helping potential customers find the specific West Virginia coal to meet their needs. It is also used to help equipment designers understand the nature and variability of coal for use in heat generation and as chemical feedstock. Policy makers often call on the program's coal quality expertise to gauge the potential effects of legislation on the State's coal industry.

This year, additional samples were collected and analyzed, analyses were completed on stored samples, and values in the computer database were verified and/or corrected. A large number of analyses from records at the West Virginia Department of Tax and Revenue were added to the database.

- **Comparison of Mid-Carboniferous Floras**—Geologist B.M. Blake, Jr. is participating in a National Science Foundation (NSF)-funded research project to compare mid-Carboniferous fossil plant collections available from eastern Europe and North America to address questions relevant to vegetation responses during onset of a major glacial interval. Findings will be compared with vegetative patterns of change during the Pleistocene.

Besides the benefits of increased understanding of vegetative evolution and distribution patterns during the Carboniferous, the work provides the opportunity to heighten public awareness of the severity of climatic oscillations recorded during an earlier period of earth's geologic history and the implications for the present day. W.H. Gillespie, paleobotanist, is also a cooperating scientist on the project. Lead investigators are Dr. H.W. Pfefferkorn of the University of Pennsylvania and Dr. R. Gestaldo, Colby College.

- **Derivative Map Project**—This is a pilot study using geologic data and other information to develop derivative maps to aid in the visualization of geologic hazards and other environmentally-related aspects in the areas of Jefferson and Berkeley counties east of 78 degrees west longitude, in West Virginia's eastern panhandle. Further work is planned as more digital geologic map data becomes available from the Digital Map Compilation Project.

- **Digital Map Compilation Project**—This project will produce geographic information system (GIS) data sets and digital maps of legacy geologic information. Currently, source material is limited to recent 1:24,000-scale published and open-file report maps deemed acceptable for inclusion in the data set. Line work for all maps is initially digitized at a scale of 1:24,000 and then generalized to a scale of 1:100,000 for inclusion in the National Geologic Map Database. Once this work is completed, attributes are assigned to geologic contacts, faults, and bedding orientations, thus completing the process of providing detailed data for inclusion in West Virginia's growing 1:24,000-scale GIS database.

To date, 1:100,000-scale digital data is available for 48 7.5-minute quadrangles located in the eastern panhandle. The more detailed 1:24,000-scale work is in

progress, supported by matching funds provided by the U.S. Geological Survey's STATEMAP Program. Other work planned in this project includes digital compilation of any remaining acceptable 1:24,000-scale published or open-file report maps, a "maps-on-demand" printing and plotting system, compilation of the 1:250,000-scale West Virginia State Geologic Map, preservation of the 1:62,500-scale county report series geologic maps, and other early agency-published maps.

• **Generation of Oil and Gas Production Declines**—A study was undertaken for the West Virginia Department of Tax and Revenue(WVDTR), Property Tax Division, to reevaluate the oil and natural gas production declines for producing wells in the State. The previous study, completed in 1991, evaluated up to 11 years of production data for more than 17,000 wells drilled since 1979. This study evaluated production histories for the past 24 years (and for as many as 70 years for a small subset of data) for more than 70,500 wells.

The current study evaluated data for 22 natural gas plays and 10 oil plays delineated by the stratigraphic and geological controls in their formation. The gas plays followed those described in **The Atlas of Major Appalachian Gas Plays** (publication V-25) and the oil plays included both primary and secondary production. Production and pay data in the database were edited, analyzed, and organized by play. Play assignments were made according to the deepest pay zone in a well, regardless of the number of pay zones. Calendar years of monthly production were converted to true "production years" based on when the wells went on-line. Gas and oil production decline ratios were calculated for each play as Flush-1 (year 1 to year 2), Flush-2 (year 2 to year 3), Settled-1 (year 3 to year 20), and Settled-2 (year 20 and beyond). The results were presented to the WVDTR for their review and assessment.

• **Geographic Information System (GIS) Technical Support Center at West Virginia University (WVU)**—As part of the overall State GIS program, legislative funding was approved for the establishment of a GIS Technical Support Center at WVU, with general administrative oversight provided by the Office of State GIS Coordinator and direct management by WVU. The center is responsible for the archiving, organization, and accessibility to public domain GIS databases created by the Mineral Lands Mapping Program (MLMP) and other State and federal agencies. It serves first in the capacity of a GIS clearinghouse, with training facilities and other services to be added in the future. Metadata, geospatial statistics, socioeconomic modeling, environmental monitoring, and public policy in the information age are among the GIS issues already being addressed by the facility.

• **Mine Index**—The Mine Index is comprised of 7.5-minute topographic quadrangle maps tracking the State's surface and underground mine permits. This open-file database is very useful to coal operators, land owners, equipment salespeople, and many others.

• **Mineral Lands Mapping Program**—The Mineral Lands Mapping Program was initiated in 1995 as a pilot project to demonstrate the capabilities of geographic information system (GIS) technology within State government. The pro-

## **RESEARCH (CONTINUED)**

gram is to redefine the process by which mineral resources in West Virginia, especially coal property, are evaluated and assessed for taxation purposes. The program uses the emerging computer technology of GIS in order to accomplish its goals and serves as the “GIS pilot project” for the State as proposed in the 1993 Plangraphics GIS Development Plan. The program’s legislative mandate also states that progress be reported to county tax assessors.

With this program, West Virginia takes a lead role in applying GIS to natural resource assessment in the U.S. The program is unique in concept and vision and represents the most complex and comprehensive data development effort ever attempted within the public sector of state government to map geological and natural resource holdings.

The program is a collaborative partnership between the West Virginia Department of Tax and Revenue, Property Tax Division (DTR); the West Virginia University GIS Technical Support Center (WVU); and the West Virginia Geological and Economic Survey. The Survey has overall fiscal and managerial oversight of the program. Each partner agency is responsible for data development and project management corresponding to its particular jurisdiction and expertise. The Survey manages the Coal-bed Mapping Project. DTR administers the cadastral mapping and creation of the parcel database and will create the linkages to existing DTR assessment systems. WVU is responsible for creation of the GIS data layers to which the parcel and coal-bed maps will be geographically referenced. In addition to general program oversight, the Office of Statewide GIS Coordinator is responsible for coordinating data development activities with other local, State, and federal entities which will feedback into the work of the program. Auxiliary input from numerous other parties (including coal companies, county tax assessors, and other government agencies) will strengthen and promote the program as it matures over the course of the next several years.

The maps, GIS coverages, and databases generated will contribute significant added value to a wide range of information useful to others outside of the program.

• **National Coal Resources Data System (NCRDS)**—For over a decade, the Survey has received grants from the U.S. Geological Survey’s NCRDS program to build the West Virginia portion of a national computerized database dedicated to coal information. This database is used for a variety of investigations including the Coal Availability Study, but its use is not limited to cooperative federal projects.

Data acquisition, entry into Survey computer databases, and verification by Applied Coal Resources Investigations Program personnel are ongoing processes. Non-confidential data are uploaded to the NCRDS periodically. Stratigraphic database work accomplished under this effort directly benefits the Coal-bed Mapping Project. Additional funds were also added to the Survey’s cooperative agreement in support of the U.S. Geological Survey’s Overburden Characterization for Prediction of Acid Mine Drainage Program. Funds were designated for core drilling and for mineralogical, elemental, and more recently, trace ele-

ment analyses from laboratories at West Virginia University. Two core holes were drilled in the mountaintop mining region as part of this project, one in Raleigh County and the other in Boone County. A third was drilled in Preston County.

**• Petroleum Technology Transfer Council Project in the Appalachian Basin**—The result of a cost-shared effort by the U.S. Department of Energy (USDOE) and the petroleum industry to identify technical problems and their solutions in the production of oil and natural gas, the Petroleum Technology Transfer Council (PTTC) selected the National Research Center for Coal and Energy (NRCCE) at West Virginia University (WVU) to assist producers in the Appalachian basin region with production-related problems. The original five-year program was extended until May 2003.

Goals for this fiscal year were to continue to develop and host focused technology workshops; continue a program of active outreach to build name recognition; and expand and add value to the regional Web site, including an on-line newsletter and an interactive geographic information system containing information on wells of particular interest (coal-bed methane, directional, historic, and new Trenton). The Survey participates in this program with the expertise and resources of its geologists and staff, and staff members played important roles in each of these areas.

The PTTC hosted or co-hosted nine workshops during the year, including a cooperative venture with the Gas Technology Institute (formerly the Gas Research Institute) which examined unconventional gas reservoirs. The Ordovician Trenton and Black River exploration targets were the subject of a stakeholders meeting which led to the formation of the Trenton-Black River Research Consortium. Other workshops held during the year relevant to the Trenton-Black River play included those on fractured reservoirs, 3-D seismic, and reservoir characterization. Workshops of interest to oil producers included those on produced water and on paraffin, asphaltene and scale. These workshops were held in conjunction with the Preferred Upstream Management Practices Project. Two safety workshops for well tenders were very well-attended. Geologist and Program Head K.L. Avary assisted with most of these workshops, and maintained the database of all attendees at PTTC-sponsored functions to be used for future mailings.

Outreach consisted of setting up a PTTC exhibit at various meetings and giving talks at numerous oil and gas meetings. Exhibits were set up at the Eastern Section, American Association of Petroleum Geologists annual meeting, and the Independent Oil and Gas Association of New York summer and fall meetings. The regional PTTC Web site was further expanded by Geologists R.R. McDowell and M.E. Hohn, and Web and Database Manager John Bocan. New issues of the quarterly, on-line newsletter were posted. Negotiations for contract renewal continued.

**• Preferred Upstream Management Practices Project**—This five year, U.S. Department of Energy-funded effort will identify and disseminate, through technology transfer, the best practices currently in use in the nation's oil fields. As

# **RESEARCH (CONTINUED)**

part of this program, Geologist and Program Head K.L. Avary and Geologists M.E. Hohn and R.R. McDowell worked to identify best practices using a combination of a search of published literature and personal interviews with selected producers.

A common problem identified by many producers is dealing with data and to that end, a workshop is scheduled for October, 2003 to provide information on various methods of dealing with well data. A project Web site was developed by Web and Database Manager John Bocan. The site includes a search feature which can be used to find information on various best practices.

•**STATEMAP Geologic Mapping**—The purpose of this U.S. Geological Survey annually-funded, competitive grant program is to produce high-quality geologic maps. Two mapping project proposals were approved for funding this year.

Mapping projects slated for completion in 2003 were finished. Geologists R.R. McDowell, K.L. Avary, and D.L. Matchen were principal investigators in bedrock mapping and geochemical sampling of the Circleville and Thornwood 7.5-minute quadrangles, Pendleton, Pocahontas, and Randolph counties and Highland County, Virginia.

Using geochemical analysis for all samples collected during STATEMAP reconnaissance, a stratigraphic geochemical database was compiled and is available to the public.

•**Trenton-Black River Research Consortium**—In response to the interest in new, deep drilling to the Trenton and Black River carbonates in West Virginia and New York, the Survey joined with the other members of the Appalachian Oil and Natural Gas Research Consortium to write a proposal for a basin-wide study of these rocks. The proposed study, which will result in the creation of a regional play book, was presented to a stakeholders meeting in September, 2002.

One outcome of this meeting was the formation of a Trenton-Black River Research Consortium with industry membership to support this research effort. The Survey responsibilities in this project is to create the database and geographic information system products as well as provide data on the West Virginia wells which penetrate this interval.

•**Wileyville Oil Field Research**—The Survey became a member of the Stripper Well Consortium (SWC) at Pennsylvania State University. The SWC is designed to fund research related to oil and gas reservoirs which produce at low rates. Almost all of West Virginia's producing oil and gas wells are classified as stripper wells. The Survey's proposal to the SWC to study the Gordon sandstone in the Wileyville oil field, Wetzel County, was selected for funding. The knowledge gained about the nature of the Gordon in the nearby Jacksonburg-Stringtown oil field during the Reservoir Characterization Project is being used to evaluate the Gordon in the Wileyville field. Wileyville is currently being water-flooded by the operator. More water was injected into the field than was

estimated to have been produced during primary oil production which indicates that the reservoir is heterogeneous and not well understood. This one year project concluded in May 2003. Data for the field were acquired from the operator; digitizing of wireline logs and description of the cores was completed; permeability data were acquired from the cores using the minipermeater; maps of reservoir properties were created; and permeability and other petrophysical properties of the reservoir were analyzed and modeled. A final report was written and submitted; presentations about the project were made at the eastern and western SWC meetings.

**Publications (bold names denote Survey staff)—**

- **Avary, K. L.**, 2003, Recent drilling activity to the Upper Ordovician Trenton-Black River, West Virginia and Pennsylvania, USA: **Geological Society of America, Northeastern Section, Abstracts with Programs**, vol. 35, no. 3, p. 70.
- **Avary, K. L.**, 2003, Trenton-Black River Play Sparks Renewed Interest in Appalachian Basin: **American Oil and Gas Reporter**, vol. 45, no. 12 (November, 2002), p. 107-113.
- **Avary, K. L.**, 2002, Recent drilling activity in the Upper Ordovician Trenton-Black River Limestone, West Virginia and New York: Eastern Section, American Association of Petroleum Geologists Annual Meeting.
- Cole, S. and **R.R. McDowell**, 2003, Implications of bifungites from the Upper Devonian of West Virginia, USA (abstract): **Geological Society of America Abstracts with Programs**, vol. 35, no. 3, p. 91.
- Eble, C.F., B.S. Pierce, and **W.C. Grady**, 2003, Palynology, petrography and geochemistry of the Sewickley coal bed (Monongahela Group, Late Pennsylvanian), Northern Appalachian Basin, USA: **International Journal of Coal Geology**, no. 55, p. 187– 204.
- Kammer, T.W., and **D.L. Matchen**, 2002, Biostratigraphic constraints on the timing of valley incision and deposition of the Lower Mississippian Black Hand Sandstone of Ohio: **Geological Society of America, Abstracts with Programs**.
- **Loud, E.I.**, 2003, **The Coal Availability Study in West Virginia: Tables of Results for Mount Storm Lake and Weirton 7.5' Quadrangles**: West Virginia Geological and Economic Survey, publication OF0301, 14p.
- **Matchen, D.L.**, D.A. Hemler, and **T.E. Repine, Jr.**, 2002, Teachers as field geologists: **Geological Society of America, Abstracts with Programs**.
- **Matchen, D.L.** and T.W. Kammer, 2002, Sequence stratigraphy of the Lower Mississippian in Ohio and West Virginia: Origin of the Black Hand Sandstone as incised valley fill: Eastern Section, American Association of Petroleum Geologists Annual Meeting.

## ***RESEARCH (CONTINUED)***

- **Matchen, D.L.** and T.W. Kammer, 2002, Reinterpretation of the Black Hand Sandstone (Lower Mississippian) of Ohio as incised valley fill: **Geological Society of America, Abstracts with Programs**.
- **McDowell, R.R.**, K. Aminian, **K.L. Avary, M.E. Hohn, D.L. Matchen**, and B. Thomas, 2003, Drill core helps breathe new life into Appalachian Basin oil fields (abstract): **American Association of Petroleum Geologists 2003 Annual Convention Program**, vol. 12, p. 116.
- **McDowell, R.R., K.L. Avary, D.L. Matchen**, R. Diecchio, S. Cole, and A. Gross, 2002, **Preliminary Bedrock Geologic Map of the Circleville Quadrangle**: West Virginia Geological and Economic Survey, publication OF0201, 1:24,000 scale.
- **McDowell, R.R., K.L. Avary, D.L. Matchen**, R. Diecchio, S. Cole, and A. Gross, 2002, **Preliminary Bedrock Geologic Map of the Thornwood Quadrangle**: West Virginia Geological and Economic Survey, publication OF0202, 1:24,000 scale.
- **McDowell, R.R., D.L. Matchen**, and **K.L. Avary**, 2002, Igneous Rocks in West Virginia—Unheard Of?: Pittsburgh Geological Society.
- **Patchen, D.G.** and **K.L. Avary**, 2003, Evolution of exploration, drilling and completion concepts for Appalachian Basin's Trenton-Black River play: 2003 AAPG Pacific Section Annual Convention.

# **ADMINISTRATIVE AND FACILITIES MAINTENANCE PROJECTS**

Administrative and Facilities Maintenance projects provide financial planning and management, personnel and employee benefits, purchasing, accounts payable, accounts receivable, and facilities maintenance services.

## **Financial Planning and Management**

Financial planning and management provide direction and coordination for all administrative activities.

**Program-based Budgeting**—The agency's internal accounting system was modified as required to provide financial reporting summaries for the use of project managers. Monthly expenditure statements were generated for 20 general revenue, 25 Federal revenue, and 25 special revenue projects. A total fiscal 2002-2003 agency budget, with amendments and reappropriations, of \$5,211,471 was allocated to these projects and a \$4,920,554 budget was developed for fiscal 2003-2004.

**West Virginia Financial Information Management System (WVFIMS)**—Receipt and disbursement processing on WVFIMS continued in fiscal 2002-2003 with a total of 1,592 transactions approved for entry. WVFIMS reports are reconciled with the agency's internal accounting system on a monthly basis.

**Program and Project Support**—Development continued on procurement and financial reporting procedures to adequately monitor and account for individual procurements made on the State Purchasing Card Program. In addition, the GIS financial reporting system was modified to meet fiscal reporting and monitoring needs of the program in fiscal 2002-2003. Budget planning support and assistance were given to numerous grant and contract proposals and limited-term special projects.

## **Personnel and Employee Benefits**

In addition to payroll processing and employment record maintenance, this activity also provides explanation of benefits and assistance with such programs as insurance, health care management, and participatory retirement plans. The agency payroll as of June 30, 2003 consisted of 50 full-time and 8 part-time staff.

## **Purchasing**

The purchasing function includes procurement processing, travel coordination, and fixed asset accounting. Over 1,600 requisitions and purchase authorizations were processed for the procurement of services, commodities, and operating expenditures in fiscal 2002-2003. In addition, over 200 travel expense accounts were prepared and 16 items were added to the fixed asset inventory.

**Purchasing Card Program**—Procurements via the State Purchasing Card Program accounted for 34 percent of the number of all purchases in fiscal 2002-2003. This program enables authorized employees to make agency purchases

on assigned VISA cards, as opposed to through the existing requisition/purchase order procedure. Eight project managers have been issued VISA cards with which to make purchases for projects funded from non-general revenue sources. All other agency credit card purchase activity is conducted through two central purchasing cards. Total agency Purchasing Card Program procurements totaled \$112,914. The Purchasing Card Program will eventually replace virtually all existing paper-based purchase and payment processing procedures for agency-level purchases of \$2,500.

Accounts payable is responsible for vendor payment processing and requisition and payment file maintenance. Over 1,550 transactions were submitted for payment on WVFIMS in fiscal 2002-2003. Of these, 32 (1.9 percent) were returned by the State Auditor's Office for clarification or correction, comparable to the rate for all State agencies.

A total of 219 invoices were generated in fiscal 2002-2003 for publication sales, geological services, facilities rentals, and contractual agreements. Collections from these sources for the year ended June 30, 2003 totaled \$404,335. VISA and MasterCard sales accounted for \$45,093 of collections. Accounts receivable on June 30, 2003 totaled \$27,725.

Administrative services continued to provide support for routine agency operations in fiscal 2002-2003.

**Reception/Telecommunications/Correspondence Processing**—As the agency's initial point of contact, this activity received and transferred 20,350 telephone inquiries and opened and routed to appropriate staff over 9,300 pieces of mail in fiscal 2002-2003. In addition, over 1,400 pieces of correspondence, forms, and documents were typed and prepared for further processing.

**Facilities/Vehicle Scheduling**—Conference areas were reserved for both staff and external use, subject to availability. No major upgrades of conference facilities were undertaken during the year. Vehicles leased from the State Travel Management Office are routinely scheduled for use by staff for travel purposes or are assigned for long-term usage to project field work. Three vehicles were retired from the fleet and one new one was added in fiscal 2002-2003.

**Security and Custodial**—Routine household cleaning and maintenance schedules have been developed. The job description of a recently vacated custodial position has been modified to include secondary maintenance responsibilities. An individual was hired for this position in fiscal 2002-2003.

**Library**—The library is maintained as an in-house repository of earth science reference texts and technical journals. Services include receiving, cataloging, and storing publications, as well as maintaining staff loan records. No significant additions were made to the library in fiscal 2002-2003.

## Accounts

## Accounts Receivable

## Administrative Services

## ***ADMINISTRATIVE AND FACILITIES MAINTENANCE PROJECTS (CONTINUED)***

### **Facilities Maintenance**

A comprehensive building and grounds maintenance program established among existing purchasing, maintenance, and custodial staff was continued in fiscal 2002-2003. The work of this group resulted in several major improvements during the year. Surplus funds o \$16,000 realized from contractual reimbursements were partially utilized for building and grounds upgrades. In addition, work to restore areas damaged by a water line break in February 2002 was completed during the year. All major safety and fire issues identified in an annual loss engineering inspection for the Board of Risk and Insurance Management were satisfactorily resolved during the year.

# **ADVANCED GEOSCIENCE RESEARCH PROJECT**

## **Michael Edward Hohn**

**Petroleum Technology Transfer Council (PTTC)**—Continued to maintain the Web site for the PTTC Regional Center at West Virginia University (WVU) until these duties were transferred late in the year.

**Committees**—Member of the American Association of Petroleum Geologists Computer Applications Committee.

**International Association for Mathematical Geology**—Served Deputy Editor of the journal, *Mathematical Geology*, and book review editor for *Natural Resources Research*. Also serve as Chair of the Publications Committee.

**American Association of Petroleum Geologists (AAPG)**—As Past President of the AAPG's Eastern Section, chaired the Nominations Committee, and continue to maintain the Eastern Section's Web site.

**Presentations/Exhibits**—Delivered the keynote speech, "The Role of International Associations in the Geosciences," at the 2002 annual meeting of the International Association for Mathematical Geology.

## **Ronald R. McDowell**

**Manuscript Review**—Reviewed abstracts and manuscripts generated by Survey staff and reviewed manuscripts submitted to the journal *Natural Resources Research*.

**Survey Web Site**—Created and maintained pages on the Survey's Web site presenting the results of past and present STATEMAP investigations.

**Educational Outreach**—Taught Historical and Environmental Geology at Fairmont State University for the 2002-2003 school year, and acted as mentor for two WVU undergraduate geology students, K. Hicks and C. Howton.

**Continuing Education**—Attended a workshop on geophysical well-logging fundamentals sponsored by the Appalachian Geological Society and the Appalachian Section of the Society of Petroleum Engineers. Also attended four workshops sponsored by PTTC: one on oil-field water production; one on paraffin and scale buildup in wells; one on fracture analysis in carbonate rocks; and one on advanced use of Powerpoint presentation software.

**Presentations/Exhibits**—Co-authored a poster presentation for the Northeastern Section, Geological Society of America convention, Halifax, Nova Scotia; co-authored a poster presentation for the AAPG annual convention, Salt Lake City, UT; led a field trip for the Pittsburgh Geological Society to examine West Virginia's Eocene igneous rocks, and gave a colloquium presentation on the same topic for the WVU Geology and Geography Department.

### **Service**

### **Professional Activities/Outreach**

### **Service**

### **Professional Activities/Outreach**

# **APPLIED COAL RESOURCES INVESTIGATIONS PROGRAM**

## **Data Collection**

Activities associated with the program's research projects result in the addition of abundant geologic data to the files. These include core logs; coal analyses; measured sections of outcrops, highwalls, and roadcuts; maps of underground coal mines; and a host of other important information. Most data collection throughout the year was associated with the Coal-bed Mapping Project and the Coal Availability Study.

## **Service**

**Service Requests**—During the year, the program responded to numerous service requests from the general public, industry, academia, and government. The majority of requests were for information on mine subsidence and coal resources data, but requests for coal quality, mine index, and general geology information were also numerous.

## **Professional Activities/ Outreach**

### **Committees**—

- Geologist, Statistician, and Assistant Program Manager G.H. McColloch, Jr. is one of five state representatives serving on the North American Geologic Map Data Model Steering Committee, and continues to serve as Survey representative on the West Virginia GIS (Geographic Information System) Steering Committee. McColloch also serves as the agency's liaison to the U.S. Geological Survey (USGS) National Geologic Map Database Project, and as a member of the USGS/American Association of State Geologists Data Capture Working Group.

**Coal Reports**—G.H. McColloch, Jr. updated the West Virginia section of the **Keystone Coal Industry Manual**, a bi-annual publication, and completed the annual article on 2002 West Virginia mineral production for the Society of Mining Engineers' **Mining Engineering** magazine.

### **Continuing Education**—

- Geologist B.M. Blake, Jr. continued academic work in the doctoral program at West Virginia University (WVU).
- GIS Database Administrator K.J. Hutchinson, GIS Technical System Administrator F.L. Hutchinson, and Geologist S.E. Gooding attended the 2002 ESRI User Conference, San Diego, CA.
- Several program staff members attended the West Virginia GIS Forum and Exhibition, Charleston.

### **Presentations/Exhibits**—

- Geologists J.Q. Britton, B.L. Nugent, R.J. Johnson, J.M. Sutton, and S.E. Gooding presented geologic talks and conducted interpretive walks at State Parks around West Virginia as part of the Visiting Geologist Project.
- J.Q. Britton lead a field trip for a secondary school class visiting the area from the northern panhandle.
- Geologists E.M. Sturgill, J.M. Sutton, and A.G. Thomson were instructors in the "Expanding Your Horizons" conference, Fairmont State College.
- Geologist and Program Manager N. Fedorko made a presentation on the Coal-bed Mapping Project at a mine safety workshop held in conjunction with the

annual West Virginia Coal Association Symposium, Charleston, and a similar presentation at the U.S. Mine Safety and Health Administration Mine Safety Academy, Beckley.

- G.H. McColloch, Jr. presented “Digital Geologic Mapping in a Data Rich, Urban Environment” at the 2003 Digital Mapping Techniques meeting.

# **APPLIED OIL AND GAS RESOURCES INVESTIGATIONS PROGRAM**

## **Data Collection**

**Oil and Gas Database**—For over 30 years, the Survey has been proud of the fact that it has developed and maintained the most comprehensive, dynamic, public-domain oil and gas database in the Appalachian basin. This year, data for newly permitted and newly drilled wells, and monthly and annual production, were added, and existing data were continually used and enhanced in the course of routine work, research, and service requests. In addition, Geologist and Program Manager K.L. Avary continued to add data to the tables and files that are available on the Survey's Web site for new activity in coal-bed methane research and the Trenton. A major technical upgrade occurred this year when the database was migrated to the Oracle software environment.

**Core and Sample Library**—Cores for the Stripper Well Consortium Project were loaned to the Survey for the duration of the project and stored at the agency's core and sample warehouse. Detailed permeability measurements were made on the cores using the minipermeameter. Industry geologists visited the warehouse to examine Trenton cores and Greenbrier Limestone samples, as interest in these reservoirs expanded.

**Well Log Library**—Some logs were donated by companies. A new log scanning system was acquired during the year. Well logs are now being scanned and .tiff files of the scanned images made available to customers on CDs. Also, new hardware and software were acquired to digitize log curves and produce .LAS files. Logs for most wells that reach the basement have been digitized and the .LAS files are available on the Survey's Web site.

## **Service**

**Service Requests**—During the year, the Applied Oil and Gas Resources Investigations Program responded to more than 80 requests per month received through phone calls, e-mail, letters, and personal visits for completion, stratigraphic, production, well location, and other data. In addition, K.L. Avary continued to review all applications for Underground Injection of Liquids permits.

### **Academia—**

- Chief Geologist D.G. Patchen and K.L. Avary continued to serve as Adjunct Associate Professors of Geology in the Department of Geology and Geography at West Virginia University (WVU).
- K.L. Avary, D.L. Matchen, and R.R. McDowell taught a group of nine K-12 teachers basic geologic field mapping methods during a three-week program entitled “AGeoteach@,” funded by the Eisenhower Professional Development Fund. They served as mentors for two WVU undergraduate students as part of a Mentored Field Experience Program, sponsored by the National Science Foundation and the Association of American State Geologists. They conducted a one-day field trip for the Pittsburgh Geological Society to examine the igneous rocks in Pendleton County. They also committed to and made preparations for running similar field trips for the Virginia Geologic Field Conference in October, 2003 and for the joint meeting of the Northeastern and Southeastern Sections of the GSA in March, 2004.
- K.L. Avary served as faculty advisor for the West Virginia University American Association of Petroleum Geologists (AAPG) Student Chapter.
- D.G. Patchen continued to participate in the Visiting Geologist Program of the AAPG.

**Oil and Gas Reports**—Reports and data were submitted or presented to the Independent Petroleum Association of America, and the Energy Information Administration of the U.S. Department of Energy (USDOE).

**Sponsored Symposia**—Survey geologists participated in several of the Petroleum Technology Transfer Council (PTTC)-sponsored workshops. The Trenton Stakeholders Meeting led to the formation of a research consortium and submission of a proposal to the USDOE. A very well-attended workshop on the Fractured Reservoirs was held in Washington, PA. A workshop on 3-D seismic was well received. The response to two safety workshops for well tenders was so great that people who wanted to attend were turned away and additional workshops were scheduled for summer 2003. The two workshops dealing with water production and paraffin, asphaltene and scale addressed problems of particular interest to oil producers. Chief Geologist D.G. Patchen, as PTTC Program Manager, is responsible for coordinating all of these workshops, which totaled nine this year. Several hundred geologists, petroleum engineers, and other petroleum industry professionals attended these workshops, designed to increase awareness of new technology which can be used in the oil and gas industry.

#### **Committees—**

- K.L. Avary served on the Honors and Awards Committee of the Eastern Section, AAPG; is a member of the AAPG Mentoring, Student Job Quest, and Youth Education Activities committees; and is a member of an Ad Hoc AAPG Committee to design a survey to determine member satisfaction with the association. She is the delegate elected to represent the Appalachian Geological Society in the AAPG House of Delegates, and served as the Eastern Section representative on the House of Delegates Honors and Awards Committee. Avary also served a one-year term as Secretary/Editor of the AAPG House of Delegates, and was a candidate for AAPG Secretary.
- D.G. Patchen is the Eastern Section Councillor for the AAPG Energy Minerals Division; is a member of the AAPG Committee on Preservation of Cores and Samples; is the delegate elected to represent the Pittsburgh Association of Petroleum Geologists in the AAPG House of Delegates; was a candidate for AAPG Vice-President; and represents West Virginia on the Potential Gas Committee, a group funded by the American Gas Association and company donations. He also serves as the Appalachian Basin Chairman for the Potential Gas Committee. Patchen is the General Chair for the 2003 meeting of the Eastern Section AAPG and the Eastern Region of the Society of Petroleum Engineers (SPE). This meeting will be the first time that these two groups will be meeting together. K. L. Avary has agreed to act as general chair for a similar meeting of both groups, which will be held in Morgantown in 2005.
- D.G. Patchen and K.L. Avary attended AAPG Leadership Days, Tulsa, OK, and the annual AAPG meeting, Salt Lake City, UT, to attend committee and section business meetings.

**Continuing Education**—Geologist D.L. Matchen took graduate seminar courses in geology at WVU as part of the requirements for his doctoral program in geology.

## **Professional Activities/ Outreach**

# ***APPLIED OIL AND GAS RESOURCES***

## ***INVESTIGATIONS PROGRAM (CONTINUED)***

### ***Presentations/Exhibits—***

- The Appalachian Oil and Natural Gas Research Consortium has a contract to implement the PTTC project in the Appalachian basin. As a full consortium member, the Survey has an obligation to participate actively in outreach efforts to make producers more aware of PTTC and the workshops. Consequently, D.G. Patchen attended various meetings to make presentations, promote upcoming workshops, put up displays, or distribute information packets about the PTTC program. These meetings included the Eastern Section AAPG, Champaign, IL; PTTC Regional Lead Organization Directors meetings, Las Vegas, NV and Washington, D.C.; Independent Oil and Gas Association of New York, Buffalo, NY and Niagara Falls, Ontario; Stripper Well Consortium meeting, Oklahoma City, OK; and the North American Coal-bed Methane Forum, Morgantown.
- Geologist R.R. McDowell and Student Intern S. Cole presented a poster on trace fossils found at new exposures along Corridor H, Randolph County, at the annual meeting of the Northeastern Section of the Geological Society of America (GSA), Halifax, Nova Scotia.
- K.L. Avary presented a talk on recent permitting and drilling activity in the Trenton-Black River in West Virginia and Pennsylvania at the annual meeting of the Northeastern Section of the GSA, Halifax, Nova Scotia; a talk on recent coal-bed methane drilling and permitting in West Virginia to the Appalachian Geological Society, Charleston; and a talk on recent coal-bed methane permitting, drilling and production activity in West Virginia at the North American Coal-bed Methane Forum, Washington, PA, and at the Interstate Oil and Natural Gas Compact Commission's Conference on Coal Seam Natural Gas in the Northern Appalachian Basin, Charleston.
- D.L. Matchen gave a talk on the Black Hand Sandstone at the GSA Annual Meeting, Denver, CO; a talk on the geology of the Wileyville oil field, Penn State University; and a talk on the geology of the Jacksonburg-Stringtown oil field, Juniata College, Huntington, PA.
- D.G. Patchen gave a talk on current activity in the Trenton/Black River at the annual meeting of the AAPG Pacific Section, Long Beach, CA.

# **COMPUTING SERVICES AND COMPUTER UPGRADES PROJECTS**

## **Data Activities & Computing Operations**

### **Oil and Gas Data System—**

- Development of the new Oil and Gas Data System, part of the integrated agency-wide mineral resources data system under Oracle database software, was completed and launched this fiscal year. Oracle tables were created for the existing data domains and COMPLETIONS and OWNERS were merged into a single new record. All lookup tables were updated; forms were created to store and access data; data extraction/query and reporting programs were developed; several system-wide data edits were completed to facilitate the database conversion; coordinate conversion programs were modified to provide greater precision in the well location values; and the data were imported into the new Oracle database. Formatted-screen programs were installed on staff computers for running the applications and staff were trained on the use of the new database.
- Well-specific production data for 2001 were received, evaluated, edited, checked, and analyzed prior to being written into the database. Monthly production data records for 44,544 wells were added to the database as were several hundred additional production records for the year 2000.
- Management of the existing VAX-based data system continued as necessary.
- Staff met with personnel from the West Virginia Department of Tax and Revenue's Property Tax Division, the West Virginia Division of Environmental Protection's Office of Oil and Gas, the Public Service Commission, and representatives of the county assessors addressed the implementation of Senate Bill 731 on the combined reporting of oil and gas well production data.

### **Oil and Gas Data System Applications—**

- ESRI shapefile maps showing the locations of coal-bed methane wells and recently-permitted Trenton and deeper wells were prepared and updated for the Web site to reflect current permitting and drilling activity in the State.
- The public-access portion of the Oil and Gas Data System, known as "*pipeline*," continued to attract new customers.

### **Survey Computing Operations—**

- The agency's local area network provides connectivity for all platforms (VAX, UNIX servers and workstations, Windows-based servers and PCs, and several networked devices such as plotters and scanners), intra-agency communication, and Internet access through a T1 wide area network telecommunications link to the West Virginia Network for Educational Telecomputing (WVNET).
- Numerous PC installations, repairs, upgrades, problem troubleshooting, operational issues, and staff training occupied much staff time. These tasks involved installing new hardware and software, software updates, transferring files, network settings, viruses, printer problems and printer drivers, "lost" files and configurations, dead disk drives and network cards, other network adapter problems, BIOS issues, and problems caused by power outages.
- System accounting was run monthly and monitored regularly. Network-based full and incremental backups of systems were run. Maintenance agreements were initiated or renewed, as necessary. Regular vigilance was required to guard against system hackers and viruses. The firewall was upgraded, an agency security policy was developed, a security audit of State government systems identified a few issues which were quickly remedied, and security patches on servers were regularly updated. New database and e-mail servers

were researched and configured. Additional ArcView GIS software licenses were purchased. An Oracle strategic plan was developed. Plans were made for decommissioning of the VAX system. The Information Security Policy was developed at the request of the Governor's Office of Technology and was approved. An Internet and e-mail usage policy was being developed for the agency.

#### **Network—**

- Considerable effort was concentrated into the management of the agency-wide computer network of servers, workstations, and PCs, involving 10/100mbps and 100mbps switches, network management software, and Category-5E telecommunications cable. Firmware updates were made to various network components. Re-cabling of the Survey's Mont Chateau headquarters continued, with the installation of several new Cat.5-E cable runs; construction of patch cables; and installation of rails, boxes, and faceplates in offices.
- Updates to the enterprise edition of anti-virus software were regularly uploaded to PCs. Domain name servers were modified and updated. Network backups were performed regularly. The firewall was monitored regularly. A database of network configurations containing the specifications of all devices on the network was being maintained.

**State Information Technology Plan**—A revision of the agency's Information Technology (IT) plan and a summary of the agency's IT projects were prepared and submitted to the Governor's Office of Technology as requested and as part of an information technology review of State agencies.

#### **Service Requests—**

- Project staff completed a total of 187 external requests for data or responses to queries about basic data during this fiscal year, with 149 of these from business and industry, eight from government, 10 from education, and 20 from the general public. There was another major request for data from the U.S. Geological Survey. The “*pipeline*” public-access system has continued to off-load many common and simple requests for basic oil and gas well data to the users themselves, leaving staff with time for other jobs and projects.
- The Survey's e-mail-based INFO-line and the webmaster e-mail account on the agency's Web site continued to field a wide variety of requests for information, with 212 requests coming in via the INFO-line and 97 requests coming in via the webmaster account. The INFO-line e-mail address is **info@geosrv.wvnet.edu**. These and other requests received via the agency's Web site were forwarded to appropriate staff for response. Vigilance is required these publicly-advertised e-mail accounts because of the huge amount of spam and computer viruses (not included in these counts) they receive despite e-mail filters.

#### **Web Site Development—**

- Development and maintenance of the agency's Web site are ongoing efforts. The Web site contains sections on West Virginia geology; data and maps; the Survey's research, information services, and outreach programs; an interactive coal-bed mapping facility; geoscience education; “virtual” mini-museum;

# **COMPUTING SERVICES AND COMPUTER UPGRADES PROJECTS (CONTINUED)**

extensive frequently asked questions (FAQs); the publications catalog; articles of general interest to the public and geologists; and the visiting geologists' schedule at State Parks. Also included are feature articles and links to related sites of interest. A Web development team oversees the operations of the site.

- The Internet Map Server (IMS) software displays map products (especially coal-bed coverages) developed in the Survey's geographic information system (GIS) program and the locations of coal-bed methane wells and Trenton deep gas wells. A searchable Access database of the summary oil and gas and coal production data by county and by year is updated annually. Updates were made to several sections and pages on the Web site.
- Site content is tested on various versions of different Web browsers to ensure a consistent appearance and is checked for accessibility. Servers are backed-up regularly. System logs are monitored to ensure proper operation of the site. Links are checked regularly and the site is edited periodically to keep the information current. Usage summary statistics are run monthly. More than 522,000 page views were recorded for fiscal year 2003, an increase of 50 percent over the previous fiscal year. This "cyber-service" is free to Internet users at the Survey's Web address, <http://www.wvgs.wvnet.edu>.

## **Public Access "*pipeline*" to the Oil and Gas Data System—**

- The agency's public-access "*pipeline*" cyber-service has seen continued growth in subscription. This service provides public access to the Survey's 135,000-well database of oil and gas well completion, location, geological, production, plugging, and log, sample, and core data developed over the past 37 years. Included in the geological data are unit tops and thicknesses (in the "Stratigraphy" file), and zones and formations of pays and shows of hydrocarbons (in the "Pays and Shows" file). Other data available include well farm names and numbers and company numbers (in the "Owners" file), and depths and types of water encountered in the drilling operation (in the "Water" file). By directly accessing the Survey's Oil and Gas Data System, the information contained in the database can be used as a tool to support industry, government, and public needs for geologic, geographic, production, and other relevant data on these wells.
- Currently, access through the menu-driven formatted screens is provided only to well-specific data. Users can search for information in any of the data types and domains based on the API number (county code and permit number). User-originated queries for wells meeting specific user-defined criteria or for the downloading of ASCII files won't be implemented until a new version of "*pipeline*" is developed. These types of operations, however, can be completed in the interim by agency staff and results are forwarded to the user as ASCII or Excel files (modest fees are charged for customized data searches). Registered users can access the "*pipeline*" database at their convenience from their Internet-connected PC. On-line registration for the "*pipeline*" service is available through the agency's Web site. There were 140 registered user accounts this fiscal year.

**Agency Intranet**—Development and expansion of the Survey's Intranet continued this fiscal year, with a team of agency staff guiding the application. Among the applications operational on the Intranet are administrative forms, employee

## Professional Activities/ Outreach

### Professional Activities/Outreach

#### Committees—

- Geologist and Project Manager M.C. Behling serves on the State Information Technology Council's Internet Committee and the State Information Services and Communication's (IS&C) IPUG Committee. She is an adjunct faculty member in the West Virginia University Department of Geology and Geography.
- Geologist and Data Analyst S.C. Kite chairs the agency's Policy Committee.

#### Continuing Education—

- M.C. Behling attended the IS&C User's Conference and Expo, Charleston.
- M.C. Behling and S.C. Kite attended the "Introduction to ArcView GIS" software training course, Morgantown.
- M.C. Behling and Network Administrator S.A. Munro attended the WVNET Conference, Morgantown.
- M.C. Behling and Programmer/Analyst J.T. Saucer attended the West Virginia GIS Forum and Exhibition, Charleston.
- S.C. Kite attended the AMQUA meeting and field trip, Anchorage, AK.
- S.A. Munro and J.T. Saucer attended a Microsoft security seminar, Charleston.

# **GENERAL GEOSCIENCE PROGRAM**

Activities associated with the General Geoscience Program's service and research require continuous collection and analysis of significant amounts and types of data. Computerized databases for limestone, springs, maps, and geographic information are maintained. Additional information and materials are available for nonfuel minerals, geologic hazards, map information, and a host of other topics that fall within the expertise of the program.

**West Virginia Mineral Industries Directory**—Information was collected in preparation for the next edition of this biennial directory which lists the name, address, phone number, commodity produced, county of operation, permit number, and other key information for approximately 1,200 companies that obtained or maintained mining or drilling permits during the most recent two-year period in West Virginia. The directory also contains maps and graphs depicting geographical and historical trends in the State for the following commodities: coal, oil, natural gas, natural gas liquids, limestone, sandstone, sand and gravel, clay and shale, peat, and salt.

**Service Requests**—The General Geoscience Program responds to service requests from industry, government, the general public, and academia. As the responsibilities of the program are to address all geologic and geographic matters not directly related to West Virginia's fossil-fuel resources, the scope of service activities is quite diverse. These areas of expertise fall into these general categories:

- Economic Minerals (limestone, dolomite, sandstone, sand and gravel, clay and shale, salt, peat, etc.).
- Environmental Geology (flood hazards, landslides, karst geology, radon, seismicity, etc.).
- Water (ground- and surface-water hydrology, water resources, water supply, water quality, springs, etc.).

**Economic Minerals Geoscience Project**—The Survey receives frequent requests for geological information related to the potential development and uses of the State's limestone, dolomite, sandstone, salt, clay, shale, and sand and gravel, and other resources. The project maintains an expertise on these topics, constantly updates information files, and gives consultations when requested.

**Environmental Geoscience Project**—Each year, floods, landslides, subsidence, radon, and various other geologic hazards cause problems or concerns for many West Virginia citizens and businesses. Project staff provide information about what causes these problems and how they might be avoided or mitigated. Information about possible geologic hazards associated with a particular location for a building or development site is also provided by the project.

**Water Project**—Citizens, educational groups, industry, and government agencies frequently request information about various aspects of surface- and ground-water hydrology. Project staff provide information and assistance on such topics as springs, water quality and quantity, water availability, and water supplies and supply systems.

## **Data Collection**

## **Service**

**Earthquake Monitoring Station**—In cooperation with the U.S. Geological Survey (USGS), a state-of-the-art earthquake monitoring station is maintained at the Survey's Mont Chateau headquarters. The station, linked by satellite to the National Earthquake Information Center in Colorado, monitors earthquake activity in West Virginia and throughout the world.

**Visiting Geologist Project**—In cooperation with the State Division of Tourism and Parks, the Survey conducts the popular Visiting Geologist Project at State Parks and other facilities throughout West Virginia. A Survey geologist or staff member presents a geologic talk and interpretive walk to park guests in exchange for lodging and meals, if available. This year, the project provided Survey staff as guest speakers and walk leaders for 11 parks where over 400 visitors participated.

#### **Service Highlights**

- Geological Reports: Geological reports were prepared for proposed housing development sites. A service fee recovered costs.
- Facility Siting Information Packets: These packets are prepared to provide geological information in advance of development. Packets include information on mining activity and mineral resources, oil and gas drilling, flood-prone areas, hydrogeology, and environmental geology. A service fee recovers costs.
- Industrial Minerals: Numerous companies and consultants were assisted with information on the State's industrial minerals ranging from limestone deep-mining potential, to information on resources for cement and aggregate production, to data on producers and production quantities.
- Limestone for Air Quality Control at Coal-Fired Power Plants: Numerous companies were assisted with requests for information on the chemical composition, geographic location, and stratigraphic position of West Virginia limestones and dolomites which would meet specifications as sorbents in fluidized bed combustion or emission clean-up.
- Geoscience Education: Activity-oriented geology presentations and field trips were conducted for several school visits; some RockCamp graduates were given assistance in conducting their own field trips.
- Document Review: Staff members reviewed and provided comments on a variety of documents including research proposals, design memoranda, environmental assessments, reports, environmental impact statements, plans, and draft publications for federal and State agencies, intergovernmental committees, and other groups.
- Water-well Siting: Staff members assisted other State agencies in siting water wells at State facilities.

# ***GENERAL GEOSCIENCE PROGRAM (CONTINUED)***

## **Committees and Advisory Groups—**

- Geologist/Hydrogeologist J.S. McColloch and Engineering Technician/Surveyor P.R. Liston serve as agency coordinators to the West Virginia Office of Emergency Services. They respond to situations requiring geological and geographic expertise, and assist the office in emergency preparedness and mitigation programs.
- J.S. McColloch is a member of the Natural Stream Work Group for the Canaan Valley Institute and the Appalachian States Coalition for Geological Hazards in Transportation Committee. She is Vice Chair (domestic) of the American Association of Petroleum Geologists (AAPG) Membership Committee, a member of the AAPG Mentoring Committee, and an AAPG Division of Environmental Geosciences Advisory Board member. McColloch attended the annual AAPG meeting, Salt Lake City, UT, to participate in division and committee business meetings.

**Continuing Education**—J.S. McColloch attended the AAPG annual Eastern Section meeting, Champaign, IL; the Geological Society of America Annual Meeting, Denver, CO; and the AAPG annual meeting, Salt Lake City, UT. McColloch also attended the Geological Hazards in Transportation in the Appalachian Region Technical Forum, Huntington, and the Digital Mapping Techniques Conference, Millersville, PA.

**Awards**—J.S. McColloch received the AAPG Division of Environmental Geosciences Meritorious Contributions Award, Champaign, IL.

## **Professional Activities/ Outreach**

# **GEOGRAPHIC INFORMATION SYSTEM PROGRAM**

A state-level Geographic Information System (GIS) program in West Virginia was first proposed in 1992. The program was authorized by Governor's Executive Order 04-93. A funding proposal for GIS implementation was presented to the Legislature and approved under House Bill 2222 in February 1995, with a recommended annual operating budget of \$2 million. This funding provided for the establishment of a State GIS Coordinator, the GIS Technical Support Center, and a GIS pilot demonstration project. The program's fiscal, administrative, and managerial responsibilities reside with the West Virginia Geological and Economic Survey. For fiscal 2003, the funding level was about \$1.6 million.

A research agenda is incorporated into the overall scope of the Office of State GIS Coordinator. The objective is to implement a statewide GIS program that will develop a comprehensive, standardized, public domain computerized digital cartographic database to be shared and used by government agencies, the general public, and the business community in order to modernize and improve decision-making processes at all levels for the benefit of West Virginia society. This implementation is being done in partnership with all State, Federal, county, and municipal governments, and in cooperation with private industry. More specific tasks include:

- Coordinate various GIS initiatives and projects between State agencies and other government entities.
- Monitor ongoing initiatives such as consultant activities and agency projects.
- Answer general inquiries about the GIS program in West Virginia.
- Develop databases that support GIS applications with the greatest utility for multiple organizations.
- Facilitate access to data and GIS functionality by multiple users.
- Pool financial, staff, and technical resources to build the State GIS.
- Establish and enforce data standards to facilitate use of information that may be used by different organizations.
- Improve the quality, availability, and equatability for access and dissemination of geographic information to support decision-making and management.
- Minimize duplication of effort of State agency funding and labor.
- Demonstrate the use of GIS to increase the productivity of State agency management and staff regarding their daily operations and standard procedures.
- Promote and publicize West Virginia GIS activities within and outside the State.
- Foster geographic education and professional career development in geospatial technologies.

This mission is organizationally represented at the agency level by the State GIS Steering Committee. The State GIS Coordinator, C.A. Neidig, reports directly to the Deputy Director and Associate State Geologist of the Survey.

The Office of State GIS Coordinator is not directly responsible for the development or collection of digital data for incorporation into any specific GIS project. However, the Coordinator is responsible for the promotion and implementation of GIS activities that integrate all levels of data development and varying types of GIS applications within the State. There are several ongoing GIS database initiatives in which the Coordinator plays a principal role, primarily through the purchase of existing data sources or allocating funds for contractual and consulting activities:

**Mineral Lands Mapping Program (MLMP)**—The State GIS Coordinator provides general administrative oversight of the program, which is providing data development and advanced computer mapping capabilities in support of tax reassessment and valuation of the State's coal-bearing properties and other natural resource ownership. Four major data development projects are subsumed under the program: the Coal-bed Mapping Project at the West Virginia Geological and Economic Survey, the Digital Line Graph (DLG) Development Project at the GIS Technical Support Center at West Virginia University (WVU), the Mineral Parcel Mapping Project at the West Virginia Department of Tax and Revenue (WVDTR), and the Reserve Coal Valuation Project at WVDTR. The goal of the program is the creation of a consistent and standardized GIS database at 1:24000 scale covering the entire State. The data development activities of the program serve as the foundation for other GIS activities in other State departments and agencies, and also at the Federal, county, and local level. Fiscal 2003 activities were concentrated in southern coal-field counties of the State. Significant progress was made in the completion of the DLG coverages and creation of digital parcel map layers, as well as the coal-bed geometry for this region of West Virginia.

**West Virginia Statewide Addressing and Mapping Board (WVSAMB)**—In October 2001, the Governor appointed C.A. Neidig to the WVSAMB; Neidig was selected as board Chair in November 2001 and continues to serve in that capacity. The WVSAMB received a \$15 million grant from Verizon to complete the mapping and addressing work needed to improve Enhanced 9-1-1 (E9-1-1) services for the State's emergency response providers. Duties include annual budget preparation and fiscal oversight, chairing board meetings, providing presentations, preparation of requests for proposals and evaluation of bidders' responses, preparation of legislative rules, correspondence and other documents, oversight of contractors, and other duties as required. Executive Assistant to the Office of GIS Coordinator L. Cielensky was hired in July 2002 to prepare meetings and conduct administrative duties related to the WVSAMB. The WVSAMB selected a project manager, Michael Baker Jr., Inc., in September 2002 and a mapping contractor, BAE Systems, Inc., in January 2003. Aerial photography flights operated from February through April 2003 and data delivery is anticipated to start in October 2003. An addressing contractor will be selected by December 2003. The WVSAMB is scheduled to sunset in April 2007. For further information, the WVSAMB Web site is [www.addressingwv.org](http://www.addressingwv.org).

**West Virginia GIS Technical Support Center**—The State GIS Coordinator provided \$60,000 in supplemental funding to the Center at the WVU's Department of Geology and Geography to support research and data development ef-

## Data Collection

## Service

forts related to the MLMP's Digital Line Graph Project, and to acquire several data sets to support the Center. Among the projects this year C.A. Neidig worked with Technical Support Center staff were mapping and GIS issues related to Homeland Security requirements, and digital tax parcel mapping standards.

**West Virginia Department of Tax and Revenue**—C.A. Neidig assisted GIS Unit Supervisor Ed Maki and other WVDTR staff in the development of guidelines related to digital tax parcel mapping standards.

**Service Requests**—During the year, C.A. Neidig responded to dozens of requests for information regarding the GIS program from the general public, industry, academia, and government. Most were for general information, including availability of aerial photography and digital orthophoto quadrangles, status of MLMP data development, agency GIS activities, and State GIS program history. Neidig provided general information and assistance for computer system design specifications, request-for-proposal/quotation development, and GIS data requirements for several State agencies and counties and the WVSAMB. He met with various county and local officials, Federal agencies, representatives from utilities and industry, and GIS vendors and consulting firms to discuss potential data development and cost-sharing opportunities with the State.

**GIS Reports**—C.A. Neidig prepared updates to the GIS Coordinator section of the **2001-2005 West Virginia Information Technology Plan**, published by the Governor's Office of Technology; and assisted in preparation of budget descriptions and performance measures for GIS program sections of the Survey's fiscal 2004 budget request. He also assisted in the content development and review of the first edition (April 2003) of the **West Virginia 9-1-1 Addressing Handbook**. Survey staff assisted in the production of over 2,000 copies for distribution.

## Professional Activities/ Outreach

**Committees and Advisory Groups**—C.A. Neidig serves as Co-Chair of the National States Geographic Information Council (NSGIC) Communications Committee and is the NSGIC representative on the National Digital Elevation Program Steering Committee. He is a member of the Urban and Regional Information Systems Association (URISA) and the American Society for Photogrammetry and Remote Sensing. He represents West Virginia on the Federal Geographic Data Steering Committee, and is an associate or affiliate member of Miss Utility of West Virginia (One Call), the West Virginia Association of Land Surveyors, West Virginia E-911 Council, and the West Virginia Association of Counties. Neidig is the alternate Bureau of Commerce representative on the West Virginia Information Technology Council (ITC) and serves on the ITC Personnel Subcommittee. He also serves on the Bureau of Commerce Information Technology Committee, is Chair of the State GIS Steering Committee, and serves on the State Mapping Advisory Committee. Neidig chaired meetings of the GIS Steering Committee, 20 meetings of the WVSAMB, and assisted with preparations and presentations at the fiscal 2004 Executive and Legislative budget hearings for the Survey. Neidig served on the West Virginia Flood Management

# ***GEOGRAPHIC INFORMATION SYSTEM PROGRAM (CONTINUED)***

Task Force, attended six committee meetings, and assisted in the preparation of the GIS and mapping sections of the task force report, released in December 2002.

**Continuing Education**—C.A. Neidig participated in GIS sessions and presentations at the Federal Emergency Management Agency's Region 3 Workshop, Sheperdstown; the U.S. Geological Survey's Eastern Region State Mapping Workshop, Reston, VA; the ESRI Land Records Seminar, Morgantown; "Local Implementation," A URISA Summit to Promote National Data Partnerships and Collaboration, Washington DC; and the National Digital Orthophoto Program Steering Committee meeting, Sheperdstown.

**Presentations/Exhibits—**

- C.A. Neidig was organizer of the 2003 West Virginia GIS Forum and Exhibition, Charleston. The event included 30 exhibitors, 30 presentations, and attracted over 200 attendees. Neidig presented the talk, "WVSAMB Update," for the Clarksburg Lions Club, The West Virginia Association of Counties Annual Meeting, Charleston, the National Digital Orthophoto Steering Committee meeting, Sheperdstown, and participated in a panel discussion, "WVSAMB Update," at the West Virginia Emergency Telecommunicators Annual Conference, Charleston. Neidig presented "State Mapping and GIS Data Sources" at the Mapping and GIS Workshop, Glenville State College, and presented the keynote address, "So You Thought Lewis and Clark Had It Rough: Try Addressing a Whole State!," at the Missouri GIS Conference, MO. He was also a judge for the 2003 West Virginia Geography Bee, Charleston.
- C.A. Neidig, K. Donaldson of the GIS Technical Support Center at WVU, and Center staffers manned the GIS exhibit at the West Virginia Association of Counties Annual Meeting, Charleston.

# **GEOSCIENCE EDUCATION PROGRAM**

The Geoscience Education Program is now in its second decade of providing professional development “teacher experiences” to West Virginia’s kindergarten through 12th-grade (K-12) science teachers, unique education initiatives in geology continue to be developed and presented. These include a variety of cooperative programs, meetings, presentations, field trips, and workshops. The main goals of the Geoscience Education Program are to increase general citizenry awareness of earth science in general, and of the Geological and Economic Survey in particular. These are accomplished by encouraging the program’s primary audience—teachers and students—to formally and informally share their new-found understanding of how earth science is relevant to daily economic, social, political, environmental, and educational activities and issues, and to encourage the use of the Survey as a resource for geologic data, expertise, and outreach services. To facilitate these accomplishments, classroom-useful activities and lessons are developed. Improved and updated information on a broad spectrum of West Virginia geology is distilled and modified for actual classroom implementation. Development and evaluation of these materials and activities are carried on through a network of contractual and volunteer work involving private, government, business, and educational facilities.

## **Service**

### **Service Requests—**

- The Geoscience Education Program responds to numerous requests to visit classrooms, lead field trips, conduct tours of the Geological and Economic Survey, provide referral for educational equipment and publications, discuss classroom teaching strategies, and arrange professional outreach opportunities. Education Specialist T.E. Repine, Jr. works closely with the West Virginia Department of Education and faculty from West Virginia University and Fairmont State College to ensure Survey materials and training are appropriate to current educational pedagogy.
- This fiscal year, the total number of service requests (teacher experiences, mail, telephone, fax, and email) exceeded 1,100. This is an average of 92 per month, or five per working day.

### **Outreach—**

- In 11 years, the program surpassed 1,500 cumulative professional development teacher experiences. One professional development “teacher experience” represents outreach and assistance in the form of a time-intensive workshop, field trip, professional presentation and/or publication opportunity to a single teacher.
- The cumulative number of direct educational contacts of all types in 11 years has exceeded 6,400. These 6,400 contacts have resulted in the indirect transfer of awareness of the Survey and an appreciation of the relevance of geological knowledge to more than 132,000 classroom students in 52 counties.

### **RockCamp—**

- Under the direction of T.E. Repine, Jr., the Survey’s RockCamp project has become the keystone to the agency’s efforts to increase public appreciation for the earth sciences. Changes in educational pedagogy, improvements to facilities, and consolidation of personnel and paperwork have made the project one against which others are compared. The Survey’s full-time Education Spe-

cialist position has been copied and implemented by other state geological surveys. RockCamp addresses a critical need of West Virginia teachers by providing a on-going and permanent program which presents them with ideas allowing and encouraging development of classroom-useful lessons. In response to changing educational philosophy, RockCamp also provides participants with educational sessions lead by award-winning educators addressing current ideas in teaching and evaluation, and utilizes the many areas of expertise found among Survey staff.

- Originally funded for three years by the National Science Foundation (NSF) and the West Virginia Department of Education, RockCamp began it's twelfth year of summer workshops in 2003, with 26 teachers participating in a three-day field work experience to collect and organize field specimens for their classrooms.
- Continuation of the program has been made possible through sound fiscal management of the original grant, by new annual funding approved by the West Virginia Legislature, periodic funding obtained from the Department of Education's Coordinated and Thematic Science (CATS) project, and Eisenhower Professional Development grants administered by the West Virginia Higher Education Policy Commission. The West Virginia University (WVU) Department of Geology and Geography and education faculty from Fairmont State College have played an important role in the project's success. Many RockCamp participants, activities, and ideas have been incorporated into the Department of Education's Project CATS.
- Primary activity leaders include Geologist and Program Manager M.C. Behling (computers), Engineering Technician/Surveyor P.R. Liston and Geologist B.L. Nugent (maps and aerial photography), Administrative Assistant R.D. Lane (math skills), Geologist/Hydrogeologist J.S. McColloch (water), Administrative Service Manager G.J. Rowan (glaciers), Geologist and Program Manager S.W. McClelland (fossils and earthquakes), and Geologists J.M. Sutton, and J.Q. Britton (coal). In addition to activities lead by staff scientists, others, such as Maintenance Man G.C. Rowan, Editorial Assistant B.L. Schelger, Technical Photographer/Draftsman R.L. Strawser, Cartographer J.D. Barker, Production Assistant C.P. Bowman, and Coal Technician D.E. Bolyard, provide essential support and logistic services for the project.
- Nationally recognized Presidential Awardee educators provide RockCamp participants with a working teacher's perspective, as do the many RockCamp graduates who return each summer to share ideas. Dr. R.E. Behling, WVU, leads major field trips, and Dr. D.A. Hemler, Fairmont State College, directs classroom application of content knowledge.

**Funded Projects**—This fiscal year, the Geoscience Education Program received a No Child Left Behind grant of \$35,000. Administered by the West Virginia Higher Education Policy Commission, the grant was awarded for a project called GEOCATS, and will conclude in fiscal 2004.

## Professional Activities/ Outreach

**Committees**—As a member of the Project CATS Advisory Council, T.E. Repine, Jr. helps assess the success of this multi-million dollar NSF-funded program. Repine is National Councilor-at-Large for the National Association of Geology Teachers and was elected to serve on that organization's National Executive Council. He is also President of the 12-county North-Central West Virginia Mathematics, Science, and Technology Consortium.

### Presentation/Exhibits—

- T.E. Repine, Jr. and D.A. Hemler conducted several sessions on “Geologic Education and West Virginia Geology” at the statewide meeting of the West Virginia Science Teachers Association, Summers County. They also conducted a session, “The Impact of The Geoscience Education Program And The Role Scientists Can Play in Outreach,” at The annual meeting of the National Association of Geoscience Teachers, Buffalo, NY.
- T.E. Repine, Jr. awarded Mary Sue Burns of Pocahontas County High School the 2003 I.C. White Earth Science Teacher of The Year award.
- D.A. Hemler awarded the 2003 National Association of Geoscience Teachers Eastern Section Award to Debbie Rockey of Wellsburg Middle School, Brooke County.
- T.E. Repine, Jr., D.A. Hemler, R.E. Behling, and Dr. J.J. Renton of WVU conducted a three-day field trip for 22 West Virginia teachers to relate recent glaciation to land forms of West Virginia and neighboring states. They also conducted a short course, “Using Constructivism to Introduce Historical Geology,” at the National Association of Science Teachers meeting, Portland, OR.
- T.E. Repine, Jr., D.A. Hemler, and Geologist D.L. Matchen presented “Teachers as Field Geologists” at the Geological Society of America meeting, Denver, CO.

# **PUBLIC SERVICE PROGRAM**

**Requests for Information**—During the year the Public Service Program responded to 1,341 requests for information from the general public, industry, other branches of government, and academia. Questions ranged from hobbyists interested in the Mountain State's geology and where to collect fossils and minerals, to property owners concerned about geological hazards and what is located under their property, and business people with questions about the State's mineral resources. Most questions come by telephone or fax, but many people e-mail, write letters, search the Survey's Web site, or visit the Survey's offices.

**Earth Science Information Center**—The Survey's Earth Science Information Center (ESIC) is part of a national network providing public access to geographical and geological information. ESIC maintains extensive collections of aerial photographs, topographic maps, flood-prone area maps, geodetic control information, and other materials. These collections are frequently used by government, academia, the military, industry, and individuals for a wide variety of purposes. To maintain ESIC's efficiency and effectiveness, all of the information collections are being converted to digital formats. As a result of continued high levels of exposure and expanded services, the Survey's ESIC office received over 650 requests for service this year.

- ESIC's aerial photography acquisition service assists companies, government agencies, and individuals in obtaining aerial photography of specific areas. The availability of existing photography is researched and the photos are obtained for the requestor. A service fee recovers costs.
- Historic map and aerial photograph reproductions are available through ESIC. This service provides duplicate copies of materials in the Survey's collection. Material is reproduced with enlargement, reduction, cropping, etc., as requested on a high-resolution color printer/copier. A service fee recovers costs. ESIC's aerial photography collection continued to increase this year through acquisition of over 1,000 historic aerial photographs from the period 1938 to 1939.
- ESIC's flood-prone area information service assists companies, government agencies, and individuals in determining the flood potential for specific parcels of real estate. The requestor is assisted in selecting the appropriate map, locating the property, and obtaining map copies. A service fee recovers costs.

**Publication Sales**—Survey publications are sold to the public through the Publication Sales Office, the best source for maps of West Virginia in the State. The office makes printed reports and maps and paper or electronic copies of open-file reports and maps available by mail order, telephone order, or in person. Also available are the popular 7.5-minute topographic quadrangle maps produced by the U.S. Geological Survey (USGS) in cooperation with the West Virginia Geological and Economic Survey.

**Visiting Geologist Project**—In cooperation with the State Division of Tourism and Parks, the Survey conducts the popular Visiting Geologist Project at State Parks and other facilities throughout West Virginia. A Survey geologist or staff member presents a geologic talk and interpretive walk to park guests in exchange for lodging and meal, if available. This year, the project provided Survey staff as guest speakers and walk leaders for 11 parks where over 400 visitors participated.

**Service**

## Professional Activities/ Outreach

**Geographic Service**—Engineering Technician/Surveyor P.R. Liston resolved a controversy concerning the tallest mountains in the State and determined that, while Spruce Knob remains West Virginia’s highest peak, Thorny Mountain at Snowshoe supplants Bald Knob as the second highest peak. The story of the investigation appeared in the July 4, 2003 *Charleston Gazette*. In addition, Liston researched and resolved an issue concerning “halo” ownership of Department of Natural Resources property around Cheat Lake, Monongalia County

### Committees—

- Geologist K.C. Ashton is a member of the National Highway Geology Symposium Steering Committee and is the Survey’s representative for the West Virginia Facilitator’s Network. He is also a member of the American Geological Institute’s Earth Science Outreach Committee.
- Engineering Technician/Surveyor P.R. Liston and Geologist/Hydrogeologist J.S. McColloch serve as agency coordinators to the West Virginia Office of Emergency Services. They respond to situations requiring geological and geographic expertise, and assist the office in emergency preparedness and mitigation programs.
- P.R. Liston is a Board Member of the West Virginia High Accuracy Reference Network. Installed by the National Geodetic Survey, this is a network of reference stations that serve as control points for global positioning systems. Liston also serves as the West Virginia’s advisor and representative on all matters related to official State and county boundaries, and geodetic and geographic information. He is the West Virginia representative on the Council of Geographic Names Authorities in the U.S., a member of the Preston County Addressing Board, and an affiliate member of the West Virginia Association of Land Surveyors.

### Continuing Education—

- P.R. Liston attended the Emergency Response Commission and Office of Emergency Services-sponsored conference and workshop, “Working to Keep West Virginia Safe,” Charleston; the USGS Cooperators Forum and Workshop, Reston, VA; the NASA and USGS-sponsored workshop, “Remote Sensing,” Sioux Falls, SD; the WVU-sponsored conference and workshop, “Appalachian Remote Sensing,” Morgantown; and at the West Virginia Association of Land Surveyors Convention, Charleston, the courses “New Airborne Mapping Tools and Product Development Techniques,” “Floodplain Management,” and Boundary Research in West Virginia and Research Analysis.” In addition, Liston completed the Glenville State College-conducted courses “Understanding GPS and Its Applications,” Snowshoe; “Mapping and GIS,” Glenville; and “Applications of Boundary Law,” Charleston.

### Presentations/ Exhibits—

- The Public Service Program represented the Survey throughout the year with exhibits at various events and meetings ranging from professional societies to civic organizations. In addition, speakers are provided to a variety of schools and civic groups.
- Geologist and Program Manager S.W. McClelland was a judge at the 2003 West Virginia North Central Regional Science Fair, Fairmont State College.

## ***PUBLIC SERVICE PROGRAM (CONTINUED)***

- P.R. Liston helped coordinate the GPS observation field trip, workshop, and seminar for the conference, “How High’s the Mountain, Momma?”, Snowshoe. He was also lead speaker at that event which resolved the controversy over West Virginia’s three highest peaks. In addition, Liston conducted an ESIC display and exhibit at the West Virginia Association of Land Surveyors Convention, Charleston, and at the West Virginia Industrial Expo, Charleston.

# **PUBLICATIONS AND GRAPHICS PROJECT**

## **Publications**

### **New Publications—**

**Annual Report of the West Virginia Geological and Economic Survey, 2002:** publication AR-02, 98 pages.

**Preliminary Bedrock Geologic Map of the Circleville Quadrangle:** R.R. McDowell, K.L. Avary, D.L. Matchen, R. Diecchio, S. Cole, and A. Gross, 2002, publication OF0201, 1:24,000 scale.

**Preliminary Bedrock Geologic Map of the Thornwood Quadrangle:** R.R. McDowell, K.L. Avary, D.L. Matchen, R. Diecchio, S. Cole, and A. Gross, 2002, publication OF0202, 1:24,000 scale.

**The Coal Availability Study in West Virginia: Tables of Results for Mount Storm Lake and Weirton 7.5-minute Quadrangles:** E.I. Loud, 2003, publication OF0301, 14 pages.

**Revisions—Publications, Maps, and Services of the West Virginia Geological and Economic Survey:** 2002, publication ED-A, 56 pages.

### **Miscellaneous Publications—**

- Booklets outlining the agency's program and fiscal information, activities, and finances during fiscal 2002 and 2003 were produced and distributed to legislators.
- Agency letterhead was converted to digital format, eliminating the need and expense of printed letterhead.
- Business cards were produced for many staff members.
- Business envelopes, travel forms, and purchase order forms were produced.
- Mont Chateau note sheets and phone lists were produced throughout the year.
- New nameplates for office doors were produced.
- Various materials were produced for an interim Government Affairs Committee meeting.
- Media releases and publication announcements were produced for publications released to the public during the period, and media releases were produced for events sponsored and conducted by the Survey.

The Publications and Graphics Project provides editorial, composition, design, drafting, cartographic, photographic, xerographic, and digital and print production services for Survey research, service, and outreach efforts, and Survey-affiliated programs. In addition, the project provides publications production support and materials to professional societies and other organizations. In a year's time, this constitutes numerous publications, from reports, maps, CDs, and journal articles to forms, cards, and flyers. Extensive work is done producing posters, and other visual and printed material for presentations and exhibits. Also, editorial, cartographic, and production guidance and advice is given to Survey staff on a continuing basis.

**Service Requests**—Although the vast majority of service the Publications and Graphics Project provides is in support of Survey operations, the project does provide assistance to the public, other government entities, academia, and industry on requests for information concerning Survey publications, and editorial, cartographic, and digital and print production techniques. In addition, project personnel devote significant time in assisting other Survey staff in locating and reproducing archive and open-file material in response to service requests.

**Mineral Parcel Mapping Project**—Editorial, graphic, and production support was given to this project to produce quarterly reports, mailouts, contract and agreement documents, manuals, overhead transparencies, posters, booklets, spreadsheets, and other explanatory and promotional materials. Extensive cartographic support was given in digital editing of mined areas.

**STATEMAP Geologic Mapping**—Production assistance was given for open-file publications.

**Geographic Information System Program**—The project gives extensive support to this program through production of reports, promotional materials and other publications, Web site assistance, and graphic and event support. The project also assists with activities of the Statewide GIS Coordinator's office, this year including production and distribution of the West Virginia 9-1-1 Addressing Handbook and CD.

**Geoscience Education Program**—A wide variety of items were produced for various earth science teachers' workshops and RockCamp activities including presentation and training booklets, handouts, photos, schedules, flyers, posters, certificates, and reports. Significant resources were devoted to the revision of a teacher-authored, interactive CD on the geologic history of West Virginia as well as producing materials for a teacher education seminar. In addition, project staff assist in administrative and other support activities for the Geoscience Education Program.

**Web Site**—The Publications and Graphics Project is responsible for editorial and graphic development for, and content management of the agency's Web site. Additions and revisions of site content occur continuously, and this year saw a major revision of the Geoscience Education section.

## Service

## Professional Activities/ Outreach

**Digital Product Development**—A major effort continues this fiscal year to convert existing Survey publications and produce new publications solely in digital formats. The goal of the effort is to enable publications to be distributed on CDs, by e-mail, as digital files, or as hard copy, depending on a user's wishes and capabilities. Customized products will also be capable of being produced. A working group continues to develop and oversee standardized methodologies and procedures to produce digital maps and publications.

- As work continues on a digital revision of the State's transportation map, the software and procedures derived from that project are being applied to map products from the STATEMAP project. From this, standardized format and content guidelines and production procedures will be established, not only for STATEMAP products, but all future digital Survey maps.
- Work continues on reissuing the agency's famed County Geologic Report series volumes and maps on CDs. With all of the large-format maps scanned and archived, efforts continue on the scanning the report volumes. It is hoped all of the report series will be available for reissue in Spring 2004.
- Contacts were made with the Division of Tourism on the possibility of producing a Web-based, interactive map of golf courses in the State. Such a product is an offshoot of the technology used in the interactive coal-bed mapping pages on the Survey's Web site. After a demonstration of the capabilities of interactive maps, Tourism officials agreed to supply the data and information needed to construct such a map.

**Other Activities**—A number of abstracts, professional papers, and funding proposals were edited and given production assistance; News releases, certificates, and photos were produced as part of the Bureau of Commerce's Employee of the Quarter and Employee of the Year program; booklets were produced for the West Virginia University Credit Union; editing and production continued on a joint agency and U.S. Geological Survey literature review which will be issued as an agency publication; project staff participated in meetings and activities of the Survey's Pricing Committee, Information Technology group, and Intranet Committee; and photos, media contacts and news releases, and other support was given to the swearing in ceremony of Director C.J. Smith.

**Informational and Promotional Material**—In a continuing effort to keep the public informed and aware of the Survey's activities and services, information flyers, handouts, publications catalogs, posters, bookmarks, and brochures were produced and distributed at the numerous conferences, displays, meetings, and other events attended by Survey personnel.

**Publication Sales Displays**—Catalogs, flyers, display materials and other items were produced to support sales efforts at sports shows, the West Virginia State Fair, and other events. Project staff assist at many of these events.

**County Outreach**—Packets containing handouts and posters, publications catalogs, talking points, and other materials highlighting the services and products of the agency were produced for distribution to county clerks' offices throughout the State.

## **PUBLICATIONS AND GRAPHICS PROJECT (CONTINUED)**

**Gem and Mineral Show**—Catalogs, handouts, and flyers were produced for this annual event.

**Geographic Information System (GIS) Forum and Exposition**—Significant project support was given to this event, held in Charleston in fall, 2002. Developed and produced were registration booklets and materials, nametags, forms, posters, mailing list operations, Web site operations, promotional and informational materials, signs and banners, news releases, t-shirts, and GIS program reports. In addition, on-site support was given at the event by project staff.

**Presentations/Exhibits**—The project produces a variety of materials for talks, displays, exhibits, presentations, and journal articles. These materials involve varying combinations of drafting, cartographic, photographic, editorial, compositing, digital design, and xerographic work. Among them this year were:

- Materials and handouts for a Petroleum Technology Transfer Council presentation.
- New label and placards for the Survey's museum displays.
- Editorial and production support for meetings of the American Association of Petroleum Geologists.
- Editorial and production support for the national AAPG meeting.
- Editorial and production support for a Geological Society of America meeting.
- Editorial and production support for presentations on the Geoscience Education Program at meetings of the West Virginia Science Teachers Association, the National Science Teachers Association, and the Geological Society of America.
- Handouts for several presentations to school students.
- Catalogs and flyers for presentations on the Survey's Earth Science Information Center.