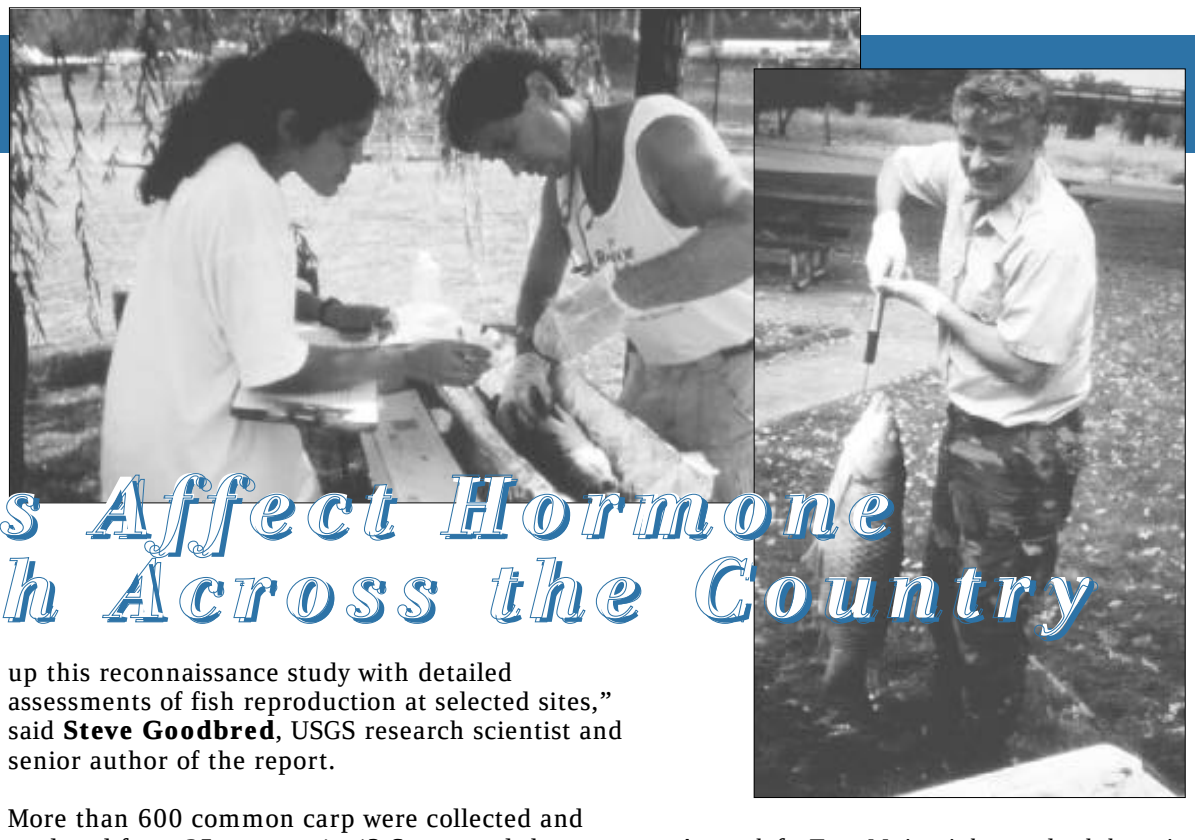
Gordon Eaton, Director
Kathleen Gohn, Bureau Editor



Contaminants Affect Hormone Levels in Fish Across the Country

Study Finds Cause for Concern

Levels of fish sex hormones—estrogen and testosterone—may be affected by contaminants in some U.S. streams, according to a recent USGS report. These hormones, which are produced by the endocrine system, regulate important physiological functions, including sexual development and reproductive ability. The national reconnaissance study that produced the report is the broadest investigation to date of the potential for endocrine disruption in fish.

"The finding of a correlation between hormone levels and contaminant levels in fish from such diverse locations is both a cause for concern and a call for further investigation," said **Dr. Gordon Eaton**, USGS director. "With its extensive water quality and new biological research capabilities, the USGS has a unique responsibility to provide critical resource information such as this to policymakers across the government and in the private sector."

The study did not assess whether the apparent disruptions in endocrine systems have adversely affected fish. "Since altered sex hormones may cause reproductive impairment, we need to follow up this reconnaissance study with detailed assessments of fish reproduction at selected sites," said **Steve Goodbred**, USGS research scientist and senior author of the report.

More than 600 common carp were collected and analyzed from 25 streams in 13 States and the District of Columbia. The selected streams drain areas with a wide range of land uses and different degrees of contamination. Results of the study indicate significant differences in sex hormones and vitellogenin, an estrogen-controlled protein necessary for egg development in fish and birds. Although some of these differences probably result from natural variability, correlations between contaminants and the levels of sex hormones in carp indicate that some of the site-to-site differences were associated with certain contaminants.

It is not yet possible to pinpoint which specific contaminants or factors may be related to the significant differences noted among the hormones. The groups of contaminants that were significantly correlated with hormones were pesticides in water, phenol compounds in streambed sediments, and organochlorine compounds in biological tissue.

The study was a collaborative effort among the National Biological Service (now the Biological Resources Division of the USGS), the USGS, and the University of Florida's Biotechnologies for the Ecological, Evolutionary, and Conservation Sciences Program. Most of the sites sampled are established water-quality sites of the National Water Quality Assessment program, a major USGS initiative responsible for assessing the levels and distribution of contaminants in the nation's water resources.

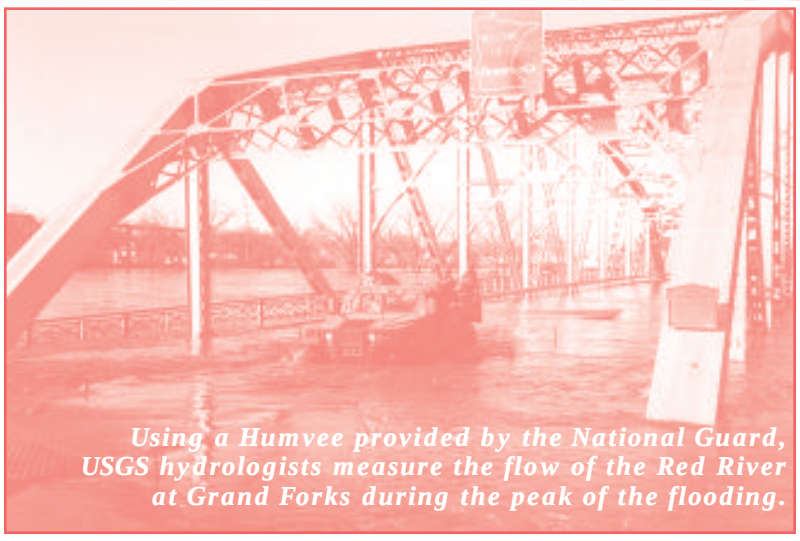
At top left, Tom Muir, right, and a lab assistant take tissue samples for lab analysis. At top right, Steve Goodbred, first author of the report, holds an extremely large carp.

The report is entitled *Reconnaissance of 17b-estradiol, 11-ketotestosterone, vitellogenin, and gonad histopathology in common carp of United States streams: Potential for contaminant-induced endocrine disruption*. It was authored by Steven L. Goodbred, Robert J. Gilliom, Timothy S. Gross, Nancy P. Denslow, Wade B. Bryant, and Trenton R. Schoeb (USGS Open-File Report 96-627). The report is available for inspection on the World Wide Web at http://water.wr.usgs.gov.

Assessing the Red River's Historic Flood

As North Dakota's Red River receded after record spring flooding, USGS specialists began studying the flood's effects on river structures and water quality, and collecting streamflow information to refine flood forecasting models.

The April-May flooding in North Dakota far exceeded previous floods in 1950, 1969, 1978, 1979 and 1996. On April 17, flow of the Red River of the North at Grand Forks, North Dakota, broke a 100-year-old record of 85,000 cubic feet per second (cfs) or 55 billion gallons per day (bgd) that was set in 1897. The river continued to rise until it crested about 54 feet at Grand Forks on April 21, exceeding the maximum flood level recorded in 1897 by about four feet; the maximum flow was 112,000 cfs (72 bgd).



Using a Humvee provided by the National Guard, USGS hydrologists measure the flow of the Red River at Grand Forks during the peak of the flooding.

As the floodwaters receded, the USGS, in cooperation with several state agencies, began making additional measurements to assess the flood's overall impact. In the aftermath of a flood, USGS crews monitor the flow of the affected river to build a comprehensive profile of the flood, to track evidence of scour at bridges, which can be severely eroded and destabilized during floods, and to sample water quality to determine the presence and movement of toxic chemicals and sediments as the result of the flooding.

Discharge measurements are essential to developing flood-forecasting models and helping to understand the nature of a particular flood. In addition, streamflow discharge data collected by the USGS are the basis for the design of dams, bridges, water-treatment and waste-water treatment plans, and the formulation of environmental regulations.

While river stage—the height of the river during a flood—is an important piece of the flood picture for the public, river discharge is more commonly used for technical design and scientific study. Many engineering structures (flood-control reservoirs, for example) are designed to pass, treat, or hold a volume of water for a specific period of time. In these cases, the discharge is the primary design variable and the piece of information that is most highly valued.

In addition, in order to use streamflow data, scientists must often transfer data collected at one site to other locations along a river course or to nearby rivers where data are not available. For most purposes, discharge data provide the most transferable information. Discharge at one site is often directly related to discharge at other sites on the same or nearby rivers, but river stages at different sites are rarely correlated as easily and usually are of limited value beyond the immediate vicinity at which they are collected.

Nationwide, 1997 has already been a year of extensive flooding. Since January 1, more than 175 USGS streamflow-gaging stations have been seriously damaged or destroyed by major floods in California and Nevada, the Pacific Northwest, the Ohio River Valley, and North Dakota. The USGS worked quickly to replace and repair stations and to keep the information flowing from this network.

Through its network of 7,000 streamflow-gaging stations, which are cooperatively funded by more than 700 federal, state, and local agencies, the USGS provides vital information to the agencies responsible for flood warnings and river forecasts. Under this program, which has operated since 1887, the USGS collects streamflow information needed by federal, state and local agencies for planning and operating water-resources projects and for watershed management, in addition to flood warnings.

In recent years, the network has changed considerably with the advent and widespread use of real-time streamflow data. More than 60 percent of the stations in the network use satellite radio transmitters to broadcast data 24 hours a day directly to cooperators like the National Weather Service, who in turn use the information to provide river forecasts and flood warnings. The number of stations equipped with data-collection platforms, which provide for the real-time data, has more than doubled in the past ten years, even though the overall number of gages is decreasing.

General access to the real-time data is available through the World Wide Web on the Internet. Those in need of information on the height and flow of a river—from flood forecasters to fly fishers—can access state-by-state information through the USGS main home page at: http//www.usgs.gov/. By clicking on the word "water" and then accessing "real-time streamflow," users can click on the state for which they need information and then the individual river where gaging stations are located.

Helping Restore Appalachia's Damaged Streams

In partnerships with other federal agencies such the Office of Surface Mining (OSM), states, academia, industry, and local interest groups, the Biological Resources Division of the USGS is helping to restore acid-damaged streams in the Appalachian coal region. BRD is helping to reduce recovery costs and improve aquatic resources by developing new technologies to treat the acidity and by producing new information on biological effects to assist management.

Appalachian streams provide unique recreational opportunities for an expanding urban and suburban population. However, many of these streams also suffer from the degradation created by the extraction of another important Appalachian natural resource—coal.

More than 8,000 miles of streams in the Appalachian coal region have been affected by acid mine drainage (AMD). In Pennsylvania alone the 3,200 miles of stream degraded by AMD create an estimated annual loss of $67 million in revenue associated with sport fishing.

Additional miles of streams have been acidified by the byproduct of burning coal—the emissions form acidic deposition that is transported in the atmosphere, traveling long distances to affect even remote streams. In Pennsylvania, for example, it is estimated that more than 1,800 miles of trout streams are influenced by this form of acidity. New cost-effective treatments are needed to restore stream water quality degraded specifically by AMD. One such tool has been designed and is being developed by the USGS Leetown Science Center in cooperation with the Freshwater Institute, Shepherdstown, West Virginia. The equipment was demonstrated during a recent visit by **OSM's Acting Director Kathrine Henry**.

"The pulsed-bed design of this new equipment uses carbon dioxide to improve dissolution of granular limestone, increasing alkalinity and reducing acidity in the treated water," explained **Barnaby Watten**, a scientist at the Leetown Center. "This technology also prevents metal coating of the limestone materials used for treatment." Limestone is a natural buffering agent, but it often becomes covered by the iron that precipitates during the treatment reaction, in a process called "armoring."

Preliminary trials of the equipment have been very promising. At the National Park Service's Friendship Hill Historic Site in Pennsylvania, the treatment of an AMD stream on the property raised the pH of the water from 2.6 to 7.3, well within the range of a biologically healthy stream. Additional field tests, supported by a USGS State Partnership grant, are currently underway at the state-operated Toby Creek AMD treatment plant near Kersey, Pennsylvania.

A patent application has been submitted and the next steps in the process include further field tests and the use of cooperative research and development agreements to assist in the technology transfer.

Barnaby Watten, left, BRD scientist, explains the new AMD treatment technology being developed at USGS Leetown Science Center to Kathrine Henry, far right, acting director of the Office of Surface Mining, during a recent demonstration. From left, are Watten, Fred Fox (OSM), Vermell Davis (OSM-with back to camera), Hardy Pearce (BRD), and Kathrine Henry.

Related biological studies are examining the behavioral effects on fish exposed to acute increases in dissolved carbon dioxide and determining the health of wild fish after stream treatment. **Bill Krise** at Leetown Science Center's Research and Development Laboratory in Wellsboro, Pennsylvania, and colleagues at Pennsylvania State University are concurrently conducting this research.

The toxicity of AMD effluent on fish and aquatic invertebrates and the effects of manganese, one of the metal precipitates, is also being investigated. Additionally, cooperators at Cornell University are developing a computer program that will simulate performance of the equipment and assist in field applications.

The Leetown Science Center has worked since 1985 to develop and demonstrate treatment technologies for Appalachian highland streams damaged by acid deposition. "Working with the West Virginia Department of Natural Resources, a rotary drum treatment system was tested on Dogway Fork and application of this technology has contributed to the restoration of approximately 25 miles of the Cranberry River," said **R. Kent Schreiber**, the research manager at the Leetown Center.

The restoration effort has provided additional fishing opportunities that add an estimated $2 million annually to the revenues of the State of West Virginia. This technology, as well as the cooperative effort to test direct application of limestone sands to the stream bed, is now being used on other streams with measurable success. "One of our goals in building these cooperative projects," said Center Director **Bill Palmisano**, "is to demonstrate the effectiveness of partnerships and a shared vision to improve our resource management."

By participation in Appalachian Clean Stream Initiative, Eastern Mine Drainage Federal Consortium, and Mid-Atlantic Highlands Coordinating Council, the USGS has joined with more than 40 government and citizen groups to ensure this technological and biological information is widely distributed.

Geologic Division Targets AMD

Several projects within the USGS's Geologic Division are focussed on aspects of acid mine drainage in the Appalachian basin. AMD associated with mineral deposits is also a significant problem in the region. For both coal deposits and mineral deposits, the culprits are the same: pyrite (iron sulfide) and other heavy-metal sulfide minerals that weather to produce acidic, heavy-metal laden waters.

Acid mine drainage destroys vegetation and impacts downstream areas miles from the pollution source.

The primary objective of the first project is to develop the ability to predict locations that are prone to acid mine drainage and other potentially hazardous impacts of surface coal mining. Current methods of sampling coal-bearing rocks to determine potential acid production in mining and reclamation are nonrepeatable and subjective, making prediction, mitigation, and treatment difficult.

This project is developing methods to use geophysical logging tools to chemically characterize the rock layers to predict the acid-producing and -neutralizing potential of the rocks.

The second project is determining the role of bacteria in the detection and treatment of acid mine drainage. Natural precipitates of iron compounds can easily be confused with AMD from active and abandoned coal mines. Bacteria that produce AMD create yellowish precipitates, in contrast to those producing reddish precipitates where neutral ground water discharges. This project has used remote sensing techniques to discriminate between these two different kinds of precipitates, in cooperation with federal and state agencies tasked with environmental protection from AMD.

In cooperation with the National Park Service, industry, and other stakeholders, the Geologic Division is investigating the geochemical controls on acid mine drainage associated with massive sulfide deposits—deposits that are as much as 50 percent pyrite and heavy-metal sulfides. Historically, massive sulfide deposits have been valued for their sulfur content, and more recently, for the copper, lead, zinc, gold, and silver they contain. Changing economic conditions have resulted in the abandonment of many of these mines.

The goals of the research effort are to provide a better understanding of the environmental signatures of these deposits to aid land-use planners and industry in their decision making process, and to improve our theoretical understanding of the environmental processes that affect these deposits to aid reclamation efforts.

At the Cabin Branch Pyrite Mine, now within the National Park Service's Prince William Forest Park, Virginia, the discovery of more economic sources of sulfur caused the closure and abandonment of the mine. The National Park Service recently reclaimed the site. The USGS is cooperating to evaluate the success of the reclamation by assessing the current ground- and surface-water quality.

In the Great Smoky Mountains National Park of North Carolina and Tennessee, the USGS is cooperating with the National Park Service to investigate the geochemical controls on water quality associated with the abandoned Fontana and Hazel Creek mines in the southern part of the park.

Preliminary results indicate that watersheds draining regionally extensive, pyrite-bearing country rocks in the park produce natural acid "rock" drainage that represents a greater load of acid and heavy metals than the comparatively insignificant drainage issuing from the abandoned mines, which locally have greater acid and heavy-metal concentrations. Ironically, the Great Smoky Mountains ecosystem has been adapting to the natural acid rock drainage for millions of years.

AMD Interest Group:

Additional information is available through the Internet Newsletter of the USGS Mine Drainage Interest Group at http://water.wr.usgs.gov/mine/

Pettinger Honored for Remote Sensing Work

The Alan Gordon Memorial Award was presented to USGS scientist **Lawrence R. Pettinger** by the American Society for Photogrammetry and Remote Sensing during the Society's annual convention in Seattle, Washington. The award was given in recognition of Larry's career accomplishments in remote sensing research, remote sensing program coordination, operational remote sensing applications, and technology transfer of remote sensing.

Larry Pettinger, left, receives the Alan Gordon Memorial Award from Dr. Tina Cary, president of the American Society for Photogrammetry and Remote Sensing.

The purpose of the award, which was presented on April 9, is to encourage and commend individuals who contribute significant achievements in remote sensing and photographic interpretation.

Our $400 Billion Minerals Industry

The United States' output of mineral-based materials contributed nearly $400 billion to the nation's economy in 1996, according to a new USGS report. *Mineral Commodity Summaries 1997* is the latest government publication to provide detailed information on 1996 events, trends, and issues in the domestic and international minerals industries.

The report summarizes minerals industry trends according to continent and mineral type and also provides an outlook for domestic minerals growth for 1997. It also provides statistics on the major world production of nearly 90 mineral commodities supported by cooperative information exchange partnerships with more than 60 countries.

According to Mineral Commodity Summaries 1997:

The value of U.S. raw nonfuel minerals production remained at $38 billion in 1996. The value of domestic minerals production has increased in 30 of the past 36 years. The top three states were Arizona ($3.5 billion), Nevada ($3.2 billion) and California ($2.8 billion). Delaware ranked 50th ($11 million).

Total U.S. international trade in raw minerals and processed materials of mineral origin was valued at $88 billion in 1996. Imports of processed mineral materials were valued at an estimated $49 billion, and exports were valued at an estimated $33 billion. Imports of metal ores and concentrates and raw industrial minerals increased 8 percent to $2.6 billion. Exports of raw minerals increased slightly to $3.1 billion.

The outlook for the domestic minerals industry in 1997 will depend largely on the demands for metals by the automobile industry and for industrial minerals by the building and highway construction sectors. These industries are significant consumers of steel, aluminum, copper, glass, cement, crushed stone, and sand and gravel.

On the international scene, global mineral priorities were focused on gold, nickel, steel, aluminum, cobalt, and base metals. Demand for industrial/construction minerals was fueled by economic growth in Asia and Latin America.

The report is available for purchase from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. The stock number is 024-004-02443-7; the price is $16 inside the United States and $20 if ordering from outside the nation. Individual two-page summaries are available through MINES FaxBack (703) 648-4999 and are on the World Wide Web at http://minerals.er.usgs.gov/minerals.

USGS Scientists Help Students Study AMD

Fourth graders at Kingwood Elementary School (Preston County, West Virginia) were treated to an acid mine drainage Earth Day activity by a bevy of earth scientists. The group included USGS scientists, **Eleanora Robbins** and **Melvin Mathes**, a USGS volunteer, **Cindy Warren**, and colleagues from USDA-Natural Resources Conservation Service, **Brooke Levy**, West Virginia State Soil Conservation District, **Jill Hauser**, and Monongahela Soil and Water Conservation District, **Mary Lebnick**.

The Cheat River Watershed Association also provided membership cards for each student. Teacher **Linda Newcome** had the students primed with water samples they collected from their wells, creeks, ponds, and the Cheat River.

Lacking fish in many rivers, Preston County is one of the places in West Virginia most highly affected by abandoned coal mines. Some samples were very acid indeed (pH 2.5—more acid than vinegar). Water from the drinking fountain and toilet were also tested for acidity (and hilarity), along with cola and non-cola soda pop, which are more acid than the streams in Preston County.

All the local data were transferred to a large map of the county. The activity was covered by reporters from a local newspaper and TV station. The following day, a parent sent in a note reporting that her son had shifted his career goal to becoming a scientist and saving mankind.

Students at Kingwood Elementary listen to USGS scientist Eleanora Robbins. In right foreground is Jill Hauser. Photo by Mary Lebnick

Teacher Linda Newcome and her 4th-grade students at Kingwood Elementary School in West Virginia. Photo by Mary Lebnick

Where Has All Their Water Gone?

USGS Maps an Answer

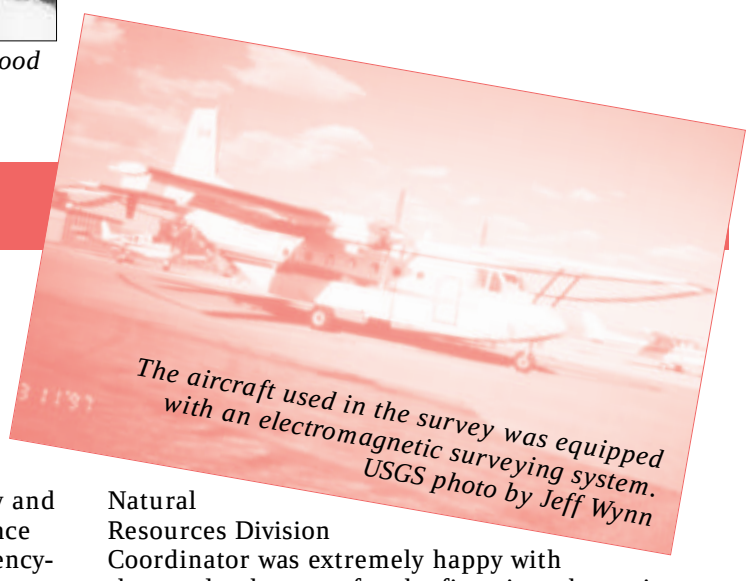
Since 1978, there has been intense political and legal controversy in southeastern Arizona over the effects of ground-water withdrawal by the Fort Huachuca Army base and the neighboring town of Sierra Vista on the nearly San Pedro Riparian Refuge.

The Upper San Pedro River basin hosts a remarkably diverse range of wildlife, some of it endangered. At the Ramsey Canyon Nature Conservancy Reserve, for instance, at least 15 different species of hummingbirds have been identified. In 1978 a Riparian Refuge was established along the San Pedro River, whose drainage basin extends into northern Mexico.

There are only a few wells in the area, so the extent and character of the water table are not well known. This lack of hard data was fundamental to the disagreements. Recently, USGS geophysicist **Jeff Wynn** extended earlier geophysical studies by supervising an airborne electro-magnetic survey to characterize the ground-water hydrology of the Upper San Pedro drainage around the Army base.

The survey area included several active gunnery and artillery ranges, a busy unmanned reconnaissance aircraft test range, and a Drug Enforcement Agency-tethered drug-interdiction dirigible (called an Aerostat). Support from and coordination with local military authorities was excellent.

Jeff and his colleagues are still developing the software needed to fully interpret the new electromagnetic survey data, but the initial conductivity-vs-depth profiles examined go a long way toward explaining how the geology affects the aquifer in this region. The Army Environmental and Natural Resources Division Coordinator was extremely happy with the results, because for the first time the entire water table has been continuously mapped.



The aircraft used in the survey was equipped with an electromagnetic surveying system. USGS photo by Jeff Wynn

The coordinator can now see, among other things, structures in the basin that both channel and block the aquifer in different places. Further analysis of this new data set should show the relationship (if any) between Upper San Pedro aquifer being tapped by the Fort Huachuca well-field and the surface water flow in the San Pedro Riparian Refuge.

Office of Surface Mining and Reclamation

Kathrine L. Henry, Acting Director
Jerry Childress, Bureau Editor

Kathy Karpan of Wyoming Nominated OSM Director

Calling her a "no nonsense administrator," **Secretary Babbitt** praised the selection of Wyoming state leader **Kathy Karpan** as the next director of the Office of Surface Mining Reclamation and Enforcement. President Clinton announced his intention to nominate Karpan on May 6. She must be confirmed by the Senate.

"Kathy Karpan has the background, experience, integrity, and impressive professional qualifications that are needed to help protect America's natural resources and carry out the vigorous program at OSM," Babbitt said.

Karpan was elected in 1986 and reelected in 1990 to serve as Wyoming's secretary of state, the second highest office after governor. Prior to that she spent two years on the Wyoming attorney general's staff and two years (1984-86) as director of Wyoming's Department of Health and Social Services, one of the largest agencies in the state government.

Karpan currently serves as the manager of Karpan & White Law Offices, and president of the Karpan & White Corporate Services. Her other work experience includes serving as deputy director of the Office of Congressional Relations and later as legal counsel in the Economic Development Administration, U.S. Department of Commerce (1978-81), during the **Carter Administration**.

She spent six years on the staff of U.S. Representative **Teno Roncalio**, as press secretary and later as chief of staff. Karpan also worked as a journalist for newspapers in Cody and Cheyenne, Wyoming, and for the Canberra Times in Canberra, Australia.

A native of Rock Springs, Wyoming, and the daughter of a coal miner, Karpan earned both a bachelor's degree in journalism and a master's degree in American Studies from the University of Wyoming, and a J.D. from the University of Oregon.

Kathy Karpan, a Wyoming state leader, attorney, experienced government administrator—and daughter of a coal miner—has been nominated by President Clinton to lead the Office of Surface Mining and Reclamation.

Upon confirmation by the Senate, Karpan will become the 13th director of the 20-year old Office of Surface Mining Reclamation and Enforcement. The OSM Director has policy and administrative responsibility for developing and enforcing mining regulations under the Surface Mining Control and Reclamation Act. The agency operates with an annual budget of $271 million and a work force of 670 employees nationwide.

Citizen Awards Program

OSM is establishing a program of Citizen Awards to recognize outstanding contributions by coalfield citizens and grassroots organizations to the implementation of the Surface Mining Control and Reclamation Act.

OSM **Acting Director Kathrine L. Henry** said nominations from the public are being sought in two categories: Regional Awards, and Partnership Awards. OSM also will present a Director's Award recognizing an individual's lifetime contributions.

"Citizen participation is at the heart of the surface mining program," Henry said. The surface mining law would not have come into being without the sustained efforts of coalfield citizens crusading to end the environmental abuses of the past and shift the country to new ways of mining coal with built-in safeguards for people and the environment.

Kathrine L. Henry
OSM Acting Director

"Once the surface mining law was passed, it created many avenues for citizens to get involved," Henry said. Thus individual citizens have a statutory role in practically every phase of the surface mining program.

"At the 20-year mark, it is only fitting for those whose contributions have meant the most to receive public recognition for their efforts on behalf of safeguarding the coalfield environment and protecting people's homes and farms from potentially damaging effects of coal mining.

Nominations should give the name, address, and telephone number of the individual being recommended for a Citizen Award, plus organizational affiliation, if any. The most important part of the nomination is a brief description (two to three pages) of the nominee's work on behalf of the implementation of the Act's programs and activities. Awards will be presented August 3, 1997, in connection with the Act's 20th anniversary observances. Completed nominations should be sent to the nearest Coordinating Center:

Appalachian Regional Coordinating Center, Office of Surface Mining, 3 Parkway Center, Pittsburgh, PA 15220, FAX (412) 937-2903; Mid-Continent Regional Coordinating Center, Office of Surface Mining, Alton Federal Building, 501 Belle Street, Alton, IL 62002, FAX (618) 463-6470; Western Regional Coordinating Center, Office of Surface Mining, 1999 Broadway, Suite 3320, Denver, CO 80202-5733, FAX (303) 672-5622.

OSM EEO Specialist Diane Wood joins New Mexico State University vice president Averett Tombes, and WRCC Director Rick Seibel in signing a cooperative agreement to provide funding for Hispanic students to develop geographic information system coverages and scientific research relating to reclamation of surface coal mines in New Mexico, Kentucky and Tennessee. Support for this and similar initiatives is part of an OSM plan to increase educational and employment opportunities for Hispanic and other minority students.

Shirley Lahr

Excellence in Government Award to Shirley Lahr of OSM's Denver Center

Shirley L. Lahr of OSM's Western Regional Coordinating Center in Denver, Colorado, has been named runner-up for Outstanding Equal Opportunity and Special Emphasis Program Coordinator as part of the 35th Annual Excellence in Government Awards Program, sponsored by the Denver Executive Board.

Beginning in January 1996, Lahr coordinated the Center's initiative for sponsoring minority candidates in the Department's Summer Intern Program. Her efforts aided summer interns in becoming familiar with mining and reclamation on Indian tribal lands, while also learning about the regulatory process that governs those activities, in addition to exploring government employment possibilities.

During fiscal year 1997, Lahr assumed responsibility in OSM offices nationwide for ensuring the agency's compliance with laws and regulations for federally conducted programs and activities to ensure accessibility for persons with disabilities.

OSM officials said that Lahr's initiative both in the federal workplace and in implementing programs with states and tribes will have permanent benefits in making the federal/state/tribal workforce more diverse, and will result in a quality workforce with more cultural awareness.