



ANNUAL REPORT 1992



WATER RESOURCES DIVISION
NATURAL RESOURCES REPORT NPS/NRWRD/NRR-93/02

The National Park Service Water Resources Division is responsible for providing water resources management policy and guidelines, planning, technical assistance, applied research, training, and operational support to units of the National Park Service. Program areas include water rights, water resources planning, regulatory guidance and review, hydrology, water quality, watershed management, watershed studies, and aquatic ecology.

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WATER RESOURCES DIVISION

National Park Service
Fort Collins, CO 80525

Natural Resources Report NPS/NRWRD/NRR-93/02

April 1993



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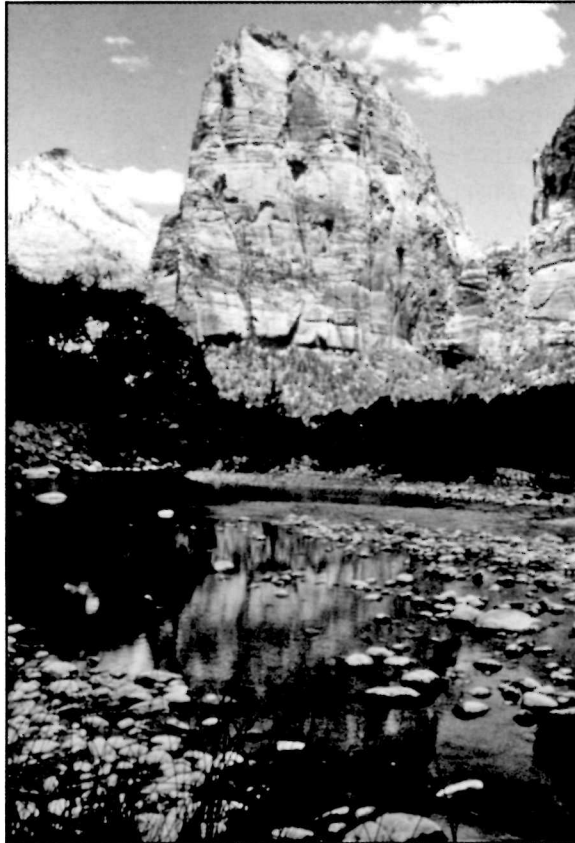
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A WORD FROM THE ASSOCIATE DIRECTOR, NATURAL RESOURCES

F. Eugene Hester

*T*his Annual Report provides a summary of significant accomplishments of the Water Resources Division (WRD) of the National Park Service (NPS) in 1992. This Washington Office is located in Fort Collins, Colorado, with additional program offices in Washington, D.C., and Denver, Colorado. The Division provides servicewide leadership for the preservation, protection, and management of water and water-related resources of units of the National Park System. The Division carries out a broad-based water resources program involving a variety of activities including planning and evaluation, water rights, water quality, floodplain management, watershed and wetlands protection, information management, training, and applied research. In addition to national program responsibilities, the Division provides day-to-day support to parks, regions, the Washington Office, and other NPS organizational units.



I appreciate the excellent cooperation and support provided by park and regional staffs throughout the Service during the past year. These efforts have provided an environment for the high level of success achieved by our Natural Resources Program.

COMMENTS FROM THE ACTING DIVISION CHIEF

Dan Kimball

*A*s in previous years, 1992 was a very productive year and was characterized by a number of significant accomplishments which are reflected in this Annual Report. From a budget standpoint, the Water Resources Division (WRD) program operated at a level essentially the same as in 1991. While personnel costs have continued to rise, project and research funding, and technical assistance have been maintained at 1991 levels, principally through careful management of WRD's administrative overhead. From a personnel standpoint, WRD was able to achieve some limited additional resources in the areas of water rights, contaminants assessment, and Washington Office program coordination.

From a program standpoint, some examples of significant accomplishments of the WRD for 1992 include the following:

- ✦ Designed and developed an interactive, national park-based Water Quality Data Management System for data storage, retrieval, and management.
- ✦ Developed a \$2.5 million budget initiative with the U.S. Geological Survey's National Water Quality Assessment Program for long-term water quality monitoring of selected waters of the National Park System.
- ✦ Revised the NPS's Floodplain Management Guidelines.
- ✦ Assisted in various activities associated with operation of the Colorado River reservoir system (e.g., Glen Canyon Dam Environmental Impact Statement and Colorado River Annual Operating Plan Task Group).
- ✦ Achieved a settlement between the United States and the state of Idaho to protect instream flows and present and future consumptive uses at Craters of the Moon National Monument and the Idaho portion of Yellowstone National Park.
- ✦ Made significant progress with respect to development of a Reserved Water Rights Compact with the state of Montana which addresses Yellowstone and Glacier National Parks, and Big Hole National Battlefield.
- ✦ Assisted in the preparation of Water Resources Management Plans and scoping reports for over 20 parks.
- ✦ Supported a number of wetland restoration, inventory, and impact assessment projects, and published a color brochure, *Wetlands in the National Parks*.

- ♦ Evaluated highly controversial projects such as the proposed Windy Craggy Copper Mining Project, located upstream of Glacier Bay National Park and Preserve, the proposed research drilling in designated wilderness of Katmai National Park and Preserve, and the proposed hazardous waste landfill near Dryden, Texas, located upstream of Amistad National Recreation Area.
- ♦ Carried out research in the use of biological indicators to affect regional water quality management, long-term watershed/ecosystems studies, and the evaluation of toxic problems affecting many units of the National Park System.
- ♦ Participated in various aspects of implementing the Natural Resources Strategic Plan and the Vail Agenda.

Many of the accomplishments listed above are described in more detail later in this Annual Report.

Consistent with the tradition of the WRD, we are dedicated to customer service and to providing professional and technical support of the highest quality. I am extremely proud of the hard work and commitment to these goals demonstrated on a daily basis by the staff and management of the WRD. In addition, we will continue to search for more innovative, efficient, and cost effective ways to provide support and services to parks and regions in protecting and managing water resources of the National Park System.

WASHINGTON LIAISON HIGHLIGHTS

Pam Matthes, Program Coordinator*

*T*his year has been one of change and opportunity for the Water Resources Division (WRD) Liaison position in the Washington Office. Early in 1992, I was selected to serve as the NPS Liaison in the Office of the Assistant Secretary for Fish and Wildlife and Parks. This detail assignment provided an opportunity to offer many members of the WRD as well as interested NPS regional and park staff, a chance to travel to the Washington Office and act as the Division's Program Coordinator during my absence. We were also fortunate to have Margaret Osborne from the Wildlife and Vegetation Division detailed to the WRD as Program Coordinator for several weeks during the spring of 1992. The Liaison Office continued to advocate the protection of water resources in units of the National Park System and assist the Associate Director for Natural Resources in meeting the challenges of numerous water resource issues.

All of us in WRD are very pleased to welcome Sharon Kliwinski to the WRD Washington Liaison Office. She joins us from the Washington Office, Mining and Minerals Branch of the Land Resources Division. Sharon is an accomplished negotiator and has years of experience in dealing with controversial and complex policy issues affecting natural resources of the National

Park System. Her talents will provide WRD with a Washington component to several broad, sweeping program areas, such as hazardous materials, coastal and offshore resources, and state water quality and regulatory programs administered under the provisions of the Clean Water Act. The Clean Water Act will be reauthorized by Congress in the near future, and Sharon will serve as the Division's team leader for assisting the Service in developing its policy positions during this process.

*Pam Matthes transferred to the U.S. Fish and Wildlife Service in February 1993.

PLANNING AND EVALUATION BRANCH HIGHLIGHTS

Dan Kimball, Branch Chief

*T*he Planning and Evaluation Branch (PEB) of the Water Resources Division (WRD) was involved in a number of major projects and technical assistance activities in support of park, region, and servicewide needs during 1992. Principal activities included assistance in the preparation of water resources management plans and related scoping reports; the review of resource management plans; evaluation of complex regulatory issues; and implementation of the Wetlands Activity Component of WRD's Watershed Protection Program. Other PEB activities included technical review and advice, and servicewide guidance and training.

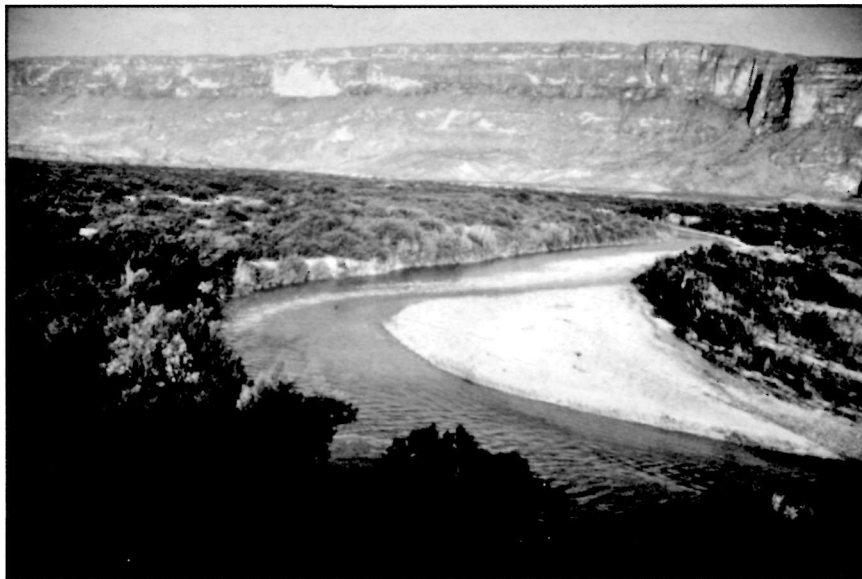
Some examples of these activities include involvement in the preparation of water resources management plans for nine units of the National Park System; assistance in the preparation of water resources management plan scoping reports for 11 units (see following article); continued evaluation of the Windy Craggy Project, a proposed copper mine in British Columbia, Canada, upstream of Glacier Bay National Park and Preserve; assessment of a proposed hazardous waste landfill near Dryden, Texas, in the vicinity of Big Bend National Park and Amistad National Recreation Area; participation in a number of Great Lakes protection activities which include serving as the official NPS Observer to the Great Lakes Commission, and providing support to the recently established NPS Great Lakes Coordinator; evaluation and monitoring of wetlands protection projects; and providing servicewide guidance, training, and technical assistance with respect to wetlands inventory, mapping, restoration, and regulatory requirements (see following article).

The PEB (with the assistance of the Division's other branches) also reviewed more than 280 documents (e.g., NPS planning documents [including over 50 Resource Management Plans], National Environmental Policy Act documents, and proposed regulations). Written comments were prepared on over 25 percent of these documents.

WATER RESOURCES 'PLANNING IS UNDERWAY AT BIG BEND NATIONAL PARK

Mark Flora, Hydrologist

Big Bend National Park (BIBE), located in western Texas along the Rio Grande border with Mexico, preserves a representative portion of the desert, montane, and riverine environments found in the northern Chihuahuan Desert. Water plays a particularly important role in these harsh environments, strongly influencing the surficial geology, the distribution of biological communities, and the patterns of human settlement and use.



The predominant water feature of BIBE is the Rio Grande River (Rio Bravo del Norte), which forms a ribbon of riverine and riparian environments that stand in stark contrast to the adjacent desert. The river provides access to water supply and popular recreational activities including river-rafting and fishing, as well as supporting wildlife and an important migratory route for birds. In addition, BIBE also contains several important ephemeral streams, more than 200 springs, seeps, and tinajas, as well as man-made water features including water-holes, stock tanks, etc.

In FY92, the Water Resources Division (WRD) and BIBE jointly completed a water resources scoping report for the park (Technical Report NPS/NRWRD/NRTR-92/08). This report identifies a number of complex water-related issues that are of concern to park management and summarizes the existing hydrological information pertaining to these issues. The most immediate of these management concerns include:

- ✦ assessing "transboundary" water resource issues potentially affecting water quantity, water quality, and recreational river-use;

- ✦ developing riparian zone protection and recreational river-use management alternatives that protect sensitive riparian environments while allowing for acceptable levels of use;
- ✦ evaluating floodplain delineation and management requirements relating to visitor and endangered species protection; and
- ✦ establishing procedures, including drought contingency planning, which will help to assure the availability of an adequate and safe water supply.

During the next year, the WRD, BIBE, and the Southwest Region will coordinate the development of a Water Resources Management Plan (WRMP). The WRMP will formulate practicable management alternatives for each of these issues and provide the park with an "action plan" for managing complex, and sometimes controversial, water resources issues over the next 5 to 15 years.

STREAM RESTORATION PLANS DEVELOPED FOR HOG CANYON, DINOSAUR NATIONAL MONUMENT

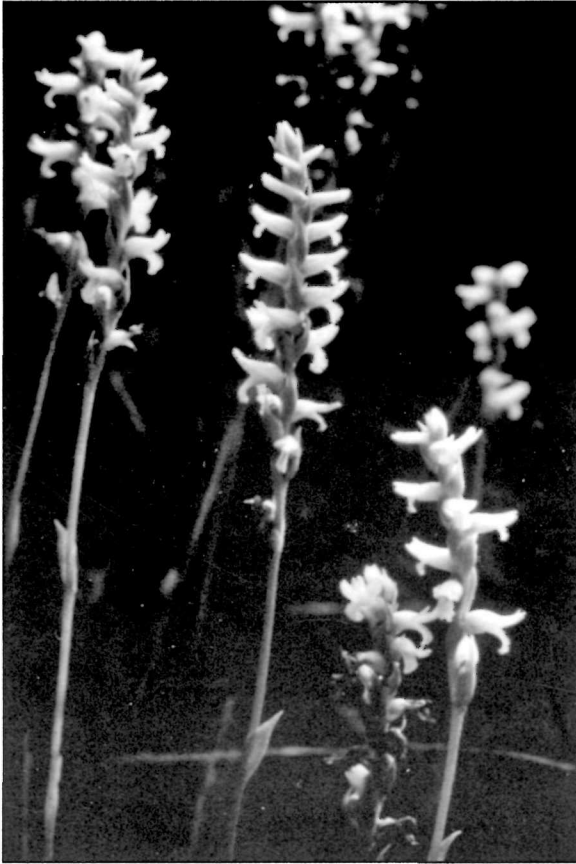
Joel Wagner and Larry Martin, Hydrologists

Hog Canyon, located in Dinosaur National Monument (DINO) supports both a riparian community along a perennial stream and an adjacent wet meadow community sustained by a high water table. Long-term grazing by domestic livestock has significantly altered vegetative communities



and stream channel morphology throughout the canyon. In the lower part of the canyon, the stream is incised in a ditch approximately 1 to 2 feet (ft) wide and up to 5 to 6 ft deep. This

to 5 to 6 ft deep. This incision is directly related to past ditching efforts by ranchers in attempts to divert the streamflow for irrigation purposes.



In 1989, a small population of the federally-listed orchid species *Spiranthes diluvialis* was discovered along the incised stream channel in lower Hog Canyon. Subsequent monitoring in 1991 indicated a population of more than 100 plants, most found in a wet meadow adjacent to a non-incised reach of the stream. In September of 1990, an interdisciplinary team of hydrologists, botanists, soil scientists, and park resource managers met to develop a plan for evaluating riparian conditions and management opportunities for Hog Canyon, with primary objectives of restoring the stream to natural conditions and increasing habitat for *Spiranthes diluvialis*.

The Water Resources Division's (WRD's) role in the interdisciplinary studies was to identify existing hydrology and soil moisture conditions, and ecological relationships in lower Hog Canyon.

The ultimate objective was to develop alternatives for reestablishing the stream in its prechannelization location while improving orchid habitat and maintaining canyon water yields for downstream users. To meet these objectives, a report entitled *Hydrologic conditions related to the Hog Canyon riparian restoration project, Dinosaur National Monument* (WRD Technical Report NPS/NRWRD/NRTR-92/13) was published in 1992.

The study showed that the artificially incised channel has lowered the adjacent water table, causing the vegetative community to change from a wet meadow complex (orchid habitat) to a more xeric community. In addition, straightening and incising the channel reduced the "moist streamside zone" along the perennial stream, which appears to be important orchid habitat in Hog Canyon. The study concluded that additional potential streamside and wet meadow orchid habitat would be created by eliminating the straight, incised ditch and returning the stream to a sinuous channel in its more natural position on the surface of the canyon floor. Surface and ground water analyses also indicated that this could be accomplished with no measurable effect on canyon water yield.

The report includes a set of alternatives for meeting restoration objectives. The preferred alternative involves a temporary, reversible relocation of the stream to its natural position on the canyon floor, initially for a period of 2 to 3 months. In the course of the experiment,

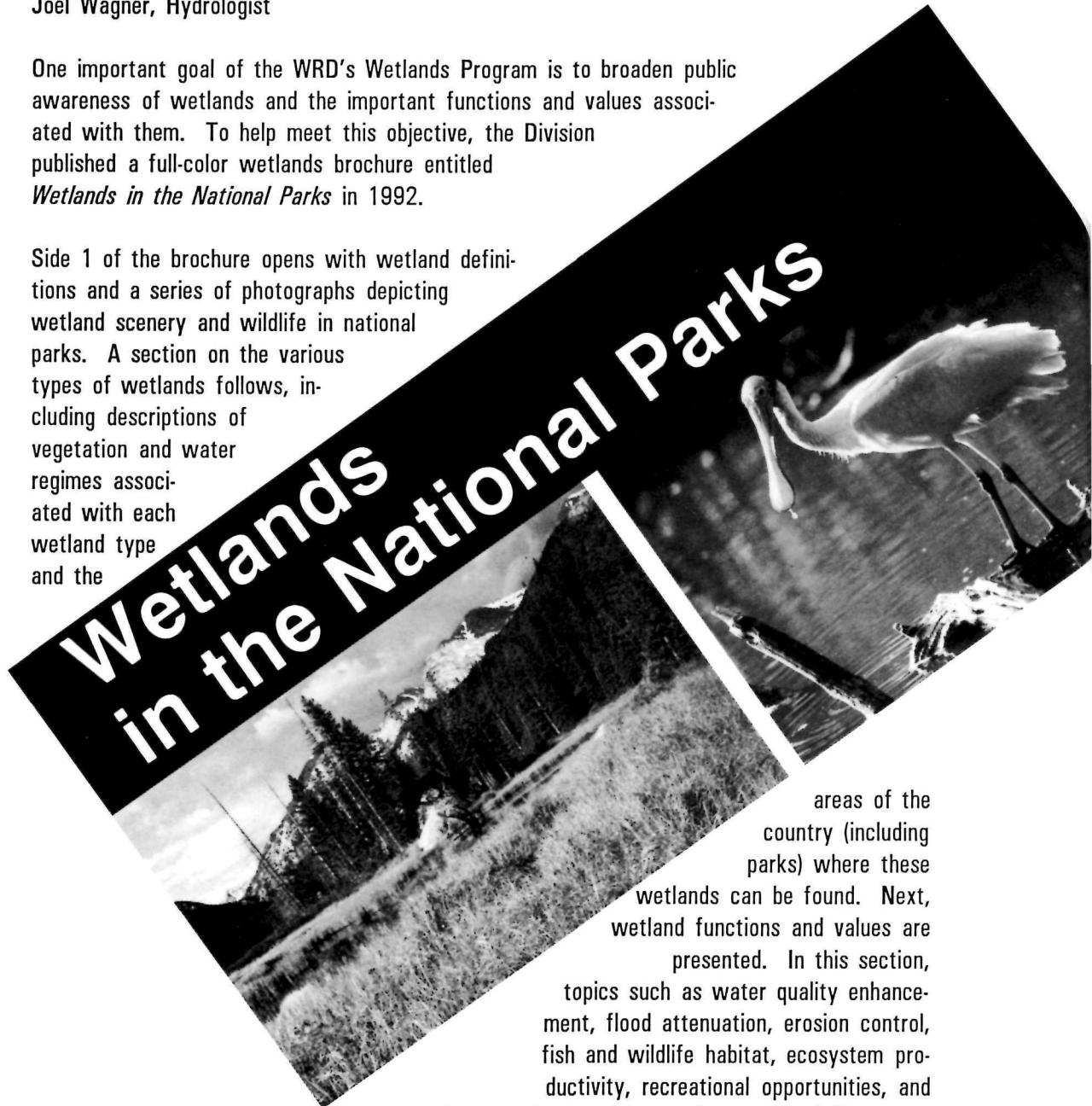
surface water, ground water, and soil moisture data will be collected to determine if predicted effects including higher water table, increased near-surface soil moisture, and no measurable reduction in canyon water yields actually occur. The experimental relocation is scheduled to begin in the fall of 1993.

"WETLANDS IN THE NATIONAL PARKS" BROCHURE PUBLISHED

Joel Wagner, Hydrologist

One important goal of the WRD's Wetlands Program is to broaden public awareness of wetlands and the important functions and values associated with them. To help meet this objective, the Division published a full-color wetlands brochure entitled *Wetlands in the National Parks* in 1992.

Side 1 of the brochure opens with wetland definitions and a series of photographs depicting wetland scenery and wildlife in national parks. A section on the various types of wetlands follows, including descriptions of vegetation and water regimes associated with each wetland type and the



areas of the country (including parks) where these wetlands can be found. Next, wetland functions and values are presented. In this section, topics such as water quality enhancement, flood attenuation, erosion control, fish and wildlife habitat, ecosystem productivity, recreational opportunities, and environmental education are discussed and illustrated.

Side 2 of the brochure leads with an illustration of where various wetland types occur in the landscape, from mountains to seashores. Next, a section on wetland origins discusses various forces of nature and human activities that create and sustain wetlands. The final section of the brochure describes the role of the NPS in wetlands protection, restoration, and education.

The first printing of 75,000 brochures is nearly exhausted. Over 70,000 brochures were sent to parks across the United States and to regional and Washington interpretation and public affairs offices for distribution to the public. The brochure has also been used by the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service for public education purposes, and was included in the information packet for participants at Intercol's Fourth International Wetlands Conference in 1992.

For further information about the brochure, contact Joel Wagner at (303) 969-2955.

WATER RIGHTS BRANCH HIGHLIGHTS

Owen R. Williams, Branch Chief

*T*his year has been a time of increasing workload for the Water Rights Branch (WRB). The heavy load this past year has been the outgrowth of generally positive events. Issues have been settled, a case has been won (at least temporarily), and agreements have been reached. These things have taken a lot of time and work, but the outcomes have been very positive.

For example, this year the water rights case in Colorado's San Luis Valley (American Water Development, Inc.), which posed a significant threat to the instream flow water rights at Great Sand Dunes National Monument (GRSA), was won by the United States. Much of the case, which involved other federal entities (Bureau of Reclamation, U.S. Fish and Wildlife Service, and Bureau of Land Management) turned on the potential for impacts to GRSA water rights. The studies supported by the Water Resources Division (WRD) were pivotal in the trial.

In addition, a concentrated effort to negotiate water rights claims for Craters of the Moon National Monument (CRMO), and the Idaho portion of Yellowstone National Park (YELL) proved successful. The result was a settlement between Idaho and the United States which protects instream flows and present and future consumptive uses at both parks. This settlement must next be accepted by the court and withstand protests from other water users.

Along similar lines, the efforts of the Montana Reserved Water Rights Compact Commission and the NPS Negotiation Team have produced an "agreement in principle" on YELL reserved water rights. Also, it appears that additional agreements in principle are about to be established for Glacier National Park and Big Hole National Battlefield. All parties are working feverishly to produce a compact and get public comment in time to submit it to the Montana Legislature for ratification in the 1993 biennial legislative session.

Numerous other efforts continue to challenge the Branch: preparations for hearings on the water rights applications of the Las Vegas Valley Water District (involving Death Valley National Monument [DEVA], Lake Mead National Recreation Area, and Great Basin National Park); negotiations with the Bureau of Reclamation on a water service contract for Black Canyon of the Gunnison National Monument; a motion for summary judgement concerning Rocky Mountain National Park reserved rights; and negotiations and trial preparation in Utah's Virgin River adjudication (Zion National Park).

Overall, I feel this has been a productive year. This positive outcome has been the direct result of the dedicated and competent staff which comprises the WRB. This group of individuals is dealing with a lot of work, and is doing their job very well, indeed. They face even more work as the demand for water grows and its availability shrinks.

The following articles describe two water rights issues which are of some consequence. Specifically, one of the articles concerns water levels at Devil's Hole (administratively, a part of DEVA) and



how they relate to water rights. Of particular interest, is the effect of earthquakes upon Devil's Hole and the resident endangered desert pupfish. Also presented, is an article concerning the process involved in the settlement of YELL and CRMO reserved water rights issues in Idaho.

As for the future, the work pace will probably continue to quicken, but the Branch will attempt to maintain its capacity to handle both problems and opportunities as they present themselves. This means, that as demands increase, so does the necessity for field support in order to work through the issues. I believe that future Branch support will be similar to that given in the past, and will be most appreciated.

WATER RIGHTS NEGOTIATIONS CAN SAVE TIME AND MONEY

Chuck Pettee, Hydrologist

The wave of water rights adjudications that has spread across western states in recent decades is responsible for heightened concern over NPS water rights. These adjudications usually pit appropriative rights advocates against federal reserved rights advocates in a battle for one of the West's most precious resources, water. In a region where water often means economic as well as environmental survival, both sides will tend to expend whatever resources they can muster to win in court.

A recent court case, in which a federal reserved water right claim was litigated, required millions of dollars from both sides for expert witnesses, exhibit preparation, and staff time. In view of the large number of adjudications on the horizon, and the reality of ever-shrinking budgets, it is advantageous to the NPS, as well as state and federal taxpayers, to consider less expensive alternatives in responding to adjudications.

Water rights adjudications do not have to lead to long hours of high tension courtroom proceedings. With an attitude of problem solving on both sides, negotiations offer the opportunity to avoid long and costly court battles while still providing protection to park resources. With such an attitude, the Water Rights Branch (WRB) in FY92 completed negotiated settlements with the state of Idaho for reserved water rights at Craters of the Moon National Monument and the Idaho portion of Yellowstone National Park. While the rights are not yet decreed by the court, the conditions meet the respective needs of both parties while avoiding a major clash between advocates of the appropriation and federal reserved water rights systems. Next, the settlement goes before the court for inclusion in subsequent decrees.

This has been accomplished while maintaining flexibility for NPS in meeting Congressional mandates. The agreements establish the United States' right to: 1) use a small but sufficient amount of surface and ground water for present and future visitor, administrative, and concessioner use; and 2) maintain all remaining surface water in-situ to protect park water-related resource values.

The Idaho settlements involved park units that were relatively free of water use conflicts because surface streams headwater within the parks. However, these settlements may be just the tip of the iceberg. Discussions between the NPS and state representatives concerning water needs at parks in Utah, Montana, and Colorado are also underway. Issues in these discussions often involve complex mixtures of land ownership and existing water development. WRB staff, as representatives of park, region, and Washington Office management, will continue problem solving in FY93 to secure protection of NPS water rights at the park units involved in these discussions.

THE POOL LEVEL IN DEVIL'S HOLE

Paul K. Christensen and Christine A. Gable, Hydrologists

Devil's Hole is located in the Great Basin of southern Nevada near the California border and is adjacent to Ash Meadows National Wildlife Refuge. Devil's Hole is a planar fissure (cavern) formed by the faulting and collapse of carbonate rock. A pool of water occurs in Devil's Hole, the habitat of the endangered pupfish (*Cyprinodon diabolis*), which is found nowhere else in the world. The pupfish depend on a shallow submerged rock shelf which provides habitat for breeding, feeding, and rearing. The pool is a local expression of the potentiometric surface of a ground water flow system that underlies an area of about 4,500 square miles in southern Nevada (see Winograd and Thordarson 1975; and Dudley and Larson 1976). Devil's Hole occurs at the terminal discharge area (Ash Meadows) of the ground water flow system.

Federal Reserved Water Rights for Devil's Hole

In January 1952, Presidential Proclamation 2961 added Devil's Hole to Death Valley National Monument (DEVA) as a detached 40-acre unit. The proclamation recognized: 1) the scientific importance of the pupfish and the cavern; and 2) the importance of preserving the pool and pupfish.

At the request of the NPS, the U.S. Geological Survey (USGS) began monitoring the pool level in Devil's Hole in 1956. In the early 1960s, the USGS investigated possible effects of ground water withdrawals on springs in the Ash Meadows area, including Devil's Hole. The USGS concluded that ground water withdrawals nearby or in areas hydraulically well-connected with Devil's Hole could affect the pool level (Worts 1963). This prediction was borne out in 1969 when, coincident with the withdrawals of ground water through irrigation wells near Devil's Hole, the pool level began to rapidly decline (see Figure 1). The USGS investigated and determined that nearby ground water withdrawals were causing the decline (Dudley and Larson 1976).

Administrative and legal actions from 1970 through 1974 resulted in the reduction and cessation of ground water withdrawals near Devil's Hole and the establishment of a federal reserved water right which was upheld by the U.S. Supreme Court in 1976 (*Cappaert v. United States of America*, 426 U.S. 128). The reserved right is for maintaining the pool level at a distance no greater than 2.7 ft below an arbitrary datum.

Recent Gradual Decline of the Pool Level and Ongoing Studies

After the cessation of nearby ground water withdrawals, the pool level steadily rose until 1988, when it began a gradual decline which has continued to the present day (see Figure 1). Prior to the beginning of the recent gradual decline, the pool level had not recovered, as had been expected, to the pre-1969 levels.

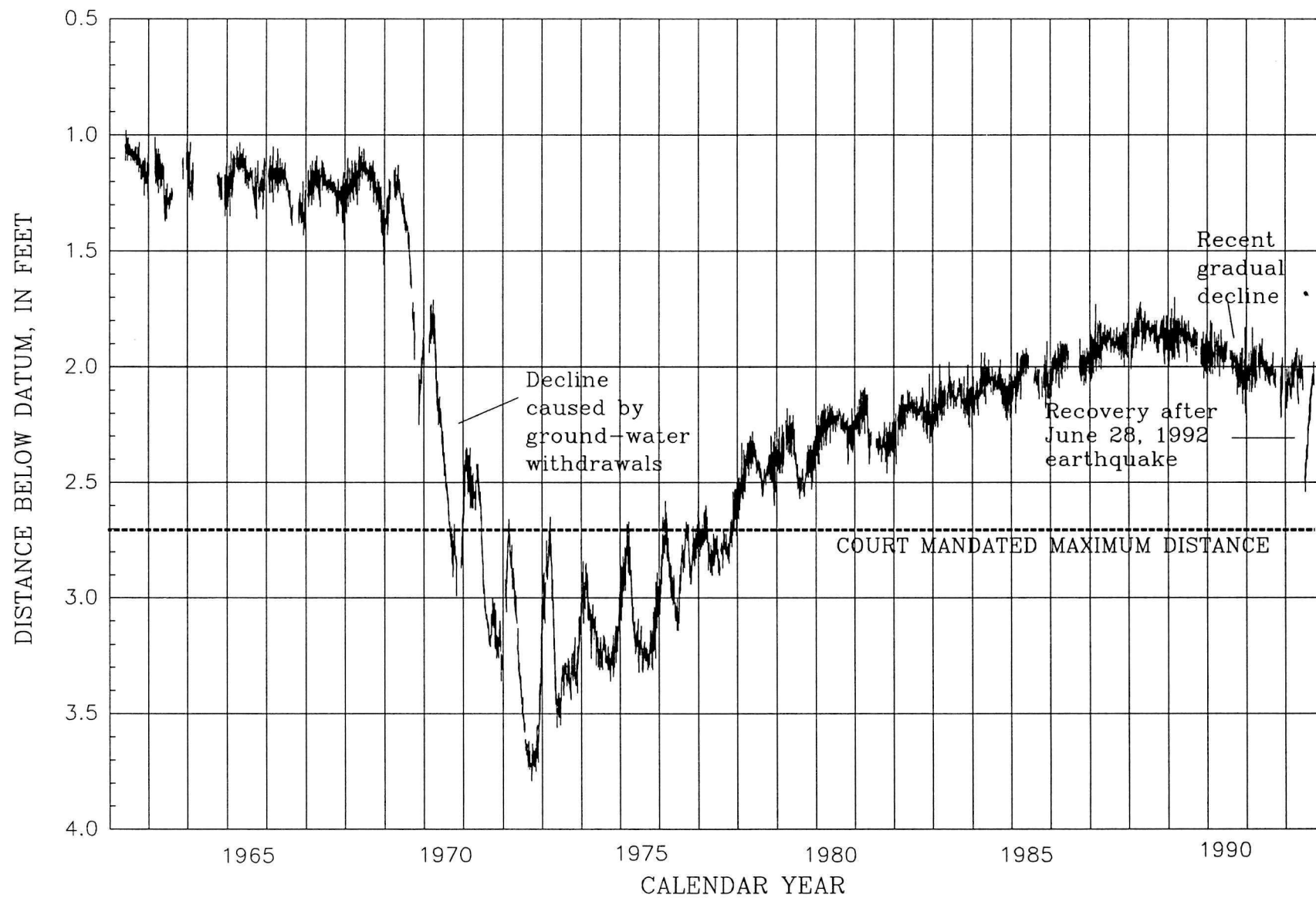


FIGURE 1. Daily Mean Pool Level in Devil's Hole,
May 23, 1962 through September 30, 1992 (Provisional)

In early 1992, the Water Rights Branch (WRB) statistically verified this recent decline and began preparing a plan of investigation to determine the probable cause of the decline. The WRB has already implemented parts of this plan. The two most probable causes for the decline include: 1) a drought from about 1985 through 1990 in the Great Basin area; and/or 2) ground water withdrawals located farther away than that which caused the rapid decline of the pool in 1969 and the early 1970s.

The drought may have caused ground water levels, and thus the pool level, to decline because less water infiltrated to the water table in ground water recharge areas. In 1992, the WRB funded a study by John James, a climatologist at the University of Nevada at Reno. The study will examine and evaluate climatological data for the Death Valley region with an emphasis on the period of record for which pool-level data are available.

The rate of ground water withdrawals in distant areas has shown a substantial net increase over the past 30 years with large fluctuations. Because of the distance of the ground water withdrawals from Devil's Hole, a long period of time would pass before the drawdown cone caused by the withdrawals reaches Devil's Hole. In 1993, the WRB plans to: 1) begin the compilation of water-rights, water-use, and well records; 2) develop a conceptual model of the ground water flow systems using existing information; and 3) provide funding for the monitoring of additional wells by the USGS. The information acquired will assist in evaluating the potential affects of distant ground water withdrawals on the pool level.

Another part of the NPS's plan includes periodically holding workshops for scientists and managers to: 1) discuss the hydrology and geology of Devil's Hole and the surrounding area; and (2) share ideas about determining the cause of the recent gradual decline. The first workshop was held in August 1992, in Denver, Colorado. Participants included personnel from the NPS, USGS, Colorado School of Mines, Bureau of Land Management, U.S. Fish and Wildlife Service, Department of Energy, the Las Vegas Valley Water District, Desert Research Institute of the Nevada University System, and private industry. All have an interest in the hydrology of Devil's Hole and the surrounding area. Scientists and managers from the federal and state agencies gave presentations. The NPS plans to hold another workshop in early 1993.

Current Monitoring Program at Devil's Hole

In August 1989, the NPS assumed the responsibility for monitoring the pool level. The primary monitoring system consists of: 1) a Stevens and Leupold A/F Data logger which electronically records data in 15-minute intervals; and 2) a Stevens and Leupold A-71 strip-chart recorder which provides a continuous record on paper. Personnel at DEVA perform monthly, or as needed, on-site servicing of equipment. The WRB provides logistical support to DEVA, assists in data collection, and analyzes and reports the data.

In late June 1992, a strong earthquake with its epicenter near Landers, California, caused a 6-ft surge wave in Devil's Hole, which damaged the primary monitoring system and caused the pool level to fall about 0.5 ft, nearing the court-mandated maximum level below the datum (Figure 1). Within 3 months of the earthquake, the pool level recovered to approximately its pre-earthquake level. When the NPS repaired the primary monitoring system, it installed a

secondary monitoring system to provide data when the primary system malfunctions, is disturbed, or is damaged. The system consists of a separate electronic data logger which receives a signal of the pool level from two transducers.

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WATER OPERATIONS BRANCH HIGHLIGHTS

William L. Jackson, Branch Chief

*T*he Water Operations Branch (WOB), in 1992, provided technical assistance to over 70 parks in all ten regions. Support encompassed the range of operational activities conducted by the Branch, including:

ground water impact assessments (e.g., Cape Hatteras National Seashore, Cape Cod National Seashore, Hot Springs National Park, Hagerman Fossil Beds National Monument, and Pipe Springs National Monument);

water supply development (e.g., El Malpais National Monument, Capitol Reef National Park, Crater Lake National Park, and Channel Islands National Park);

floodplain assessments (e.g., Dinosaur National Monument, John Day Fossil Beds National Monument, Ozark National Scenic Riverway, Glacier National Park, Big Bend National Park, and Chaco Culture National Historic Park);

water resources/Geographic Information Systems support (e.g., Natchez Trace National Scenic Trail, Delaware Water Gap National Recreation Area, Petroglyph National Monument, Yosemite National Park, and Indiana Dunes National Lakeshore);

water quality assistance (e.g., Amistad National Recreation Area, Yosemite National Park, Manassas National Battlefield, C&O Canal National Historic Park, Capitol Reef National Park, Hovenweep National Monument, Curecanti National Recreation Area, Glen Canyon National Recreation Area, and Florissant Fossil Beds National Monument); and

watershed and stream management (e.g., Virgin Islands National Park, Niobrara/Missouri National Riverways, Prince William Forest Park, Dinosaur NM, and Grand Canyon National Park).

In addition to providing park-specific technical support, several activities of national scope were initiated to enhance the level of information available on the quality of park waters. Dr. Roy Irwin, a contaminants specialist formerly with the U.S. Fish and Wildlife Service, was added to the staff to provide technical assistance in the areas of aquatic biomonitoring and environmental contaminants. Roy is developing a computer-based contaminants encyclopedia which provides ready access to summaries of literature dealing with the fate and effects of contaminants in the aquatic environment. The encyclopedia is further described in one of the articles which follows.

A major program was undertaken in 1992 to develop park-specific and servicewide water quality databases. The program involves development of user-friendly computer software, capture and analysis of existing data from national databases, development of technical guidance in the design of park-based water quality inventory and monitoring programs, and technical training. This program is described by Gary Rosenlieb in another article which follows. In addition to its database program, the Branch's Water Quality Management Activity (WQMA) is coordinating with other agencies at the national level to enhance the presence of federal water quality monitoring activities in parks, and to develop consistency between agencies in the area of water quality monitoring technical protocols. Finally, the WQMA oversaw funding support in 1992, of 17 park-based water quality projects.

The staff of the WOB remains dedicated to providing high-caliber professional support to parks. We also are diligently working to enhance our overall program effectiveness through improved interagency cooperation at the national level, and by aggressively working to identify new opportunities to support park water resources programs.

WATER QUALITY MANAGEMENT ACTIVITY MOVING FORWARD WITH NEW INITIATIVES IN 1992

Gary Rosenlieb, Water Quality Coordinator and Dean Tucker, Computer Programmer Analyst

The Water Quality Management Activity (WQMA) was initiated in 1991 to: 1) expand the professional water quality expertise in the NPS; 2) integrate the appropriate technical, legal, and regulatory water quality methodologies to resolve critical park-based water quality issues; and 3) assist in the development and initiation of park-based water quality inventorying and monitoring and data acquisition programs. To attain these goals, three national initiatives were

undertaken in 1992 that will directly support the parks' information and monitoring needs in the areas of data management, acquisition of basic field information, and water quality inventorying and monitoring guidance.

NPS Water Quality Data Management System

The park-based Water Quality Data Management System (WQDMS) (Figure 2) is a high-priority effort of the WQMA to develop an interactive national park-based water quality data storage, retrieval, and management system. The cornerstone of the system is a PC-based water quality data shell that is highly user-oriented, designed to produce attribute files for park-based Geographic Information Systems (GIS), and permits park staff to create, from a parameter pick list, a water activity database tailored to park needs. The system will foster direct data exchange with STORET, a national water quality database maintained by U.S. Environmental Protection Agency (EPA) that serves as a repository of data collected by the U.S. Geological Survey (USGS), states, and other federal agencies. Thus, park specific water quality data can be uploaded, archived, and retrieved by parks for their individual needs and by the Water Resources Division for synthesis of national-level statistical profiles.

Water quality databases will be established for 30 parks in 1993 with the assistance of Horizon Systems, Inc., a contractor that is also presently managing the EPA's River Reach File project. Horizon Systems will create individual park databases by delineating digital descriptions of park boundaries to define the scope of the retrieval, downloading all physical, chemical, and biological data that resides in STORET for each park, and reformatting the data for the NPS data management system. Horizon Systems will also prepare a hard copy report containing a compilation of available information for each water quality sampling station and a basic statistical analysis of the water quality data for each park.

National Cooperating Agency Water Quality Monitoring Initiative

The WQMA, in cooperation with the USGS National Water Quality Assessment Program (NAWQA), developed a \$2.5 million FY94 budget initiative for long-term water quality monitoring of selected NPS waters. The focus of the initiative, which was forwarded as a high priority of the Natural Resources Directorate, is to expand the scope of the present NAWQA program to include selected NPS units. The NAWQA program is establishing long-term "fixed-station" water quality monitoring programs in selected river basins, nationwide. Physical, chemical, and biological parameters are monitored by NAWQA. By managing the proposed pass-through funds, the NPS would be in a position to define its monitoring needs and priorities. The USGS, with established field, laboratory, and data management methods, capabilities and protocols, is in a position to provide needed logistical capability to the NPS.

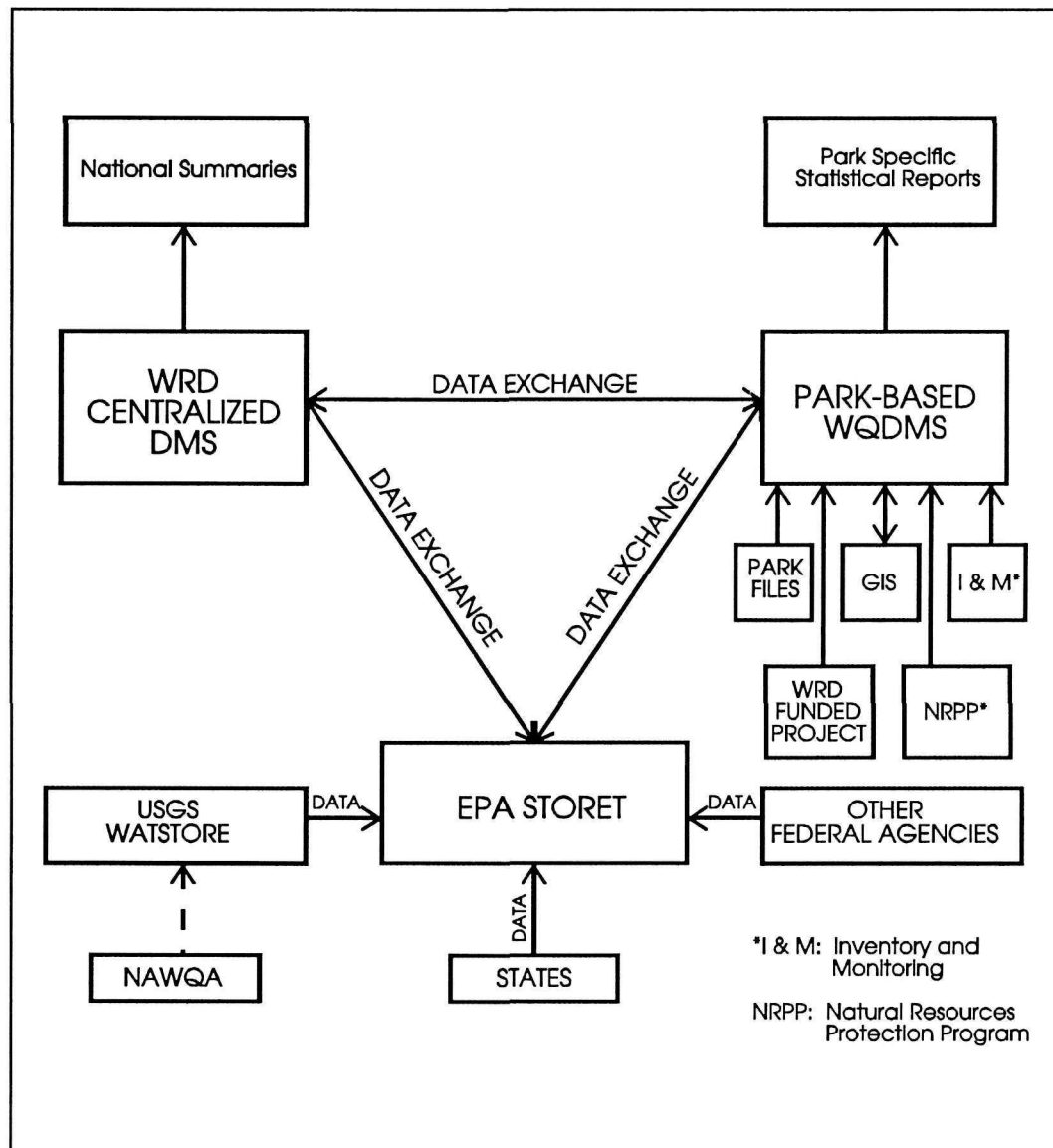


FIGURE 2. NPS Water Quality Data Management System

Water Quality Inventorying and Monitoring Technical Guidance

The WQMA initiated a contract with Dr. Lee McDonald of Colorado State University to develop guidance in the design of water quality monitoring programs and in the selection of water quality monitoring parameters. The document is intended to be a "step-down" in terms of specificity from the recently released *NPS-75 Natural resource inventorying and monitoring guideline*. A draft of the document will be circulated for review in 1993.

Other Highlights

The WQMA designed and offered servicewide training in water quality inventory and monitoring, and developed a technical report on water quality instrumentation. The WQMA participated in the Third National Citizens Volunteer Water Monitoring Conference at Annapolis, Maryland, and continues to augment and improve a WordPerfect based contaminants encyclopedia (see separate article by Roy Irwin). Also, the WQMA continues to manage approximately \$250,000 per year in park-based water quality projects, and provides technical assistance to parks on water quality matters. Finally, the WQMA is working with the NPS Engineering and Safety Services Division to develop cooperative programs in hazardous materials management as it relates to water quality, and also in monitoring the bacteriological quality of NPS-managed bathing beaches.

DEVELOPMENT OF A PROTOTYPE CONTAMINANTS ENCYCLOPEDIA

Roy J. Irwin, Contaminants Specialist and Biomonitoring Coordinator

Environmental toxicology is a rapidly expanding field. In recent years, there has been a marked increase in the production of new journal articles and computer databases providing information on the effects of thousands of chemical compounds on fish, water birds, and other aquatic life. The dramatically accelerated proliferation of new information makes it difficult for the individual who is supposed to be an "expert" on contaminants to keep up with the current state of knowledge. In many cases, the information needed to assess NPS contaminants issues is out there somewhere; the problem is being able to *quickly* access it.

To help the Water Resources Division more effectively respond to contaminants assistance requests, development of a prototype contaminants encyclopedia as a computer-based tool using WordPerfect 5.1 software, has been initiated. The prototype is designed as an example of the kind of tool which could be greatly enlarged and improved should additional funds become available.

The purpose of the prototype encyclopedia is to help environmental specialists quickly access concern levels, synonyms, and other bits of important information on contaminant topics related to impacts on fish, invertebrates, water birds, and other aquatic life. The prototype is primarily a data interpretation tool. Although some human health and terrestrial wildlife information is covered, the overall emphasis is on aquatic toxicology. If the concentrations of a contaminant in water, sediments, or tissues are known, the prototype encyclopedia is designed to help one begin to understand the environmental significance of the those concentrations. General questions about "Why is this compound sometimes a problem?" are also answered in plain language summaries of the overall environmental significance of each compound.

The prototype has recently been expanded by electronic database additions to 11.24 megabytes, several times larger than a version compiled earlier at the U.S. Fish and Wildlife Service

(USFWS). Currently the prototype is over 3,700 pages long when printed out as a hard copy. This version is now being peer-reviewed while being used on a trial basis by some select contaminant specialists in the NPS and the USFWS. It may be used as a computer search (electronic) tool or as a printed (hard copy) reference document. Those who are not "computer comfortable" can use the prototype as a hard copy, as they would a dictionary or encyclopedia, since it is organized in alphabetical order. However, the search function in WordPerfect allows for computer searches of topics, synonyms, phrases, or specific words which may be listed under topics other than the one which first comes to mind.

The prototype contains summaries of concern levels on toxic chemicals and other key information arranged alphabetically. At last count, the initial prototype included information related to over 5,000 topics and synonyms. Over 500 references are cited directly and hundreds of other references are embedded in text copied (with permission) from other databases.

Where available, biological concern levels for various toxic chemicals were summarized for concentrations in water, sediment, and tissues. In some cases, concern levels were not available, so an attempt was made to summarize concentrations that would be considered high or low. This type of data at least provides some initial indication of whether or not a concentration appears to be elevated. However, the overall emphasis of each summary is to shed light on what various contaminant concentrations may mean related to the protection of fish and other aquatic resources.

To enable computer searching, several hazardous substances lists (RCRA*, CERCLA*, OSHA*, Section 313, California List, Extremely Hazardous Substances List, New Jersey List, Reproductive Risk list, and Right-to-Know list), cross-referenced by CAS* number and reportable quantities, have already been included in the prototype encyclopedia. These lists are very lengthy and only easily searched by computer. For example, the CERCLA list alone includes over 700 toxic compounds.

Although the encyclopedia is in the early draft "prototype" stage and is uneven in its treatment of various topics, it is complete enough to have been very useful to Water Operations Branch (WOB) staff and various peer reviewers in the NPS and the USFWS. The prototype is not to be copied for use outside these two agencies at this time, since peer reviews are still under way.

The WOB has adopted the encyclopedia as a project. Currently the Branch is seeking additional funds and manpower to further support the project. NPS employees interested in accessing information from the prototype or providing peer review should contact Roy Irwin at (303) 225-3520.

*CAS (CASRN) Numbers: Common abbreviation for Chemical Abstract Service registry numbers [184,216].

CERCLA: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.

OSHA: Occupational Safety and Health Administration.

RCRA: Resource Conservation and Recovery Act.

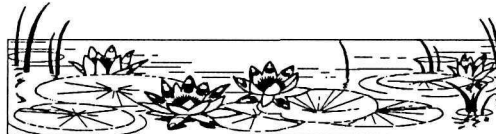
APPLIED RESEARCH BRANCH HIGHLIGHTS

Gerald E. Walsh, Branch Chief

*I*n 1992, the Applied Research Branch (ARB) of the Water Resources Division (WRD) conducted research in parks in the following scientific areas: water allocation, watershed studies, population and community analysis of macroinvertebrates and fishes, water quality, risk analysis, and multiple use analysis of park waters. Research was designed to address needs of NPS managers by analysis of park-specific and servicewide problems and by scientific studies that aid in protection, regulation, and use of water resources. Data from such studies were used to predict effects of environmental change within and outside of parks that affect the sustainability of park ecosystems.

Specifically, ARB personnel aided 39 parks, produced 34 publications and reports, and presented 33 talks at scientific meetings. Long-term research was continued on biogeochemical cycling of ions in lakes and rivers, effects of climatic change, precipitation, and terrestrial events on water balance within watersheds, acquisition of baseline data on hydrologic patterns and chemical flux in watersheds, stream ecosystem analysis in relation to use of watersheds, effects of nonpoint sources of pollution from outside park boundaries on park waters, and structure of aquatic communities in relation to water diversion practices.

The descriptions of research projects that follow give only a limited idea of the capabilities of the ARB. The scientists of the Branch are experienced in many areas, including hydrology, systems analysis, resolution of conflicting demands for use of water resources, algal, plant, and animal toxicological studies in the laboratory and field, and impact assessment.



USE OF BIOLOGICAL INDICATORS TO AFFECT REGIONAL MANAGEMENT OF WATER QUALITY

Terence P. Boyle, Research Ecologist

It is a recent view among conservation biologists that resources within protected areas must be managed in the context of the broader surrounding region. This is especially true for medium and smaller parks. Because of the general mandate of the NPS to "protect and preserve," as well as the specific legislated purpose of each of the individual parks, the development of special approaches in dealing with complex regional threats to resources in medium and small parks is warranted. Elaboration of a long-term strategy for dealing with complex issues affecting regional sustainability is imperative to anticipation of threats to resources in these parks in the foreseeable future. An approach to identify and address future threats to aquatic resources and their causal sequence in an anticipatory fashion is essential in conflict resolution, predictive planning, and long-term preservation and management of park resources.

Four critical components of this approach include: 1) establishment of the concept of addressing threats to park aquatic ecosystems in a regional context; 2) definition of water quality in its broadest possible sense to include the aquatic community and the legal protection afforded by federal and state legislation; 3) development of an awareness of the complex causality of threats to regional environmental quality and NPS resources. This includes estimates of the importance of regional political decisions, and addresses the regional socioeconomic factors affecting regional development and land use change which potentially affect changes in biophysical variables that serve as indicators of environmental quality; and 4) development of NPS policy for mitigation of threats by cooperative interaction with local institutions, and state and other federal agencies. Work along these lines is being carried out in several parks.

St. Croix National Riverway

A resource inventory using the River Continuum Concept focused on community level biological indicators (benthic macroinvertebrates and fish), as well as selected chemical parameters to evaluate the health and status of aquatic resources, has been completed. Reference stations were located in the main river at the confluence of major tributaries in order to estimate the effects of sub-basins on water quality and biological indicators. Analysis of the data was provided in a report to the Midwest Regional Office and presented at the annual meeting of the Minnesota/Wisconsin Boundary Commission. These data will be used as the foundation of a cooperative monitoring program among resource management agencies from the Minnesota, Wisconsin, and the federal government. Specific threats to aquatic resources loom in the form of increases in commercial cranberry operations along the Namekagon River and in land use patterns. A collaborative institutionalized response to these changes combined with measurement and monitoring of the natural resources would give St. Croix National Riverway a better ability to address long-term protection of resources.

Sleeping Bear Dunes National Lakeshore

An inventory of the aquatic resources is currently in the final stages of analysis to establish the health and status of park aquatic natural resources. The inventory uses chemical and biological variables to develop a baseline for measurement of the status of resources in streams and lakes in Sleeping Bear Dunes National Lakeshore (SLBE). Structure of the benthic macroinvertebrate community will be used as the principal biological indicator to assess changes of four stream ecosystems in SLBE. Various strategies for monitoring ecological health are being developed from the baseline data collected in the inventory. Profiles of lake ecosystems have been developed using a combination of optical qualities, concentration of critical nutrients, and algal density as measured by the concentration of chlorophyll *a* to establish lake trophic status. The park administration has agreed to promote use of these data as the nucleus for a cooperative regional water quality management program comprised of several lake associations and a local nature conservancy. A multiple watershed analysis of factors relating to management of regional water quality by a consortium of lake associations, a nature conservancy, and the NPS will greatly enhance this program and effect a greater degree of protection for aquatic resources in SLBE.

Pictured Rocks National Lakeshore

An inventory of the aquatic natural resources at Pictured Rocks National Lakeshore (PIRO) is planned for the next several years. Preliminary work for this project has been completed using a Geographic Information System (GIS)-facilitated risk analysis of the present status and expected changes in land use/land cover to address threats due to logging and development in the watershed outside the park. This will include an analysis of economic factors relating to the exploitation of the adjacent forests.

Six Prairie Parks Inventory and Monitoring

Resource inventories were performed on stream ecosystems in six small national parks in the midwest prairie region (Herbert Hoover National Historic Site, Homestead National Monument of America, Agate Fossil Beds National Monument (AGFO), George Washington Carver National Monument, Wilson's Creek National Battlefield, and PIRO) using macroinvertebrate and/or fish communities. Monitoring plans have been developed for these parks based on detailed research conducted at AGFO with lesser efforts at the other five parks. Monitoring in this research effort is performed by park personnel on a cyclical basis. Data obtained in these monitoring programs will be used by state water quality regulatory agencies.

LONG-TERM WATERSHED/ECOSYSTEM STUDIES

Raymond Herrmann, Water Resources Cooperative Park Studies Unit Leader

Integrated Watershed Ecosystem Studies and related research suggest that chronic stresses that originate internally and externally to parks can be subtle, insidious, and exert their effects over long periods of time. Proving environmental cause and effect involves detection of component changes and significant trends in ecological processes that can be attributed to human sources. Major changes in plant and animal distributions, abundance and biodiversity, water resources availability and quality, and fire regimes are suspected to be results of process alterations occurring at the global scale. The Watershed Program provides to park researchers and resources managers the needed tools for dealing with today's complex local, regional, and global natural resources issues.

Watershed studies provide a context for focusing NPS global change research and monitoring initiatives. The studies emphasize those minimal core measurements and common biotic and abiotic elements of change needed to analyze and partition cause and effect relationships at the watershed level. Measurements support development of a hydrologically driven input-output model. Thus, valuable information about watershed conditions is being made available for assessing predicted ecosystem changes that may result from a myriad of anthropogenic stresses. Meteorologic, microclimatic, and hydrologic data, available now and being collected, can be utilized in conjunction with data from ecosystem process studies to determine whether predicted changes are occurring or are likely to occur.

The watershed approach to long-term study and monitoring of natural and remote areas within the national parks provides data for detecting spatial and temporal changes in environmental conditions. Many water and ecological issues are most conveniently studied and best managed within a theoretically confined system: the watershed. To better address watershed issues, we recognize water as an integrator, a transporter, a solvent and an organically and inorganically active substance common to all ecological systems and common to many resource problems.

Eight parks have watershed research activities: Crater Lake National Park (CRLA), Great Smoky Mountains National Park (GRSM), Isle Royale National Park (ISRO), Olympic National Park (OLYM), Noatak National Preserve (NOAT), Rocky Mountain National Park (ROMO), Sequoia and Kings Canyon National Parks (SEKI), and Shenandoah National Park (SHEN). Additional major funding for these sites has been from external sources. Currently, ISRO, OLYM, ROMO, and SEKI are designated as part of, and receive funding from, the NPS Global Climate Change Program (GCC). The NPS has also supported acid deposition research at SHEN, and GRSM (both are included in the NPS Inventory and Monitoring Program), along with Denali National Park and Preserve, and Everglades National Park (EVER), and a substantial lake studies program at CRLA, now included in the NPS GCC Program. New watershed sites included in the NPS GCC Program are EVER, Glacier National Park, and Buffalo Wild and Scenic River/Ozark National Scenic Riverway. Because NPS watershed research was conducted within the context of the National Acid Precipitation Assessment Program and the governmentwide GCC Program, our

results are enhanced by these related research activities. In some cases, important information on biological diversity and biogeochemical processes has been obtained.

Some site specific results important to watershed science and to park resources management are:

Sequoia National Park was confirmed to have alpine and subalpine watersheds with low buffering capacities within two distinct physiographic regions. Atmospheric inputs at three elevations representing three major ecosystems (chaparral, coniferous forests, and subalpine), have been monitored and baseline data on soils, vegetation, and aquatic communities collected. Specific studies include analyses of precipitation chemistry, dry deposition, stream hydrology, biology, aquatic and soil chemistry, meteorology, nutrient fluxes, and vegetation structure and function. Emphasis has been placed on detection of long-term change in atmospheric inputs and of effects on natural ecosystems across the elevational gradient. Temporary acidification of high elevation lakes and streams of the Sierra Nevada has been documented during spring snowmelt and after acidic summer storms. Effects of atmospheric contaminants on forest productivity are being evaluated. Results for the past decade do not show a critical or changing situation with regard to atmospheric pollutant contributions to precipitation or surface water. It is planned to use watersheds as sampling units for a broad array of long-term atmospheric, terrestrial, and aquatic monitoring as soon as funding becomes available. An extensive program of water quality and aquatic ecosystem monitoring has been proposed for funding. The past five years have strikingly revealed the importance of water quantity and dynamics, not only to the parks ecosystems, but to the state of California's well-being. We hope to integrate the Watershed Program with existing Global Change research in the region.

Rocky Mountain National Park atmospheric inputs have been monitored in alpine and subalpine lakes having low buffering capacity. Baseline data on soils, vegetation, and aquatic communities have also been collected. Studies have focused on soil and water chemistry and have investigated historical changes in pH in Rocky Mountain high elevation lakes. No permanent influence on pH attributable to acid deposition has been observed. In the Loch Vale subalpine watershed site, the 7-year biogeochemical study has greatly increased our knowledge of response of natural systems to stress, sources, and types of both wet and dry deposition, bedrock weathering rates and weathering mechanisms, soil characteristics and buffering mechanisms, terrestrial nutrient cycles, and alpine and subalpine surface water chemistry, biology, and hydrology. There is a large difference in precipitation and ionic concentrations between Loch Vale and a nearby (15 kilometers [km]) but lower (672 meters [m] difference in elevation) site at Beaver Meadows. Loch Vale is less likely to be influenced by anthropogenic inputs from the Front Range urban area east of the park than the lower elevation Beaver Meadows site. Loch Vale soils have a limited ability to buffer increased amounts of acidity from deposition. The influence of soil processes on surface water composition is restricted to a short period at the beginning of snowmelt. The major source of acid neutralizing capacity appears to come from microcalcite veins in the bedrock, which are exposed to weathering through physical breakdown of primary minerals by freeze/thaw, avalanches, and debris flows. Hydrologic processes exhibit the major influence on surface waters, with concentrations increasing as flow decreases through the winter, and decreasing with snowmelt after the early

flush of materials from soil solution. Extrapolations are now being considered to other study sites within the southern Rocky Mountain region.

Isle Royale National Park represents an upper midwest forest ecosystem experiencing increased amounts of acid deposition. Seasonal variations in precipitation chemistry have been evaluated for their effect on small watershed ecosystems. Other questions investigated were the increase of atmospheric loading with elevation above Lake Superior, how vegetation affects the quality and quantity of precipitation, the influence of alkaline glacial till on streamwater quality, the quantification of biogeochemical cycling for specific nutrients, and snowpack quality. Sulfate was found to be minimally adsorbed by soils, suggesting that nutrient leaching is possible in many similar forest systems due to sulfate mobility. This may accelerate ecosystem acidification. Preliminary data show an increase in forest ecosystem nutrient leaching across the region attributable to sulfate in acid deposition. Soils throughout the region were not generally derived on site, but were brought southward and westward by glacial activity. The glaciers picked up limestone as they moved southward and this resulted in more alkaline soils than the bedrock or vegetation suggest should be present. Inputs of atmospheric sulfur are on the decline at the research sites, an observation consistent with some regional studies of stream chemistry. However, the decreases are not statistically significant. Input/output budgets and nutrient cycling studies in all major forest types show these ecosystems are presently saturated with SO_4^{2-} . Excess SO_4^{2-} causes anion leaching of base cations from the forest rooting zone. However, the amount leached is still very small relative to the total soil reservoir of exchangeable base cations. In contrast to sulfur, the concentration of nitrogen species in precipitation is increasing. Computations of nitrogen inputs show that the combined inputs of wet and dry deposition (NPS IMPROVE station about 6 km from Wallace Lake) exceed ecosystem requirements. Over 50 percent of this input is in the form of NH_4^+ , high energy nitrogen which may be preferred by conifer species. In the future, excess NO_3^- could also contribute to anion leaching of base cations from these ecosystems. However, in intensive, multi-year studies of the fate of nitrogen species input, we have not found evidence of much of it below the rooting zone. In short, the forest community appears to be utilizing this excess nitrogen. The likely future effects of this or increased nitrogen input could be leaching of cations due to NO_3^- particularly under conifer forest, nitrogen toxicity, and most likely changes in species composition due to the application, in effect, of nitrogen containing fertilizer.

Olympic National Park represents a relatively pollution free area with substantial maritime influence on terrestrial and aquatic ecosystems. Pronounced differences in the dominant ions in precipitation (sodium and chloride) and streamflow (calcium and sulfate) occur. Research objectives are to develop an understanding of the sources and flux of coastal sulfur and their biologic implications. We have recently gained better understanding of the functioning of old-growth forest watersheds in the western Olympics. Streams in these watersheds are well buffered and will not be impacted significantly by acidic atmospheric inputs. However, vegetation has a considerable effect in modifying precipitation chemistry and acidifies precipitation to a considerable extent. The West Twin Creek watershed has been identified as an excellent site to monitor impacts of global change at the biogeochemical level because it is near the ocean/terrestrial interface.

SUPPORT PROVIDED TO REGIONS, PARKS, AND OTHER NPS ORGANIZATIONAL UNITS



ALASKA REGION

Planning and Evaluation Branch

- ✦ Glacier Bay NP and PRES
 - Assisted in evaluation of proposed Windy Craggy Project
- ✦ Katmai NP and PRES
 - Assisted in evaluation of proposed research drilling project
- ✦ Yukon-Charley Rivers NPRES
 - Initiated water resources scoping activities

Water Rights Branch

- ✦ Sitka NHP
 - Assisted with response to state of Alaska
- ✦ Miscellaneous
 - Responded to proposed changes in state water code

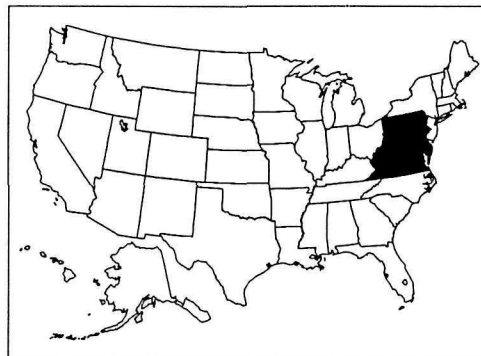
Water Operations Branch

- ✦ **Alaska Regional Office**
 - Provided statistics guidance in the form of summary entitled: "Beginner's guide to contaminants biomonitoring survey statistics"
- ✦ **Bering Land Bridge NPRES**
 - Provided statistics guidance in the form of summary entitled: "Beginner's guide to contaminants biomonitoring survey statistics"
- ✦ **Cape Krusenstern NM**
 - Provided information on available digital hydrography data
- ✦ **Denali NP and PRES**
 - Assisted in Moose Creek field study to determine navigability
 - Reduced survey data and performed cross-section analysis for Moose Creek to estimate depth of water at low flows
- ✦ **Kenai Fjords NM**
 - Conducted field reconnaissance of flood hazard
- ✦ **Klondike Gold Rush NHP**
 - Reviewed Floodplain Statement of Findings
- ✦ **Lake Clark NP and PRES**
 - Assisted park with determining an analysis for natural resources damage assessment by providing summary information on polycyclic aromatic hydrocarbons, total organic carbon, and total petroleum hydrocarbons
 - Recommended laboratories for doing metals and organic analyses
- ✦ **Northwest Alaska Areas**
 - Provided statistics guidance in the form of summary entitled: "Beginner's guide to contaminants biomonitoring survey statistics"

Applied Research Branch

- ✦ **Cape Krusenstern NM**
 - Conducted water quality analyses and monitoring
- ✦ **Denali NP and PRES**
 - Aided in development of plans for long-term research

- Recommended inventory and monitoring strategy for aquatic and terrestrial ecosystems
- ✦ Glacier Bay NP and PRES
 - Designed inventory and monitoring strategy for aquatic and terrestrial ecosystems
- ✦ Katmai NP and PRES
 - Developed plans for long-term watershed research and monitoring
 - Participated in science experiments review panel and on the Interagency Review Team
 - Provided an assessment of Interagency Cooperative Geothermal Research
- ✦ Noatak NPRES
 - Continued assistance to Alaska Regional Office and Noatak NPRES and Biosphere Reserve with development of U.S./Russia bilateral research planning activities
 - Aided in development of plans for long-term research
 - Aided in development of plans for U.S./Russia research
- ✦ Wrangell-St. Elias NP and PRES
 - Aided in development of plans for long-term research
 - Assisted in developing a research, inventory, and monitoring strategy



MID-ATLANTIC REGION_____

Planning and Evaluation Branch

- ✦ Assateague Island NS
 - Analyzed Visitor Center sewage system alternatives
 - Developed bathing beach water monitoring protocols

- Reviewed Wetlands Statement of Findings
- Staff temporarily detailed to acting Chief, Resources Management
- ✦Colonial NHP
 - Cooperated with Virginia Institute of Marine Sciences in development of a Water Resources Management Plan
 - Reviewed Yorktown Fuel Depot Remediation investigation
- ✦Delaware Water Gap NRA
 - Assisted with value analysis determinations for Weygadt Visitor Center
 - Reviewed Delaware River Basin Commission new Water Quality Standards
- ✦Friendship Hill NHS
 - Continued assistance (review of reports, development of alternatives) for treatment of acid mine drainage in Ice Pond Run
 - Reviewed Resources Management Plan
- ✦Richmond NBP
 - Initiated water resources scoping activities
- ✦Wolf Trap Farm Park
 - Reviewed General Management Plan

Water Operations Branch

- ✦Assateague Island NS
 - Provided assistance to Denver Service Center in design of water supply wells
 - Reviewed and commented on U.S. Fish and Wildlife Service's (USFWS's) proposal to maintain surface water levels by pumping ground water
- ✦Colonial NHP
 - Provided technical information to help park to decide if the chemical "permeon" should be used on bridges
 - Reviewed and commented on proposal to investigate water quality of the shallow ground water system and identify possible sources of contamination

✦ **Delaware Water Gap NRA**

- Consulted on water quality monitoring and modeling with a GIS and SAGIS data conversion
- Prepared summary report of Layton landfill ground water monitoring program for state of New Jersey review
- Reviewed project proposal for investigating contamination of shallow ground water supplies

✦ **Fort Necessity NB**

- Conducted potable ground water investigation

✦ **New River Gorge NR**

- Provided advice on location and construction design of a water supply well
- Provided assistance to the Denver Service Center in review and preparation of comments on water quality sections of the draft Gauley River General Management Plan
- Provided information on various hazardous chemicals from the contaminants encyclopedia
- Reviewed Floodplain Statement of Findings

✦ **Richmond NBP**

- Reviewed erosion study report

✦ **Shenandoah NP**

- Furnished SAGIS data conversion program

✦ **Steamtown NHS**

- Reviewed draft addendum to the Environmental Assessment for park's Comprehensive Management Plan

Applied Research Branch

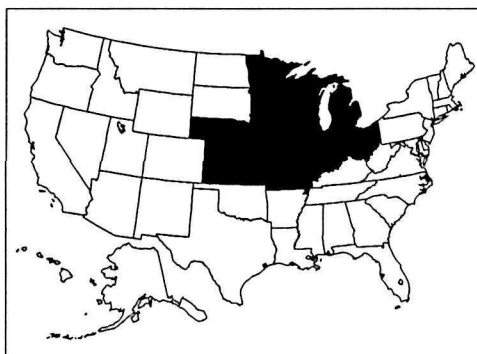
✦ **Delaware Water Gap NRA**

- Developed monitoring workplan to address nonpoint source pollution

✦ **Friendship Hill NHS**

- Developed monitoring workplan to address acid mine drainage

- ♦ Upper Delaware SRR
 - Developed monitoring workplan to address the Barnes landfill
- ♦ Valley Forge NHP
 - Provided technical assistance concerning contamination of park water by polychlorinated biphenyls



MIDWEST REGION

Planning and Evaluation Branch

- ♦ Effigy Mounds NM
 - Reviewed Resources Management Plan
- ♦ George Rogers Clark NHP
 - Reviewed Resources Management Plan
- ♦ Great Lakes National Parks
 - Served as NPS Observer to Great Lakes Commission
- ♦ Harry S. Truman NHS
 - Reviewed Resources Management Plan
- ♦ Herbert Hoover NHS
 - Reviewed Resources Management Plan
- ♦ Lincoln Boyhood NM
 - Reviewed Resources Management Plan

Water Rights Branch

- ✦ Agate Fossil Beds NM
 - Researched water rights requirements for new well
- ✦ Fort Larned NHS
 - Coordinated with legal counsel on water rights issues

Water Operations Branch

- ✦ Cuyahoga Valley NRA
 - Provided mining pit water evaluation
- ✦ Fort Larned NHS
 - Performed river survey and geomorphic analysis of the Pawnee River for the purpose of predicting the effects of removing a small impoundment dam
 - Provided advice regarding possible dam removal
- ✦ Niobrara/Missouri National Riverways
 - Reviewed 1992 Biological Assessment
 - Supported planning efforts on the Niobrara and Missouri Rivers by examining water resource issues and concerns
- ✦ Ozark National Scenic Riverway
 - Performed a flood analysis to estimate extent of 100- and 500-year floods on Gladden Creek
- ✦ Perry's Victory and International Peace Memorial
 - Reviewed Floodplain Statement of Findings
- ✦ Pictured Rocks NL
 - Provided information on available digital data for a water quality land-use study
- ✦ Saint Croix National Scenic River
 - Assisted in an Operations Evaluation of the park
- ✦ Voyageurs NP
 - Recommended strategies for ways to handle a National Pollutant Discharge Elimination System permit being considered by the state, for a Boise Cascade wastewater discharge from an International Falls pulp and paper plant

Applied Research Branch

- ◆ Cuyahoga Valley NRA
 - Provided technical assistance to address nonpoint source pollution
- ◆ Pictured Rocks NL
 - Provided risk analysis-based plans for inventory of aquatic resources and land-use changes in the area outside the park
- ◆ Regionwide
 - Recommended specifications on contract for benthic macroinvertebrate identification for Prairie Parks Monitoring Program
- ◆ Saint Croix National Scenic Riverway
 - Developed a study plan, "Cranberry growing areas along the Namekagon River"
 - Provided a plan to Minnesota-Wisconsin Boundary Commission on long-term monitoring of the St. Croix River system
- ◆ Sleeping Bear Dunes NL
 - Developed plans for a Multiple Watershed Water Quality Consortium



NATIONAL CAPITAL REGION

Planning and Evaluation Branch

- ◆ Catoclin Mountain Park
 - Conducted preliminary wetlands delineation and provided advice on routing proposed road to avoid wetland impacts

- ✦ Prince William Forest Park
 - Participated in Resources Management Plan scoping workshop
 - Reviewed General Management Plan

Water Rights Branch

- ✦ Chesapeake and Ohio Canal NHP
 - Assisted with response to permit application

Water Operations Branch

- ✦ Chesapeake and Ohio Canal NHP
 - Analyzed soil samples from sterile site on Chesapeake and Ohio Canal
 - Provided technical assistance on three canal rewatering and wetland mitigation projects
 - Provided report on hydrologic analysis, water budgets, and seepage analyses
- ✦ George Washington Memorial Parkway
 - Assisted staff in planning biomonitoring and contaminants studies
 - Identified wetland monitoring needs and provided recommendations for Dangerfield Island
 - Provided information from contaminants encyclopedia
- ✦ Greenbelt Park
 - Assisted park in development of interagency agreement with the state of Maryland
- ✦ Manassas NBP
 - Reviewed sediment sampling project and provided preliminary analysis of the data
- ✦ Monocacy NB
 - Examined floodplain issues during field reconnaissance
- ✦ National Capital Parks-East
 - Reviewed and commented on Site Assessment and Remediation Plan for East Station Property

♦ Prince William Forest Park

- Assisted park personnel with the development of Request for Proposals to investigate ground water influences on the surface water quality of Quantico Creek
- Evaluated potential influences of encroaching urbanization on water resources
- Provided detailed assessment of ground water data and monitoring recommendations pertaining to a nearby landfill

♦ Rock Creek Park

- Conducted STORET data retrieval in support of Denver Service Center project
- Provided water quality data retrieval and assistance with sediment modeling for tennis court construction

Applied Research Branch

♦ Prince William Forest Park

- Developed draft workplan to address nonpoint source pollution



NORTH ATLANTIC REGION_____

Planning and Evaluation Branch

♦ Acadia NP

- Assisted in review of nonpoint source modeling report
- Reviewed Bass Harbor Study Report
- Reviewed Resources Management Plan

- ✦ **Adams NHS**
 - Reviewed Resources Management Plan
- ✦ **Fire Island NS**
 - Published water resources scoping report (NPS/NRWRD/NRTR-92/11)
- ✦ **Gateway NRA**
 - Reviewed Resources Management Plan
- ✦ **Morristown NHP**
 - Initiated water resources scoping activities
 - Reviewed Resources Management Plan
- ✦ **Salem Maritime NHS**
 - Reviewed Wetlands Statement of Findings

Water Rights Branch

- ✦ **Fire Island NS**
 - Assisted with water resources scoping report

Water Operations Branch

- ✦ **Acadia NP**
 - Provided funding and administrative support for water quality analysis
 - Reviewed nonpoint source pollution modeling report
 - Reviewed report "Elemental mass balances and changes in chemistry of park surface waters"
- ✦ **Cape Cod NS**
 - Co-authored report defining monitoring needs, parameters, and protocols
 - Participated in workshop to identify monitoring program for water quality in kettle ponds
 - Prepared ground water flow model and draft report for review
 - Studied impact of ground water withdrawals on freshwater discharges to wetlands

✦ **Fire Island NS**

- Prepared discussion and project statement addressing abandoned flowing artesian wells for water resources scoping report and commented on report



PACIFIC NORTHWEST REGION

Planning and Evaluation Branch

✦ **Ebey's Landing NHR**

- Provided water resources issues overview

✦ **Fort Clatsop NM**

- Provided water resources issues overview

✦ **John Day Fossil Beds NM**

- Reviewed Resources Management Plan

✦ **Mount Rainier NP**

- Arranged and supervised Environmental Protection Agency (EPA) Region 10 technical assistance (wetlands delineation) for the park at Paradise Visitor Center

✦ **Olympic NP**

- Assisted the park with development of an Environmental Assessment for the "Cushman Boundary Trespass Issue"

✦ **San Juan NHS**

- Provided water resources issues overview

✦ **Whitman Mission NHS**

- Reviewed Resources Management Plan

Water Rights Branch

- ✦ **City of Rocks NR**
 - Quantified water rights, Snake River adjudication
- ✦ **Crater Lake NP**
 - Conducted adjudication studies, Klamath adjudication
- ✦ **Craters of the Moon NM**
 - Negotiated water right settlement agreement, Snake River adjudication
- ✦ **San Juan Island NHP**
 - Reviewed water right-related issues near park

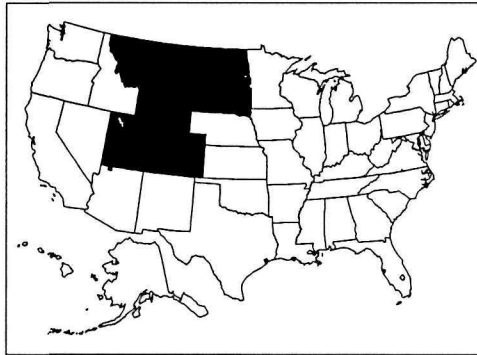
Water Operations Branch

- ✦ **Coulee Dam NRA**
 - Reviewed and provided comments to park management on U.S. Geological Survey's (USGS's) project workplan for Lake Roosevelt water quality investigations
- ✦ **Crater Lake NP**
 - Conducted potable ground water investigation
- ✦ **Hagerman Fossil Beds NM**
 - Attended workshop and developed action plan to address the problem of recurring landslides that threaten the fossil resources of the park
 - Conducted seepage study of irrigation ditch and holding ponds
 - Participated in a workshop to develop a Natural Resources Management Plan
 - Reviewed and recommended revisions to Inspector General's report on resources management in the NPS
- ✦ **Lake Chelan NRA**
 - Researched environmental effects of asphalt for the park
- ✦ **Mount Rainier NP**
 - Provided advice in the design of a water quality and biomonitoring project for a bridge replacement project on the east side of the park

- ♦ **Olympic NP**
 - Provided locations of USGS water quality monitoring stations in digital format
 - Studied Lake Cushman inflow

Applied Research Branch

- ♦ **Crater Lake NP**
 - Reviewed Crater Lake limnological studies
- ♦ **Olympic NP**
 - Provided financial support to watershed studies
 - Reviewed Watershed Studies Program



ROCKY MOUNTAIN REGION

Planning and Evaluation Branch

- ♦ **Arches NP**
 - Reviewed Resources Management Plan
- ♦ **Big Horn Canyon NRA**
 - Initiated water resources scoping activities
 - Reviewed Resources Management Plan
- ♦ **Black Canyon of the Gunnison NM**
 - Reviewed Resources Management Plan

- ✦ Colorado NM
 - Reviewed Resources Management Plan
- ✦ Devil's Tower NM
 - Reviewed Resources Management Plan
- ✦ Dinosaur NM
 - Analyzed hydrology and soil moisture data for Hog Canyon restoration project; published results in WRD Technical Report NPS/NRWRD/NRTR-92/13; presented results at meeting of Interagency Team for Hog Canyon Restoration and in paper at 1992 George Wright Society meeting
 - Provided technical assistance to park in determining research needs for establishing Green River flow requirements (releases from Flaming Gorge Dam)
 - Reviewed application to alter stream channel for mine adjacent to park
- ✦ Fort Laramie NHS
 - Reviewed Resources Management Plan
- ✦ Glen Canyon NRA
 - Reviewed Resources Management Plan
 - Reviewed supplement to Environmental Impact Statement for Animas-La Plata Project
- ✦ Grand Teton NP
 - Assisted in developing a "Scope of Work" for a detailed wetlands inventory and restoration plan for the Snake River Borrow Pit issue
- ✦ Great Sand Dunes NM
 - Reviewed Resources Management Plan
- ✦ Jewel Cave NM
 - Initiated Water Resources Scoping Report
 - Reviewed General Management Plan
 - Reviewed Resources Management Plan
- ✦ Little Bighorn Battlefield NM
 - Reviewed Resources Management Plan
- ✦ Natural Bridges NM
 - Reviewed General Management Plan/Development Concept Plan
- ✦ Rocky Mountain NP

- Identified wetlands in the Longs Peak campground and Wild Basin area in preparation for a Development Concept Plan

- ✦Wind Cave NP

- Reviewed General Management Plan

- ✦Yellowstone NP

- Reviewed proposed New World Mine Project

Water Rights Branch

- ✦Arches NP

- Reviewed water rights claims

- ✦Bent's Old Fort NHS

- Assisted with Natural Resources Management Plan

- Monitored progress of water right claim

- ✦Big Hole NB

- Negotiated with Reserved Water Rights Compact Commission

- ✦Bighorn Canyon NRA

- Assisted with Natural Resources Management Plan

- Negotiated with Reserved Water Rights Compact Commission

- Researched water rights

- ✦Black Canyon of the Gunnison NM

- Coordinated flow releases, Aspinall Flow Delivery Contract

- Quantified water right

- ✦Bryce Canyon NP

- Monitored progress of ground water study (Alton, Utah area)

- ✦Canyonlands NP

- Monitored progress of water right claim

- ✦Capitol Reef NP

- Assisted with preparation for hearing on Wayne County Water Conservancy District Water Rights Application

- Assisted with well drilling permit
- Assisted with Water Resources Management Plan
- ✦Colorado NM
 - Researched water rights for wells
- ✦Dinosaur NM
 - Evaluated impacts from placer mining on water rights
- ✦Florissant Fossil Beds NM
 - Provided technical review of contract for development of plan of augmentation
 - Responded to State Engineer, Sawmill Trail well
- ✦Glacier NP
 - Assisted with response to state of Montana, Saint Mary Site
 - Assisted with special use permit for West Glacier
 - Conducted adjudication studies, multiple adjudications
 - Negotiated with Reserved Water Rights Compact Commission
- ✦Glen Canyon NRA
 - Assessed impacts of AMCA water right application
 - Assisted with preparation for hearing on New Escalante Irrigation water right application
 - Monitored progress of Colorado River adjudication
- ✦Grand Teton NP
 - Adjusted acquired water rights
- ✦Grant-Kohrs Ranch NHS
 - Monitored progress of Montana adjudication, Basin 76G
 - Provided legal counsel information, Westside Objectors
- ✦Great Sand Dunes NM
 - Assisted with response to state concerning abandoned water claims
 - Assisted with Statement for Management

- Provided litigation support to Department of Justice, American Water Development, Inc. case
- Reviewed proposal for Stream-Aquifer Connection Study
- ✦ Little Bighorn Battlefield NM
 - Negotiated with Reserved Water Rights Compact Commission
- ✦ Mesa Verde NP
 - Conducted adjudication study, Water Division 7
- ✦ Natural Bridges NM
 - Assisted with General Management Plan
- ✦ Pipe Spring NM
 - Conducted Spring Decline Study
- ✦ Rocky Mountain NP
 - Assisted with preparation of motion for summary judgement and response to objections
 - Assisted with Resources Management Plan
 - Conducted adjudication study, Water Division 1
 - Reviewed water rights filings
- ✦ Timpanogos Cave NM
 - Assisted with Natural Resources Management Plan
- ✦ Yellowstone NP
 - Assisted with implementation of monitoring at Reese Creek
 - Conducted adjudication study (multiple adjudications)
 - Coordinated technical team on ground water and geothermal resource protection
 - Negotiated water right settlement, Snake River adjudication
 - Negotiated with Montana Reserved Water Rights Compact Commission
- ✦ Zion NP
 - Assisted with evaluation for the proposed designation of Research Natural Area
 - Assisted with water right filing, Taylor Creek well

- Conducted adjudication studies, Virgin River adjudication
- Conducted Expert Witness Conference
- Negotiated with state of Utah, Washington County
- Protected Flanigan Ditch claim
- ✦Miscellaneous
 - Conducted NPS-Department of Justice Field Hydrology Workshop
 - Responded to Montana temporary preliminary decrees
 - Reviewed Colorado Water Court resumes

Water Operations Branch

- ✦Arches NP
 - Conducted floodplain reconnaissance
- ✦Badlands NP
 - Located ground water sources for bison
- ✦Bent's Old Fort NHS
 - Performed site inspection to validate floodplain boundary prediction based on a Colorado Water Conservation Board report
- ✦Canyonlands NP
 - Advised park on possible sources of water for the Island in the Sky area and information regarding plugging of abandoned brine wells
 - Advised park on options for monitoring invertebrates and contaminants in riverine, pool, and spring habitats
 - Provided suggestions related to Rocky Mountain Region Cooperative Park Study Unit on potential contaminants studies
 - Reviewed Water Quality Monitoring Program at spring sites
- ✦Capitol Reef NP
 - Assisted in selecting location for a water well, design of well, and preparation of bid schedule; provided additional advice to correct improper construction

- Provided information on the toxicity of malathion, ethyl dibromide, chromium, and toluene from the prototype environmental contaminants encyclopedia; advised park of probable source on contaminants in barrel based on ingredients; provided information on medical monitoring options
- Reviewed progress of Fremont River Water Quality Monitoring Project
- ✦ Colorado NM
 - Prepared cost estimates for reverse osmosis treatment of well water
- ✦ Dinosaur NM
 - Assisted in developing research questions and study designs to determine effects of alternative flow releases from Flaming Gorge Dam
 - Conducted field assessment of issues related to the operation of Flaming Gorge Dam
 - Investigated riparian area restoration project in Hog Canyon
 - Prepared report of hydrologic conditions and alternatives for restoration
 - Performed a topographic survey to aid in channel relocation and riparian restoration of Hog Canyon
 - Performed river survey and subsequent flood modeling on Pool Creek to predict flood hazard for a proposed campsite
- ✦ Florissant Fossil Beds NM
 - Conducted sampling to evaluate water quality impacts from a private campground development
- ✦ Fort Union Trading Post NHS
 - Conducted literature review to identify alternative sources of potable water and prepared a memo for the park and Denver Service Center, including discussion of treatment methods to obtain better quality water
- ✦ Glacier NP
 - Performed river survey to aid in evaluation of proposed floodwall construction
 - Reviewed Floodplain Statement of Findings
 - Supported Divide Creek studies
- ✦ Glen Canyon NRA
 - Submitted final draft of the report entitled "Unique water nomination for Colorado River below Lee's Ferry" to the state of Arizona

- Coordinated with USFWS on selenium contamination and reviewed Draft Supplement to the 1980 Final Environmental Statement for the Animas-La Plata Project, Colorado and New Mexico (DES-92/0041)
- Participated in meetings to coordinate interagency long-term monitoring and research at Lake Powell
- Provided comments on the June 30, 1992, proposal for long-term monitoring at Lake Powell, Glen Canyon NRA
- Provided information on selenium from the draft contaminants encyclopedia
- Provided suggestions related to Rocky Mountain Region Cooperative Park Study Unit on potential contaminants studies
- Reduced survey data and created a computer generated topographic map to aid in beach erosion analysis
- Responded to Freedom of Information Act request regarding alleged dumping of hazardous wastes and pollutants into Lake Powell
- ♦Grand Teton NP
 - Reviewed Environmental Assessment of road material sources
- ♦Grant-Kohrs NHS
 - Provided comments on Montana Natural Resource Assessment Plan, Part II
- ♦Hovenweep NM
 - Provided encyclopedia information on petroleum hydrocarbons to help park respond to a crude oil spill
- ♦Jewel Cave NM
 - Georeferenced digital park boundary map
- ♦Mount Rushmore NM
 - Assisted staff with local community concerns about potential increase in flood risk resulting from new park facilities
 - Provided report assessing potential runoff increases from proposed visitor facility
- ♦Pipe Spring NM
 - Provided monitoring assistance to staff and assessment of ground water and spring monitoring at the monument; prepared a report entitled *Analysis of spring flow at Pipe Spring National Monument*

- ✦ Rainbow Bridge NM
 - Reviewed Floodplain Statement of Findings
- ✦ Rocky Mountain NP
 - Conducted potable ground water investigation
- ✦ Theodore Roosevelt NP
 - Provided assistance on planning invertebrate and fish collections to be included in the Water Resources Plan and/or future requests for project funding
- ✦ Wind Cave NP
 - Georeferenced digital park boundary map
 - Provided information from contaminants encyclopedia
 - Reviewed flood study
- ✦ Yellowstone NP
 - Assisted in a review of park research and resource management programs
- ✦ Zion NP
 - Conducted hydraulic evaluation

Applied Research Branch

- ✦ Grant-Kohrs NHS
 - Developed study plan to address the "Slickens Areas" along the Clark Fork River in the park
- ✦ Rocky Mountain NP
 - Aided in preparation of the Resources Management Plan
 - Provided a digitized geologic map
 - Provided financial support to watershed studies
- ✦ Yellowstone NP
 - Assisted in coordination of Known Geothermal Area research
 - Assisted with interagency coordination and review of Yellowstone NP and Corwin Springs Known Geothermal Area Research reports
 - Provided technical assistance concerning development of an Environmental Impact Statement Study Plan, New World Mine



SOUTHEAST REGION

Planning and Evaluation Branch

- ♦ Andersonville NHS
 - Reviewed Resources Management Plan
- ♦ Big Cypress NPRES
 - Assisted in development of scope of work for Water Resources Management Plan
 - Reviewed Wetlands Statement of Findings
- ♦ Blue Ridge Parkway
 - Taught a 2-day course in wetlands classification, compliance, and field identification/delineation, and provided advice regarding protection of a rare Appalachian bog
- ♦ Cape Hatteras NS
 - Reviewed Resources Management Plan
- ♦ Chattahoochee River NRA
 - Reviewed Resources Management Plan
- ♦ Cowpens NB
 - Reviewed Resources Management Plan
- ♦ DeSoto NM
 - Reviewed Resources Management Plan
- ♦ Everglades NP
 - Assisted in post-Hurricane Andrew Natural Resource Damage Assessment
 - Provided overview of nutrient dosing research activities for Technical Oversight Committee

- Reviewed Resources Management Plan
- ✦Fort Caroline NM
 - Reviewed Resources Management Plan
- ✦Horseshoe Bend NMP
 - Reviewed Resources Management Plan
- ✦Natchez Trace Parkway
 - Arranged and supervised EPA Region 4 technical assistance (wetlands mapping and restoration/mitigation advice) for parkway
- ✦Ocmulgee NM
 - Reviewed Resources Management Plan
- ✦Southeast Regional Office
 - Assisted Southeast Regional Office in selecting water resources projects for submission to WRD for FY93 funding and in prioritizing technical assistance requests

Water Operations Branch

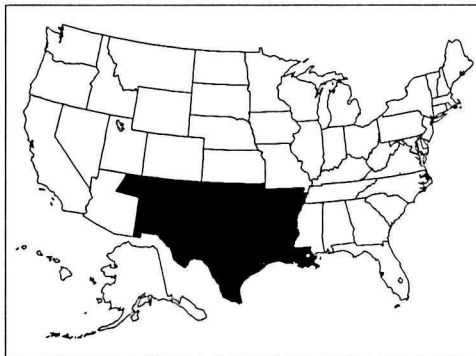
- ✦Biscayne NP
 - Assisted park management with the evaluation of proposed clay construction materials to be used as liner in new cells of the South Dade County landfill
- ✦Canaveral NS
 - Advised park on technical merit and funding options for project number CANA-N-006, TITLE: ID point and nonpoint sources of pollution
 - Conducted quality assurance review of water quality inventorying and monitoring project at Mosquito Lagoon, and facilitated state and federal interagency coordination for long-term monitoring
 - Coordinated WRD review and comment on Environmental Assessment for rehabilitation of disturbed Mosquito Lagoon marshes
 - Reviewed Bionetics' Water Quality Data Management and GIS activities on Mosquito Lagoon
- ✦Cape Hatteras NS
 - Completed technical quality control review of draft manuscript entitled *Surface water quality on a North Carolina barrier island Cape Hatteras National Seashore*
 - Provided continuing assistance on the Buxton Woods wellfield issue

- Testified as an expert witness at court hearing on proposed ground water withdrawals at Buxton Woods
- ✦Chatahoochee River NRA
 - Reviewed hydrologic plan and monitoring standards in Guidelines for Sand and Gravel Operations in Chatahoochee River NRA
- ✦Everglades NP
 - Consolidated and transmitted to the Department of Justice, WRD documents for discovery process in Florida Sugar Producers vs. state of Florida lawsuit
- ✦Fort Sumter NM
 - Provided information on how to monitor polycyclic aromatic and creosote-related contaminants at a hazardous waste site
- ✦Great Smoky Mountains NP
 - Commented on water quality data in the Environmental Impact Statement for Foothills Parkway
 - Made special comments on alkalinity and sulfate levels, provided information from contaminants encyclopedia
- ✦Gulf Islands NS
 - Advised park of sampling gear, study design, laboratory analyses, and study funding options related to preparations for a potential oil spill and/or a Natural Resources Damage Assessment
 - Reviewed National Oceanic and Atmospheric Agency's (NOAA's) September 28, 1992, request that the NPS review Mobil Exploration's appeal to NOAA to override Florida's recommended coastal denial pursuant to the Coastal Zone Management Act; warned park of impending issue
- ✦Kennesaw Mountain NBP
 - Assisted with initial scoping of a biomonitoring and contaminants project number (KEMO-N-025) for possible future funding
- ✦Mammoth Cave NP
 - Assisted in revising project number MACA2-N-009 for submission as a water quality project for the FY93 call
 - Reviewed summary report on the progress of hydrologic studies at the park during 1991
- ✦Obed Wild and Scenic River
 - Conducted STORET data retrieval

- ✦ Russell Cave NM
 - Provided comments on proposed biological and chemical survey
- ✦ Virgin Islands NP
 - Conducted erosion susceptibility study

Applied Research Branch

- ✦ Biscayne NP
 - Developed a monitoring workplan to determine ambient concentrations of ammonia in Biscayne Bay
- ✦ Great Smoky Mountains NP
 - Conducted biological and chemical analyses of mine drainage water
- ✦ Mammoth Cave NP
 - Reviewed scope of the Inventory and Monitoring Plan
- ✦ Virgin Islands NP
 - Aided in development of the GIS Water Resources Application Project
 - Cooperated with Water Operations Branch and Colorado State University staff on the GIS Water Resources Applications Project



SOUTHWEST REGION

Planning and Evaluation Branch

- ✦ Bandelier NM
 - Began revisions of Water Resources Management Plan

- ✦ **Big Bend NP**
 - Published water resources scoping report (NPS/NRWRD/NRTR-92/08)
- ✦ **Chickasaw NRA**
 - Continued development of Water Resources Management Plan
- ✦ **Jean Lafitte NHP**
 - Provided technical assistance regarding a proposal to model the Barataria Unit wetland ecosystem
- ✦ **Padre Island NS**
 - Provided technical assistance to park and region regarding preparation of a Development Concept Plan for Bird Island Basin

Water Rights Branch

- ✦ **Aztec Ruins NM**
 - Researched water rights
- ✦ **Bandelier NM**
 - Assisted with revision of Water Resources Management Plan
 - Researched water rights
- ✦ **Capulin Volcano NM**
 - Assisted with water right evaluation for proposed ground water development
- ✦ **Chickasaw NRA**
 - Conducted spring monitoring and reviewed USGS report on hydrology
- ✦ **Pecos NM**
 - Researched Grist Mill and acequia water right issues
 - Assisted with General Management Plan
- ✦ **Petroglyph NM**
 - Assessed water rights for new park
 - Assisted with General Management Plan
- ✦ **San Antonio Missions NHP**
 - Researched acequia water rights

Water Operations Branch

✦Amistad NRA

- Evaluated a Chemical Waste Management, Inc. permit application for a proposed hazardous waste landfill located near Dryden, Texas, and attended meetings related to the permit approval process
- Provided information on the toxicity of ammonia and petroleum related topics from the prototype environmental contaminants encyclopedia

✦Aztec Ruins NM

- Conducted well survey
- Evaluated historic ground water data

✦Bandelier NM

- Conducted floodplain reconnaissance
- Reviewed Water Quality Monitoring Program and water-related issues and management concerns to be addressed in a Water Resources Management Plan revision
- Provided STORET data retrieval in support of water quality program review

✦Big Bend NP

- Performed a river survey and subsequent flood modeling on Terlingua Creek to predict flood hazard for a primitive campground, Terlingua Abaja
- Reviewed water resources scoping report

✦Buffalo National River

- Reviewed report summarizing/interpreting water quality data collected between 1985 and 1990

✦Capulin Volcano NM

- Conducted potable ground water data evaluation
- Identified ground water problem

✦Carlsbad Caverns NP

- Conducted floodplain reconnaissance
- Coordinated WRD review and comment on the Dark Canyon oil and gas development Environmental Impact Statement

- ✦ **Chaco Culture NHP**
 - Conducted well location and erosion inspection
- ✦ **Chickasaw NRA**
 - Provided information on the toxicity of various compounds from the prototype environmental contaminants encyclopedia
- ✦ **El Malpais NM**
 - Supervised construction and testing of a water supply well; prepared final report
- ✦ **Guadalupe Mountains NP**
 - Conducted floodplain reconnaissance
- ✦ **Hot Springs NP**
 - Reviewed and commented on Environmental Assessment for proposal to conduct test drilling to provide data for design of flood control tunnel under West Mountain
- ✦ **Jean Lafitte NHP and PRES**
 - Consulted on the use of GIS to implement a comprehensive wetlands model
- ✦ **Padre Island NS**
 - Reviewed various options for amending oil spill proposal (for pre-spill Natural Resource Damage Assessment data collection); advised park on numerous technical details; and provided contacts for key oil spill contaminants specialists to park personnel
- ✦ **Pecos NHP**
 - Provided STORET data retrieval in support of water quality program review
 - Provided training for implementing Water Quality Monitoring Program
 - Reviewed and provided suggestions for the invertebrate monitoring plan for the park
- ✦ **Petroglyph NM**
 - Reviewed potential drainage problems and explored use of Digital Elevation Maps for modeling pre- and post-development water flows

Applied Research Branch

- ✦ **Bandelier NM**
 - Developed a workplan to study background concentrations of DDT in park waters, sediment, and biota
- ✦ **Jean Lafitte NHP**
 - Analyzed water quality data

- Provided recommendations for water resources monitoring and research



WESTERN REGION

Planning and Evaluation Branch

- ✦ **Golden Gate NRA**
 - Provided assistance regarding wetlands restoration at Big Lagoon and Bolinas Lagoon
- ✦ **Grand Canyon NP**
 - Evaluated alternatives for correcting sediment problem in water supply
 - Provided input to General Management Plan team on water supply issues and impacts
- ✦ **Great Basin NP**
 - Continued support for development of Water Resources Management Plan
- ✦ **Joshua Tree NM**
 - Initiated water resources scoping activities
- ✦ **Lake Mead NRA**
 - Designed and set up hydrologic monitoring system for the desert riparian restoration project (Sacatone Spring)
 - Assisted in preparing an Environmental Assessment for the Manzanita Lake dam and outlet structure

- ✦ Montezuma Castle NM
 - Reviewed Water Resources Management Plan
- ✦ Point Reyes NS
 - Prepared Water Resources Management Plan scoping report
- ✦ Sequoia NP and Kings Canyon NP
 - Developed a "Scope of Work" for a detailed wetlands inventory project at the Wuksachi, Lodgepole, Giant Forest, and Wolverton areas of Sequoia NP
 - Reviewed Resources Management Plan
- ✦ Tuzigoot NM
 - Reviewed Water Resources Management Plan
- ✦ Yellowstone NP
 - Reviewed park road reconstruction plan
- ✦ Yosemite NP
 - Reviewed Resources Management Plan

Water Rights Branch

- ✦ Casa Grande NM
 - Assisted with Natural Resources Management Plan
 - Monitored progress of adjudication, Lower Gila Basin
- ✦ Coronado NM
 - Monitored progress of adjudication, San Pedro Basin
 - Prepared objections to Hydrographic Survey Report, San Pedro adjudication
- ✦ Death Valley NM
 - Assisted with response to Change of Operation Environmental Assessment, Bond Gold
 - Conducted land surface survey, Devil's Hole
 - Developed draft study plan to assess water level declines, Devil's Hole
 - Filed orders for correction for NPS rights
 - Installed redundant instrumentation, Devil's Hole

- Monitored Devil's Hole
- Negotiated settlement of protests: Risinger, Phoenix Inn, and Nevada Magma applications
- Prepared for hearings on Las Vegas Valley Water District applications
- Protested Nevada Water Right applications
- Responded to interrogatories and prepared for hearing on Department of Energy water right application
- Reviewed monitoring data on U.S. Nevada Gold Search Joint Venture, Department of Energy wells
- ✦ Fort Bowie NHS
 - Amended adjudication claims
 - Evaluated Headquarters well water rights
 - Monitored progress of adjudication, Upper Gila Basin
 - Negotiated to have protests withdrawn for water right filings, Apache and Mine Tunnel Spring
- ✦ Golden Gate NRA
 - Assessed Stinson Beach water rights
 - Provided technical review of contract for water rights research for Presidio transfer
 - Researched water rights, Redwood Creek
- ✦ Grand Canyon NP
 - Assisted with General Management Plan
- ✦ Great Basin NP
 - Assessed water rights claim of Garrett Family Trust
 - Assisted with negotiations for campground water rights
 - Assisted with Water Resources Management Plan
 - Prepared for hearings on Las Vegas Valley Water District applications
 - Protested water right applications

- ✦ **Kalaupapa NHP**
 - Conducted Waikolu Stream Study
- ✦ **Lake Mead NRA**
 - Conducted inventory of water uses and rights
 - Negotiated settlement of protest, Nevada Magma water right applications
 - Prepared for hearings on Las Vegas Valley Water District applications
 - Protested water right applications
- ✦ **Lassen Volcanic NP**
 - Provided water right statement for Martin Creek
- ✦ **Montezuma Castle NM**
 - Monitored progress of adjudication for Verde River Basin
- ✦ **Organ Pipe Cactus NM**
 - Reviewed monitoring needs with USGS for Mexico Ground Water Impacts Study
- ✦ **Point Reyes NS**
 - Assisted with water rights assessment and preparation for state hearing, Lagunitas Creek
 - Assisted with Water Resources Management Plan scoping report
 - Coordinated state water use compliance inspections
- ✦ **Redwood NP**
 - Provided orders for correction for NPS water rights
- ✦ **Saguaro NM**
 - Assisted with response to U.S. Forest Service (USFS) request for water
 - Examined land acquisition proposal
 - Supported adjudication claims
- ✦ **Sequoia NP and Kings Canyon NP**
 - Researched water rights for Wuksachi Village development
 - Researched water rights question, Denver Service Center contract, Kaweah River Bridge

✦ **Tonto NM**

- Assisted with response to USFS request for water
- Monitored progress of adjudication, Salt River Basin
- Researched water rights, Cholla Spring

✦ **Walnut Canyon NM**

- Conducted adjudication study, Little Colorado River adjudication
- Monitored progress of adjudication, Little Colorado River Basin
- Negotiated with city of Flagstaff

✦ **Miscellaneous**

- Participated in San Pedro adjudication, Federal Work Group
- Reviewed hydrographic survey reports, San Pedro and Little Colorado adjudications

Water Operations Branch

✦ **Cabrillo NM**

- Provided information of effects of ocean tides on ground water level fluctuations

✦ **Channel Islands NP**

- Conducted test of water supply wells on Santa Rosa Island and prepared report of anticipated yield and alternative sources

✦ **Coronado NM**

- Provided records of aquifer tests

✦ **Fort Bowie NHS**

- Initiated potable ground water development

✦ **Golden Gate NRA**

- Provided comments on contaminated soil based on samples taken at Bolinas Lagoon
- Provided advice on design of future sampling, the kinds of parameters which should be included, and appropriate laboratory analyses
- Provided Presidio ground water evaluation

✦ **Grand Canyon NP**

- Drafted report on Beach 43L study
- Produced video entitled "Ground Water Enhanced Erosion at Beach 43L"
- Prepared draft report describing the design, use, and function of a Surface Profile Gage
- Provided ground water and erosion data with initial analysis to University of Arizona researchers in the Glen Canyon Environmental Studies project; WRD staff collected data from a validation beach during two study periods in 1991
- Provided information from draft contaminants encyclopedia and a copy of the EPA rapid bioassessment document
- Reviewed and commented on proposal for monitoring water quality from springs and investigating possible ground water flow paths
- Reviewed technical reports of sediment documents prepared by the Glen Canyon Environmental Studies Program and by the Glen Canyon Dam Environmental Impact Statement Team

✦ **Joshua Tree NM**

- Conducted Pinto Wye ground water evaluation

✦ **Kaloko-Honokohau NHP**

- Coordinated and prepared comments on park General Management Plan/ Environmental Statement
- Developed Request For Proposal for characterizing and monitoring water quality of anchialine ponds

✦ **Lake Mead NRA**

- Conducted STORET data retrieval
- Provided information on contamination of Lake Mead with diazinon and malathion
- Installed a ground water hydrologic network and assisted with initial data analysis to determine evapo-transpiration from exotic vegetation in a wetland for the "Demonstration Spring Restoration Project" at Sacatone Wash
- Provided information on environmental effects of ferrous sulfate and permanganate
- Reviewed final draft USGS geohydrologic study

- ✦ **Pinnacles NM**
 - Conducted potable ground water investigation
- ✦ **Presidio NHS**
 - Reviewed and commented on report on ground water availability and well testing
- ✦ **Saguaro NM**
 - Performed probable maximum flood analysis of an ephemeral wash to assess to potential flash flood hazard of a proposed visitor center
 - Provided floodplain delineation and advice
- ✦ **Sequoia NP and Kings Canyon NP**
 - Conducted Long Meadow/Wolverton Creek area evaluation
- ✦ **Tumacacori NM**
 - Conducted floodplain reconnaissance
- ✦ **Yosemite NP**
 - Prepared El Capitan Moraine report
 - Reviewed and commented on Resources Management Plan
 - Reviewed Water Quality Inventory and Monitoring Program and provided user training for NPS park-based Water Quality Data Management System
- ✦ **Western Regional Office**
 - Completed a 2-week detail at the Western Region as acting Regional Water Resources Coordinator

Applied Research Branch

- ✦ **Montezuma Castle NM**
 - Analyzed water resource issues
 - Conducted chemical analyses of water and sediment
- ✦ **Tuzigoot NM**
 - Analyzed water resource issues
 - Conducted chemical analyses of water and sediment

MULTI-REGIONAL SUPPORT

Water Operations Branch

- ♦ Alaska Region, Mid-Atlantic Region, North Atlantic Region, Southeast Region
 - Participated in Coastal Parks Inventorying and Monitoring Workshop and prepared draft protocols for aquatic chemistry monitoring

- ♦ Rocky Mountain Region, Western Region
 - Coordinated input from eight parks for the Colorado River annual operating planning process

SERVICEWIDE

Planning and Evaluation Branch

- Compiled an inventory of wetlands restoration projects in the NPS for the Domestic Policy Council's Wetlands Research Subcommittee

- Developed an NPS wetlands research database for the Federal Coordinating Committee on Science, Engineering, and Technology for inclusion in the Federal Wetlands Research Database

- Lectured on bathing beach monitoring activities in servicewide Water Quality Management Training Course

- Participated on the Natural Resources Interpretation Committee for the implementation of the NPS Strategic Plan

- Prepared briefing materials for Congressman Miller (D-California) regarding effects of the proposed changes to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands

- Prepared report on wetlands research in the national parks for the Domestic Policy Council's Wetlands Research Subcommittee

- Prepared WRD comments on the EPA proposed rule "Exception from Wetlands Mitigation Sequence for Alaska" (40 CFR Part 230)

- Provided overview of environmental laws applicable to NPS facilities management to Facility Managers Training Course

- Reviewed U.S. Army Corps of Engineers Regulatory Program Revision

- Taught wetlands section of servicewide course entitled "Environmental Compliance: Tools for Protecting Parks"

- Taught wetlands sections of the Denver Service Center Planning Workshop and the Eastern Team Wetlands Compliance Seminar

Water Operations Branch

- Coordinated NPS comments and prepared response on proposed USGS National Water Information System II proposal

- Designed, coordinated, and hosted Water Quality Inventorying and Monitoring Course

- Developed NPS recommendations for FY94, USGS's National Water Quality Assessment (NAWQA) study-unit basins

- Developed park-based Water Quality Data Management system

- Initiated park digital hydrographic database construction with boundary collection

- Inventoried parks which have guarded bathing beaches, and met with NPS Public Health Service representatives to coordinate the development of guidelines for monitoring of bacteriological quality at bathing beaches

- Moderated GIS water resources session at GRASS User's Conference

- Participated in meetings to determine applicability of EPA stormwater runoff regulations to NPS lands

- Participated on the USGS's NAWQA National Federal Agency Advisory Board, and on regional study unit liaison committees

- Prepared and presented briefing of WRD Hazmat capabilities for NPS Engineering and Safety Services Division

- Prepared FY94 National Cooperating Agency Water Quality Monitoring Initiative

- Prepared program description for EPA's National Database Initiative

- Prepared replies and appeals for Department of the Interior budget office questions on national Monitoring Initiative

- Presented NPS opportunities for volunteers at Third Annual National Citizens Volunteer Water Monitoring Conference

- Provided representation to the servicewide Inventory and Monitoring Program Committee

- Reviewed and commented on EPA Comprehensive State Ground Water Protection Plan
- Served on an Implementation Team to develop model organizations as part of the Natural Resources Strategic Plan
- Awarded contract to Horizon Systems, Inc. for park-specific water quality data retrievals from STORET

Applied Research Branch

- Acted as liaison between the Watershed Research Program and other research and monitoring initiatives
- Consulted with the NPS Inventory and Monitoring Program
- Coordinated the U.S./USSR Biosphere Reserves Bilateral Program
- Participated in Water Quality 2000, an interagency, inter-institutional effort to develop a broad consensus on future national water quality goals
- Provided interagency coordination to USGS (National Stream Quality Accounting Network, Water Energy and Biogeochemical Budgets, Benchmark, and Global Climate Change) Programs
- Provided interagency coordination with USGS Global Climate Change Program
- Provided support to the NPS Global Climate Change Program Committee
- Represented NPS on the National Acid Precipitation Assessment Program Ecosystems Program Team
- Reviewed and commented on over 40 NPS Global Climate Change research proposals
- Reviewed research proposals for University Council in Water Resources for water resources research under Section 105 of the Water Resources Research Act of 1984
- Served as chair of the American Society for Testing of Materials Global Change Standards Committee D18.01.08
- Served as chair of the 1992 conference "Managing Water Resources During Global Change"
- Served on Interagency Fresh Water Initiative

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FINANCIAL STATUS OF THE WATER RESOURCES DIVISION

Dan Kimball, acting Division Chief and Debi Cox, Program Analyst

FY93 base funding for the Water Resources Division (WRD) is \$5,696,000. Figure 3 illustrates the distribution of total WRD funds among technical assistance, project, and administrative overhead costs. Technical assistance, which is predominately day-to-day operational support to the parks, regions, and other NPS organizational units, includes staff salaries, travel, and associated expenses. Administrative overhead includes program management costs, administrative support, equipment, and supplies and materials Divisionwide. The projects category includes funds supporting WRD-sponsored projects, such as WRD prioritized projects, water rights studies, and our research program; staff salaries and associated overhead are not included. Tables 1, 2, 3, 4, and 5 summarize WRD-sponsored projects and studies.

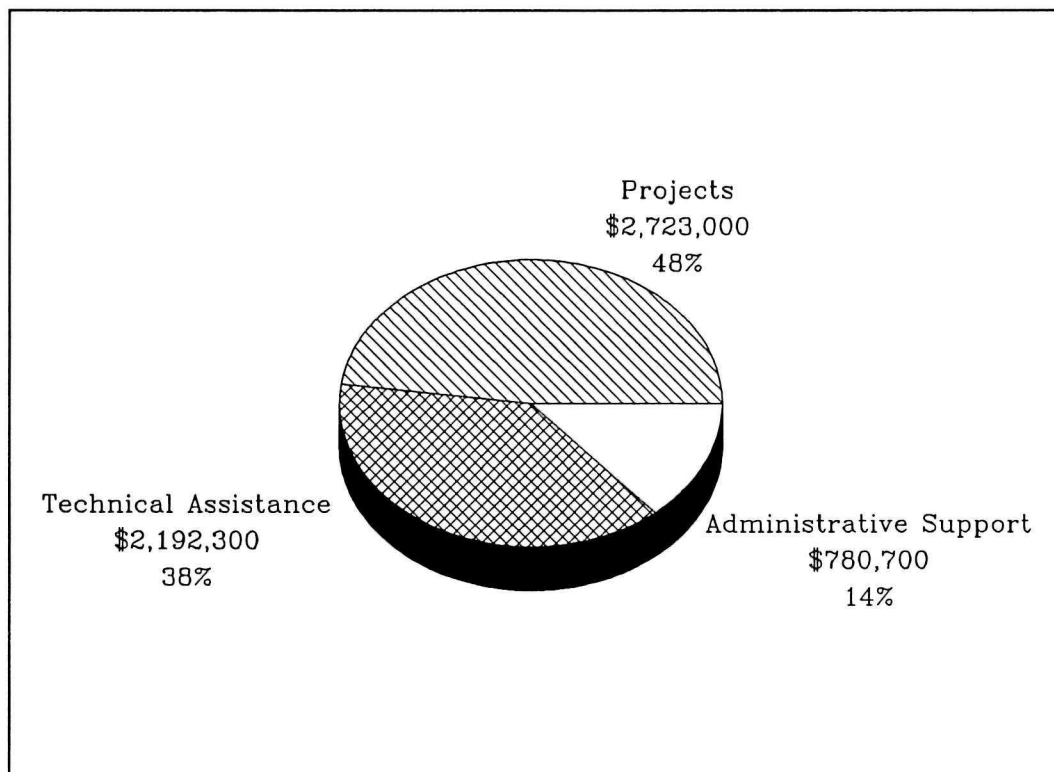


FIGURE 3. Distribution of WRD Program FY93 Funding.

FY93 WRD PRIORITIZED PROJECTS_____

TABLE 1. Continuing Projects

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. MANA/NCR	Stream Quality and Sedimentation Study	30.0	30.0		Inglis
2. BUFF/SWR	Water Quality Monitoring	27.0	27.0	27.0	Rosenlieb
3. GAAR/AR	Water Resources Baseline	10.0	50.0	50.0	Long
4. VIIS/SER	Effect of Sedimentation	20.0	40.0	20.0	Tucker
5. MORA/PNR	Jokulhlaup Prediction Study	40.0	40.0	40.0	Herrmann
6. GLCA/RMR	Water Resources Monitoring	31.0	31.0		Long
7. ORCA/PNR	Monitoring Cave Water Quality	14.0	9.6		Martin
8. PRWI/NCR	Determine Impact on Ground Water Quality at Abandoned Mine	19.0	17.0		Rosenlieb
SUBTOTAL CONT		191.0	244.6	137.0	

See Appendix A for park names.

TABLE 1 (cont.). New Projects

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. DINO/RMR	Sediment Transport Investigations on the Green River		25.0	25.0	Smillie
2. BIBE/SWR	Prepare Water Resources Management Plan		25.0	25.0	Flora
3. COSW/SER	Prepare Water Resources Management Plan/Acquire GIS System		25.0	25.0	Flora
4. DEWA/MAR	Water Resources Monitoring (New Regs)		50.0		Tucker
5. ACAD/NAR	Prepare Water Resources Management Plan		35.0	15.0	Flora
6. NOCA/PNR	Glacier Effects on Water Resources		20.0	12.0	Rosenlieb
7. WHSA/SWR	Ground Water Quality Monitoring		17.0	17.0	Inglis
8. CACO/NAR	Research Kettle Pond Hydrogeology		35.0	15.0	Martin
9. BICA/RMR	Prepare Water Resources Management Plan		25.0	25.0	Sharrow
10. SACR/MWR	Prepare Water Resources Management Plan		25.0	25.0	Sharrow
11. BISO/SER	Prepare Water Resources Management Plan		50.0		Sharrow
12. GLBA/AR	Establish Hydrologic Monitoring Stations in Glacier Bay Watersheds		15.5	34.5	Long
13. SEKI/WR	Inventory of Aquatic Resources: Phase 1 Middle Fork Drainage		45.0		Rosenlieb
SUBTOTAL NEW			392.5	218.5	
TOTAL CONT+NEW		191.0	637.1	355.5	

See Appendix A for park names.



FY93 WATERSHED PROTECTION PROGRAM FUNDING
WATER QUALITY ACTIVITY_____

TABLE 2. Continuing Water Quality

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. CUVA/MWR	Assess IJC Parameters	25.0	12.0		Irwin
2. KAH0/WR	Study Contamination of Anchialine Ponds	20.0	20.0		Long
3. DEWA/MAR	Establish Water Quality Baseline for Nutrients of Tributaries to the Delaware River	35.0	35.0		Irwin
4. CRMO/PNR	Develop Baseline on Water Resources	20.0	20.0		Long
SUBTOTAL CONT		100.0	87.0		

See Appendix A for park names.

TABLE 2. (cont.) New Water Quality

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. JECA/RMR	Analyze Contaminants Found in Cave Water Supplies	20.0	20.0		Nimmo
2. APIS/MWR	Monitor Outstanding National Resource Waters	10.0	30.0		Rosenlieb
3. INDU/MWR	Stream Ecosystem Assessment	40.0			Irwin
4. OLYM/PNR	Assess Impacts on Lake Ozette Ecosystem from Logging Activities	23.0	17.0		Long
5. GLCA/RMR	Research Trace Elements in Lake Powell	20.0	20.0		Irwin
6. MACA/SER	Inventory Aquatic Organisms and Determine Impacts of Pollution	20.0	20.0		Irwin
7. YUCH/AR	Water Quality and Hydrology Data Review	9.6			Long
8. CACO/NAR	Paleolimnology of Ryder Pond at Cape Cod NS	17.0			Martin
9. CHIS/WR	Monitor Water Quality on Santa Rosa Island	23.0	15.0		Rosenlieb
10. NAR	Evaluate Alternative Technologies for Onsite Wastewater Disposal	20.0			Rosenlieb
11. COLO/MAR	Water Resources Baseline	34.0	6.0		Martin
12. GWMP/NCR	Investigate Toxins at Dyke Marsh	20.0	15.0		Irwin
13. GRCA/WR	Reconnaissance Sampling to Enable Implementation of a Water Quality Monitoring Program	18.0	20.0		Long
SUBTOTAL NEW		274.6	163.0		
TOTAL CONT+NEW		361.6	163.0		

See Appendix A for park names.

FY93 WATERSHED PROTECTION PROGRAM FUNDING
WETLANDS ACTIVITY_____

TABLE 3. Continuing Wetlands Restoration

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. CACO/NAR	Salt Marsh Restoration	25.0	15.0		Wagner
2. ASIS/MAR	Wetlands Resources Assessment	20.0	20.0		Wagner
SUBTOTAL CONT		45.0	35.0		Wagner

TABLE 3 (cont.). New Wetlands Restoration

PARK/REGION	PROJECT DESCRIPTION	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. GOGA/WR	Big Lagoon Restoration		40.0		Wagner
2. BICY/SER	Copeland Prairie Restoration		40.0		Wagner
3. ROMO/RMR	Wetlands Restoration in the Colorado River Watershed		20.0	20.0	Wagner
SUBTOTAL NEW RESTORATION			100.0	20.0	
TOTAL RESTORATION CONT+NEW		45.0	135.0	20.0	

TABLE 3 (cont.) New Wetlands Inventory

PARK/REGION	PROJECT TITLE	FUNDING \$(000s)			WRD PROJECT COORDINATOR
		FY92	FY93	FY94	
1. OZAR/MWR	Inventory and Characterization of the Riparian Zone of the Current and Jacks Forks Rivers		20.0	20.0	Wagner
2. BLRI/SER	Characterization and Monitoring of High Elevation Southern Appalachian Bogs		10.0		Wagner
3. CARE/RMR	Conduct Inventory of Tinaja Wetlands		20.0	20.0	Wagner
SUBTOTAL NEW INVENTORY			50.0	40.0	
TOTAL WETLANDS		45.0	185.0	60.0	

See Appendix A for park names.

**TABLE 4. Projects Funded through the Water Rights Program
Fiscal Year 1993**

REGION	PARK	PROJECT TITLE	FY93	WRD PROJECT COORDINATOR
ALL	ALL	Historian Support (Reservation Purposes)	30.0	Williams
WR	DEVA LAME GRBA	Las Vegas Valley Water District	90.0	Johns
RMR	ZION	Virgin River Adjudication	212.0	Hansen
RMR	ROMO	Colorado Water Division I Adjudication	68.0	McGlothlin
PNR	CRLA	Klamath River Adjudication	53.0	Albright
RMR	BLCA	Quantification Reserved Rights	10.0	Pettee
RMR	GLAC	Montana Statewide Adjudication	18.0	Hansen
RMR	GRSA	Protected Reserved Water Rights	25.0	McGlothlin
WR	KALA	Assess Water Rights	20.0	Hughes
WR	DEVA	Ground Water Model	90.0	Christensen
SER	CAHA	Protect Park Water Rights	100.0	Pettee
WR	ORPI	Evaluate Ground Water Data	15.0	Hansen
ALL	ALL	Water Rights Dockets	55.0	Newberry
RMR	CARE	Colorado River Adjudication	15.0	Albright
WR	PORE	Protect Licensed Water Rights	12.0	Hansen
WR	GOGA	Water Rights Assessment	10.0	Hansen
SWR	CHIC	Protect Spring Flow	30.0	Christensen
WR	GRCA	Little Colorado River Adjudication	31.3	Hansen
TOTAL			\$884,300	

See Appendix A for park names.

**TABLE 5. Summary of other Project Areas Supported by WRD Funds
Fiscal Year 1993**

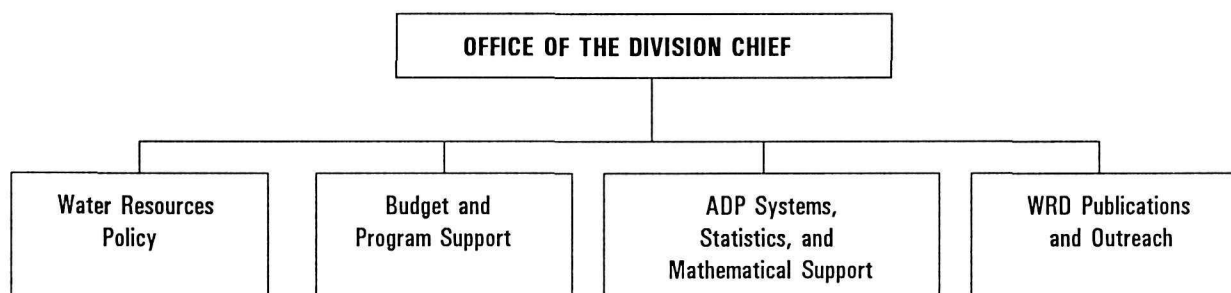
Water Resources Studies at Everglades NP	\$121,000
Watershed Studies Research Program (WRD-CPSU)	\$378,000
Servicewide Water Quality Database Development	\$ 50,000
Applied Research Branch Studies (See breakout box below)	\$156,500

Development and Application of Biological Assessment Techniques to Servicewide Water Resources Problems	\$67,900	Boyle and Hoefs
Modeling Techniques and Tools for Water Resources Management	\$35,200	Flug
Risk Assessment of Point and Nonpoint Sources of Pollution from within and outside Parks	\$53,400	Nimmo

ORGANIZATION AND STAFF

OFFICE OF THE DIVISION CHIEF

Organization and Staff_____



Dan Kimball: Acting Division Chief, see under Chief, Planning and Evaluation Branch.

Pam Matthes: Water Resources Program Coordinator, MS in Zoology. Specialty areas include natural resource management policy, environmental law and regulation, wildlife management, and wetlands ecology. (Pam has transferred to the U.S. Fish and Wildlife Service).

Sharon Kliwinski: Water Resources Program Coordinator Assistant, BS in Environmental and Pollution Sciences. Specialty area includes environmental legislation and regulations.

Dave Ryn: Mathematician, MS in Mathematics. Specialty areas include computer and statistical technology.

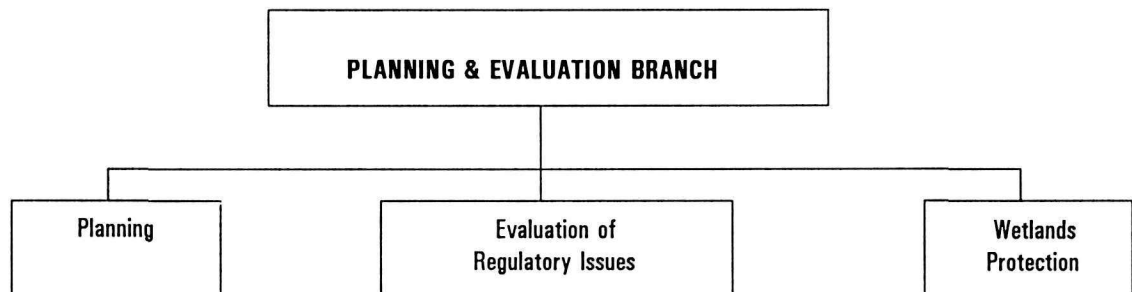
Debi Cox: Program Analyst, BA in Anthropology.

Judy Rouse: Secretary.

Carol Liester: Clerk/Typist.

PLANNING AND EVALUATION BRANCH

Organization and Staff



Dan Kimball: Branch Chief, MS in Water Resources Administration. Specialty areas include water and natural resources management planning and evaluation of complex regulatory issues.

Barbara West: Environmental Protection Specialist, MA in Public Administration. Specialty areas include regulatory support and evaluations.

Mark Flora: Hydrologist, MS in Environmental Science. Specialty areas include water resources management planning.

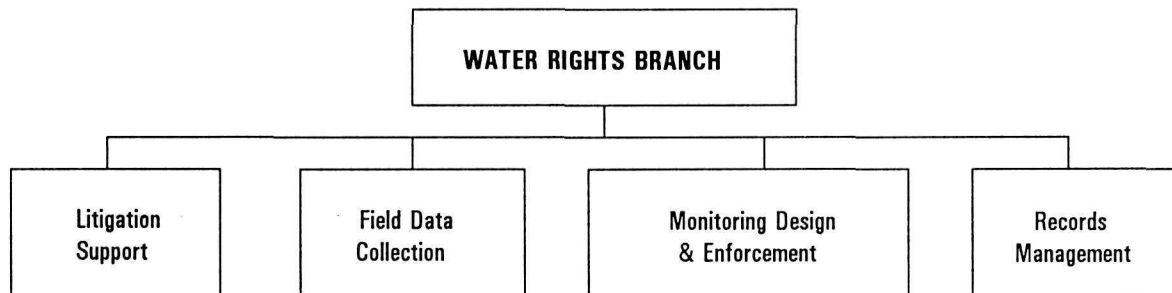
Joel Wagner: Hydrologist, MS in Environmental Science. Specialty areas include wetlands identification and protection.

David Sharrow: Hydrologist, BS in Watershed Science. Specialty areas include water resources management planning.

Bonnie Allison: Secretary.

WATER RIGHTS BRANCH

Organization and Staff



Owen Williams: Branch Chief, MS in Watershed Sciences. Specialty areas include water law, upland watershed management, fluvial geomorphology, and surface water hydrology.

Chuck Pettee: Team leader, MS in Watershed Science. Specialty areas include surface water hydrology and hazardous materials.

Dan McGlothlin: Team leader, BS in Watershed Hydrology. Specialty areas include surface water hydrology and land resource management.

Paul Christensen: Hydrologist, MS in Geology. Specialty areas include ground water hydrology, hydrogeochemistry, and computer modelling.

Bill Hansen: Hydrologist, MS in Hydrology. Specialty areas include surface water hydrology and watershed rehabilitation.

Alice Johns: Hydrologist, BS in Watershed Sciences. Specialty areas include surface water hydrology and field methods.

Jeff Albright: Hydrologist, MS in Watershed Management. Specialty areas include surface water hydrology, field methods, instrumentation.

Jeff Hughes: Hydrologist, MS in Watershed Sciences. Specialty areas include surface water hydrology, field methods, instrumentation.

Chris Gable: Hydrologist, BS in Watershed Sciences. Specialty areas include surface water hydrology, and water quality control.

Denise Newberry: Water Rights Assistant, MS in Natural Resources Management (pending). Specialty areas include NPS law enforcement, and natural resources policy and administration.

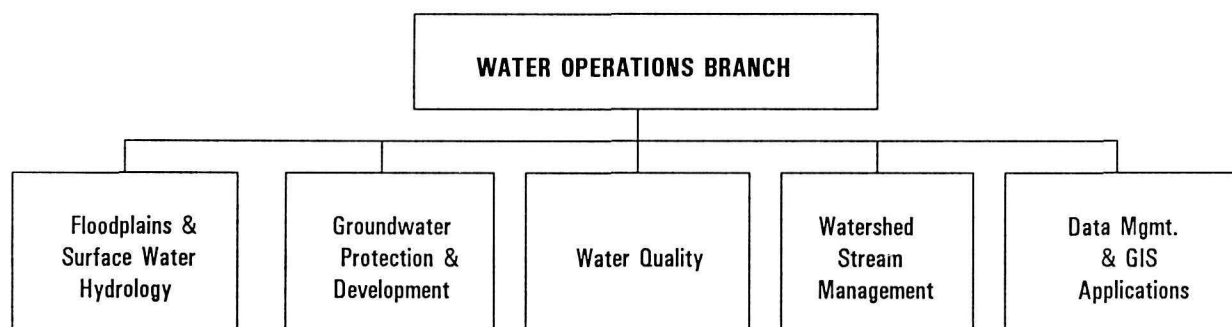
Christy Crandall: Research Associate; CSU.

Bernadette Berger: Secretary (acting), BA in Speech Communications.

Kathy Tisdale: Clerk Typist; CSU.

WATER OPERATIONS BRANCH

Organization and Staff



Bill Jackson: Branch Chief, PhD in Forest Hydrology. Specialty areas include sedimentation processes, fluvial geomorphology, and riparian rehabilitation and management.

Gary Rosenlieb: Water Quality Program Team Leader, MS in Water Resources. Specialty areas include water quality (chemistry and micro-biology), groundwater quality, and hazardous materials management.

Bill Werrell: Hydrology Program Team Leader, MS in Geology, MS in Hydrology. Specialty areas include well-siting, well design and testing, aquifer analyses, springflow monitoring, and floodplain management.

Roy Irwin: Water Quality Specialist, PhD in Biology. Specialty areas include environmental contaminants and biological aspects of water quality (including biomonitoring).

Gary Smillie: Hydrologist/Hydraulic Engineer, MS in Civil Engineering. Specialty areas include flood-frequency analysis, open-channel hydraulics, floodplain management, and sediment transport.

Barry Long: Hydrologist, BS in Watershed Sciences, MS in Forest Hydrology. Specialty areas include physical-chemical aspects of water quality.

Larry Martin: Hydrologist, MS in Hydrology. Specialty areas include watershed management, riparian management, ground water modeling, GIS applications in water resources, and hydrologic data analysis.

Dean Tucker: Computer Programmer Analyst, PhD (pending) in Natural Resources (GIS). Specialty areas include data management, computer graphics, and water resources applications in GIS.

Rick Inglis: Hydrologist, BS in Watershed Science. Specialty areas include field hydrologic data collection using automated recorders, watershed management, ground water monitoring, and data analysis.

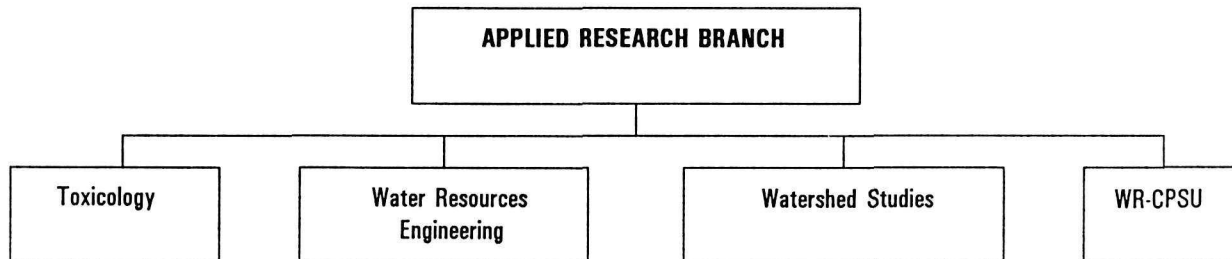
Jacque Nolan: Cartographer, MA in International Relations. Specialty areas include map preparation (including floodplain maps), graphics, and publications. Oversees Division Reference Room (which contains comprehensive water resources files for all NPS units).

Mike Martin: Hydrologic Technician, BS in Environmental Geology, MS (pending) in Watershed Science. Specialty areas include geochemistry, water quality, geomorphology, flood analysis, and tropical aquaculture.

Linda Gurunlian: Secretary, BA in English Education, technical degree in Computer Programming.

APPLIED RESEARCH BRANCH

Organization and Staff



Jerry Walsh: Branch Chief, PhD in Zoology/Aquatic Biology. Specialty areas include aquatic toxicology and aquatic ecology.

Marshall Flug: Research Hydrologist, PhD in Water Resource Engineering. Specialty areas include application of computer and mathematical techniques for management of water resources.

Ray Herrmann: Unit Leader, WR-CPSU, PhD in Geology/Hydrogeology. Specialty areas include long-term ecosystem health, hydrologic cycle, and chemical flux in watersheds.

Bob Stottlemeyer: Research Ecologist, PhD in Forest Soils/Biogeochemical Cycling. Specialty areas include long-term effects of anthropic atmospheric deposition in watersheds and long-term studies on snowpack nutrient dynamics.

Terry Boyle: Research Ecologist, PhD in Biological Sciences. Specialty areas include application of biological assessment techniques to water resource problems.

Del Nimmo: Environmental Chemist, PhD in Zoology/Limnology. Specialty areas include risk assessment related to nonpoint source pollution.

Jill Baron: Research Ecologist, PhD in Ecosystem Ecology. Specialty areas include biogeochemistry and effects of acid deposition and climate change on watershed processes.

Gustavo Diaz: Research Associate; CSU, PhD in Water Resources. Specialty areas include hydrological and systems analysis modeling.

Rob Edwards: Research Associate; CSU, MS in Ecology. Specialty areas include long-term studies on effects of climate change in watersheds.

Nancy Hoefs: Research Associate; CSU, PhD (pending) in Fluvial Geomorphology. Specialty areas include biological assessment of water resources.

Mary Willox: Research Associate; CSU, BA in English. Specialty areas include toxicity testing for detection of nonpoint sources of pollution.

Secretary: Joan Thiebaud.

AWARDS

WATER RESOURCES DIVISION_____

Fast Track awards were presented to employees from the Water Resources Division (WRD) who were detailed to the Washington Office to serve as the WASO Program Coordinator during the summer and fall of 1992: Bill Hansen, Alice Johns, Barry Long, Dan McGlothlin, Chuck Pettee, Gary Rosenlieb, and Gary Smillie.

OFFICE OF THE DIVISION CHIEF_____

Stan Ponce received a Special Achievement award for his contributions to Team Implement: NPS's 75th Anniversary Symposium.

Debi Cox received a Fast Track award for her coordination efforts of the Water Resources Division's relocation to a new office building, and her efforts in renewing the Cooperative Agreement with Colorado State University.

Debi Cox received an award for 15 years of service to the federal government.

Judy Rouse received a Special Achievement award for her support of activities in assistance with the Rocky Mountain Region Strategic Planning effort, and for her coordination efforts of the Water Resources Division's relocation to a new office building

Judy Rouse received an award for 10 years of service to the federal government.

Dave Ryn received a Fast Track award for his coordination efforts of the Water Resources Division's relocation to a new office building

PLANNING AND EVALUATION BRANCH_____

Mark Flora received a Special Achievement award for his special assignments at Assateague Island National Seashore, Everglades National Park, and Panama.

Joel Wagner received a Quality Performance award for his superior job performance.

Barbara West received an award for 15 years of service to the federal government.

WATER RIGHTS BRANCH

The Water Rights Branch received the Unit Award for Excellence of Service to the Department of the Interior. This award recognizes the branch's performance as a team to secure settlements of water rights issues in Idaho and Nevada.

Bill Hansen received a Fast Track Award for his contribution to the WRD's efforts to secure federal reserved water rights claimed for Zion National Park (ZION) by planning and coordinating a water rights conference at the park.

Jeff Hughes received an award for 5 years of service to the federal government.

Janice Taylor received a Fast Track for her contribution to the WRD's efforts to secure federal reserved water rights claimed for ZION by preparing for and assisting in a water rights conference at the park.

WATER OPERATIONS BRANCH

Rick Inglis received an award for 15 years of service to the federal government.

Larry Martin received a Fast Track award for his contribution to the analysis of ground water pumping issues at Cape Hatteras National Seashore.

Mike Martin received a Fast Track award for his support of the Division's hydrology and floodplain activity.

Gary Rosenlieb received a Quality Performance award for his contribution to the development of the Service's Water Quality Management Program.

Gary Smillie received a Special Achievement award for his contribution to the Service's floodplain and river management programs.

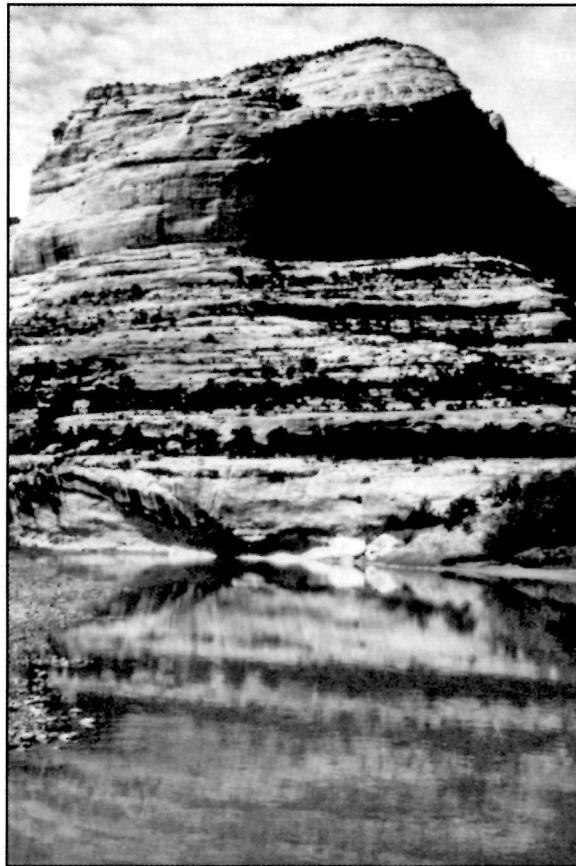
Dean Tucker received a Fast Track award for his contribution to the automation of the Division's annual work plan.

APPLIED RESEARCH BRANCH

Del Nimmo received an award for 20 years of service to the federal government.

Robert Stottlemeyer received the 1992 Director's Award for Research on Natural Resources.

Jerry Walsh received an award for 25 years of service to the federal government.



APPENDIX A

UNITS OF THE NATIONAL PARK SYSTEM

Acronym	Park Name	Region
ACAD	Acadia NP	North Atlantic
APIS	Apostle Islands NL	Midwest
ASIS	Assateague Island NS	Mid-Atlantic
BIBE	Big Bend NP	Southwest
BICY	Big Cypress NPRES	Southeast
BICA	Bighorn Canyon NRA	Rocky Mountain
BISO	Big South Fork National River and Recreation Area	Southeast
BLCA	Black Canyon of the Gunnison NM	Rocky Mountain
BLRI	Blue Ridge Parkway	Southeast
BUFF	Buffalo National River	Southwest
CACO	Cape Cod NS	North Atlantic
CAHA	Cape Hatteras NS	Southeast
CARE	Capitol Reef NP	Rocky Mountain
CHIS	Channel Islands NP	Western
CHIC	Chickasaw NRA	Southwest
COLO	Colonial NHP	Mid-Atlantic
COSW	Congaree Swamp NM	Southwest
CRLA	Crater Lake NP	Pacific Northwest
CRMO	Craters of the Moon NM	Pacific Northwest
CUVA	Cuyahoga Valley NRA	Midwest
DEVA	Death Valley NM	Western
DEWA	Delaware Water Gap NRA	Mid-Atlantic
DINO	Dinosaur NP	Rocky Mountain
GAAR	Gates of the Arctic NP and PRES	Alaska
GWMP	George Washington Memorial Parkway	National Capital
GLAC	Glacier NP	Rocky Mountain
GLBA	Glacier Bay NP and PRES	Alaska
GLCA	Glen Canyon NRA	Rocky Mountain
GOGA	Golden Gate NRA	Western
GRCA	Grand Canyon NP	Western
GRBA	Great Basin NP	Western
GRSA	Great Sand Dunes NM	Rocky Mountain
INDU	Indiana Dunes NL	Midwest
JECA	Jewel Cave NM	Rocky Mountain

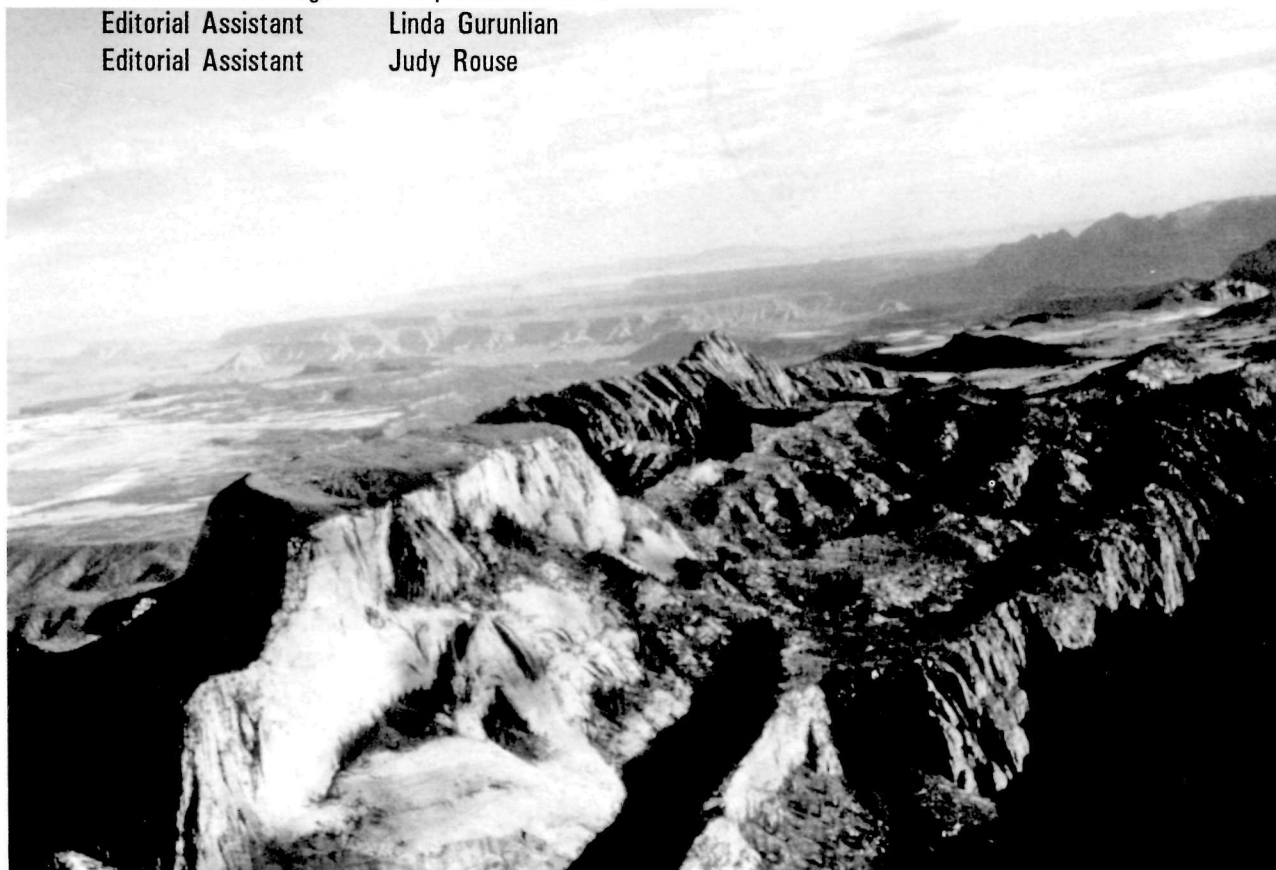
KALA	Kalaupapa NHP	Western
KAHO	Kaloko-Honokohau NHP	Western
LAME	Lake Mead NRA	Western
MACA	Mammoth Cave NP	Southeast
MANA	Manassas NB	National Capital
MORA	Mount Rainier NP	Pacific Northwest
NOCA	North Cascades	Pacific Northwest
OLYM	Olympic NP	Pacific Northwest
ORCA	Oregon Caves NM	Pacific Northwest
ORPI	Organ Pipe Cactus NM	Western
OZAR	Ozark National Scenic Riverway	Midwest
PORE	Point Reyes NS	Western
PRWI	Prince William Forest Park	National Capital
ROMO	Rocky Mountain NP	Rocky Mountain
SACR	Saint Croix Island International HS	Midwest
SEKI	Sequoia and Kings Canyon NP	Western
VIIS	Virgin Island NP	Southeast
WHSA	White Sands NM	Southwest
YUCH	Yukon-Charley Rivers NPRES	Alaska
ZION	Zion National Park	Rocky Mountain

CREDITS

PHOTOGRAPHS

Lake Sherburne, Glacier NP. Bill Hansen, cover; Dragonfly in Shark Slough, Everglades NP. Joel Wagner, cover; Angel Landing, Zion NP. Bill Hansen, p. 1; Trash in Rio Grande River from Terlingua Creek, Big Bend NP. Mark Flora, p. 5; Alluvial fan and wetlands complex at the mouth of Hog Canyon, Dinosaur NP. Larry Martin, p. 6; *Spiranthes diluvialis* orchid, Dinosaur NP. Bill Jennings, p. 7; Cover of the "Wetlands brochure," meadow in Rocky Mountain NP, and roseate spoonbill, Everglades NP. Joel Wagner, p. 8; East fork of the Virgin River, Zion NP. Bill Hansen, p. 10; Buttes and wildflowers, Zion NP. Bill Hansen, p. 75; South fork of Quantico Creek Reservoir, Prince William Forest Park. Rick Inglis, p. 80; Butte, Dinosaur NP. Janet Wise, p. 95; Oblique view of Zion NP. Bill Hansen, p. 99.

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Production & Design	Jacqueline V. Nolan
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Editorial Assistant	Judy Rouse





As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

April 1993

