National Park Service
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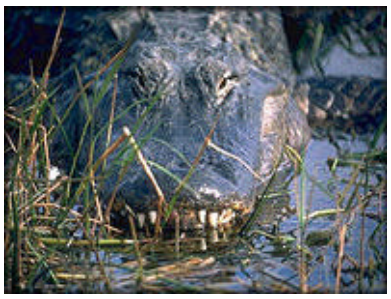
Water Resources Division
Natural Resource Program Center

Annual Report
2001








Water Resources Division
Annual Report - 2001

Water Resources Division
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Opposite: Big Thompson River, Rocky Mountain Natioal Park, NPS Photo

Contents

Black Canyon of the Gunnison National Park, NPS Photo

A Word from the Associate Director

by Mike Soukup

This Annual Report provides a summary of the accomplishments of the Water Resources Division (WRD) of the National Park Service (NPS) in 2001. WRD provides servicewide technical assistance and advice with respect to the preservation, protection, and management of water and aquatic resources of units of the National Park System. The Division provides services directly to parks through a broad range of programs in the areas of water rights; water quality; floodplain management; groundwater analysis; watershed and wetlands protection; water resources management planning; fisheries management; policy, legislative, and regulatory analysis; information management; and training. The Division's workplan is developed from an annual call to identify park needs which in turn determines WRD's priorities. In addition to direct support to parks, the Division provides day-to-day support to regional offices, support offices, and the Washington office in addressing water resources issues and concerns facing NPS. The Division is located in Fort Collins, Colorado, with additional offices in Denver, Colorado, and Washington, D.C.

I am extremely pleased with the accomplishments of the Water Resources Division reflected in this Annual Report. These accomplishments are indicative of the professionalism of the Division and the ability of the Division to work cooperatively with management and staff of parks, support offices, regional offices, and the Washington office to address water resource issues in parks. I believe WRD provides a model for cost effective centralized support for the vast majority of parks that do not have the range of technical expertise they need. Identifying, requesting, and providing technical support from a centralized program requires consummate professionalism at all levels of NPS. The collective effort of the Division, I believe, has created the environment necessary to begin to match the level of technical expertise to the magnitude of water-related issues facing national parks in a changing landscape.

I would also like to highlight the water resources component of the Natural Resource Challenge (NRC) that we implemented in 2000. I believe the NRC provides an unprecedented opportunity to increase our ability as an agency to address natural resource management issues facing parks in the modern landscape. The NRC action plan for water resources, developed by a team of NPS water and natural resource specialists and superintendents, includes budget increases for water quality monitoring, water resource protection and restoration projects, watershed condition assessments, and additional park-based aquatic resource professionals. I am very pleased with the leadership role that WRD has played in developing this action plan and WRD's continuing role in guiding implementation of this important component of the NRC.

Comments from the Division Chief

by Dan Kimball

The past year was one in which the Water Resources Division of the National Park Service endeavored to provide the highest level of support possible to parks in addressing a wide variety of water and aquatic resource-related issues. This also was a year in which we worked as diligently as possible with Washington, regional, and park management and staff to begin implementation of the water resources component of the Natural Resource Challenge. In FY2001, significant funding increases were received to support additional water quality monitoring and water rights projects in parks, two important needs identified in the water resources action plan of Natural Resource Challenge.

Examples of significant Water Resources Division accomplishments in 2000 include:

- Completion of water resource management plans for Chattahoochee River National Recreation Area and the Cold Harbor and Gaines' Mill Units of Richmond National Battlefield Park, and a water resources issues overview for Olympic National Park.

- Completion of the revegetation phase of a riparian, wetland, and stream restoration project at Glorieta Creek in Pecos National Historical Park.

- Participation on the National Coral Reef Task Force to develop a National Plan of Action to Conserve Coral Reefs.

- Significant assistance on endangered fish management issues at Dinosaur National Monument and Canyonlands National Park as part of the Upper Colorado River Recovery Implementation Program.

- Implementation of 31 park-based water quality monitoring and assessment projects through NPS's Water Quality Assessment and Monitoring Partnership Program with the U.S. Geological Survey.

- Completion of inventory and analysis of all available and applicable water quality data for 22 additional parks. (This brings to 207 the total number of parks with completed water quality databases.)

- Participation in watershed stabilization activities following the Cerro Grande Fire at Bandelier National Monument.

- Major floodplain assessment support at Glacier National Park, Grand Teton National Park, and Congaree Swamp National Monument.

- Significant assistance to Lake Mead National Recreation Area (contaminants assessments); Golden Gate National Recreation Area (evaluation of ground water-surface water interactions); Death Valley National Park (assessment of water supply alternatives at Furnace Creek); Arches and Canyonlands National Parks

(uranium mill tailings reclamation); Grand Canyon National Park (flood flow research capability as part of the Colorado River Surplus Criteria EIS); and Olympic National Park (analysis of water treatment alternatives associated with removal of the Elwha Dam).

- Continued assistance with respect to major water rights protection issues at Dinosaur National Monument, Black Canyon of the Gunnison National Park, Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, Joshua Tree National Park, Crater Lake National Park, and a number of parks in the Little Colorado River Basin in Arizona.

The Division's efforts continue to be greatly enhanced by the vigilance of park resource management staff in recognizing water resource issues and then contacting the Division for assistance. Our efforts are also supported by key staff in regional and support offices and by park-based water resource specialists.

The Water Resources Division will strive to remain focused on our principal mission – to provide technical support to the parks. We will also focus on implementation of the water resource component of the Natural Resource Challenge and continue to function in budget and policy arenas at the national level to insure that we are fully aware of, and appropriately influence, emerging programs and opportunities. Finally, we will endeavor to foster partnerships, and develop and implement new and more innovative ways to support parks in preserving, protecting, and managing water resources in units of the National Park System.

Washington Program Coordination Office

Volunteer Water Quality Monitoring in the National Parks

by Patty Hennessy

A volunteer water quality-monitoring project sponsored by the Water Resources Division is currently in progress in Rocky Mountain National Park. This project is a cooperative venture between the Colorado Division of Wildlife's (CDOW) Rivers of Colorado Water Watch Network, the Big Thompson Watershed Forum, and the National Park Service. Monitoring stations have been established at three different sites involving restoration of a wetland, remediation of a winter recreation area, and a comparison study at the convergence of two creeks. Monitoring began in November 2001 and is scheduled to continue for at least two years. This ongoing project was envisioned as a pilot project with the intent to expand to the remaining non-fee Park units in Colorado with the further goal of using this project as a template for non-fee parks within the Service with water quality issues. This project is providing the opportunity to educate youth and adults regarding the value and function of river ecosystems within a watershed and processes that contribute to water quality and their connection to those processes. As a result, this project is helping achieve both water quality protection and environmental education goals for both NPS and the CDOW. The project has several goals: 1) producing useable water quality data, benthic invertebrate data, physical habitat data and if relevant instream flow data (gage readings to determine if minimum flow is being met) for streams in the Park's watershed; 2) an interpretive display located in the Park of the data collected; 3) potential expansion of data collection into action projects recommended in Park by volunteers (i.e. riparian tree planting project, culvert replacement, and wetland restoration.); and 4) evaluation and recommendations on successes and failures and implementation plan to include other interested Colorado NPS units. Initial

funds provided through the fee demo Servicewide call have been used to purchase the equipment needed for the fieldwork and documentation of the work.

This project is utilizing an existing network of volunteers available through the River Watch program through three local high schools and the YMCA of the Rockies. Additional volunteers have been involved in the training and fieldwork. The River Watch Network provides in-kind support with field kits, data analysis, and training of volunteers. Teachers, students and other volunteers must attend a four-day training session. They sample at least 12/year including quality control and assurance samples. Volunteers collect and analyze pH, temperature, dissolved oxygen, alkalinity, and hardness. Volunteers collect and the state agencies analyze for 15 metals, dissolved and total fractions, and total suspended solids.

Volunteers at monitoring site, upstream fron Hidden Valley restortion site, Rocky Mountain Naitioal Park, NPS Photo

Planning and Evaluation Branch Highlights

By Mark Flora, Chief

I am pleased to report on a highly rewarding and productive year for the Water Resources Division's Planning and Evaluation Branch (PEB). During the year, PEB coordinated the revisions of the aquatic freshwater management, marine resources management, and fishing chapters of RM-77, the NPS Servicewide Natural Resources Management guidance document. WRD staff, working cooperatively with many of our field-based peers from throughout the National Park System, were able to revise and update this important guidance document in order to reflect newly emerging technologies, management policies and experiences gained over the past ten years. PEB was also active in developing a plan for the placement of 13 new aquatic resource professional positions brought about as a result of the NPS Natural Resource Challenge.

The WRD Planning Program, working cooperatively with park staff and other federal, state and local cooperators, was able to complete water resources management plans for Saratoga National Historical Park (NY) and Canaveral National Seashore (FL) Water Resources Scoping Reports were completed for Lake Clark National Park and Preserve (AK), Amistad National Recreational Area (TX), and Chesapeake and Ohio Canal National Historical Park (MD/DC). New water resources management planning efforts began at the following units: Sleeping Bear Dunes National Lakeshore (MI), Richmond National Battlefield Park (VA), Kings Mountain National Military Park (NC), and Isle Royale National Park (MI) Park. WRD also provided funding support, fiscal oversight and technical assistance for continuing efforts to complete water resource planning activities at the following park units: Katmai National Park and Preserve; Boston Harbor Islands National Recreation Area; Voyageurs National Park; New River Gorge National River; Gauley River National Recreation Area; Bluestone National Scenic River; and Pictured Rocks National Lakeshore. The role of the Planning Program expanded significantly in 2001 with requests for assistance from the Northern Colorado Plateau Inventory and Monitoring Network Planning staff to develop a 'concept paper' that outlined water resources planning elements necessary in the development of a water quality monitoring plan – a requirement in the establishment of a water quality monitoring program funded through the Natural Resource Challenge. In addition, PEB assisted the North Coast/Cascades Inventory and Monitoring Program in the cooperative development of a conceptual model for the long term ecological monitoring of upland and nearshore water-related resources for San Juan Island National Historical Park.

Other Planning Program activities during 2001 included: assisting NPS in the formulation of project statements and/or study plans for water resources management plans; providing water resources-related policy review of NPS planning documents (e.g. GMPs, SRSs, etc.); providing both technical review and agency comments on a number of NEPA documents (EISs, EAs, etc.) for external projects with potential to affect NPS resources; providing policy and technical review on regulatory and water quality issues relating to watershed management; and providing water-related input into several network-based and Servicewide Inventory and Monitoring workshops.

It was also a productive year for the WRD Wetlands Program. The Wetlands Program continued to dedicate a significant amount of time to interpreting and implementing NPS policies and regulations relating to wetlands protection. Program personnel worked closely with NPS units in the review and approval of wetlands statements of finding (SOF) pertaining to development projects in more than 12 NPS. In addition, the Wetlands Program initiated a program to review and follow-up on compensation/mitigation activities required in accordance with Director's Order 77-1.

The Wetlands Program also continued to serve as technical reviewers and/or COTRs for more than two dozen NPS-funded wetlands related projects including approving study plans and funding for new wetland and riparian restoration projects at Great Basin National Park, Voyageurs National Park, El Malpais National Monument, and Palo Alto Battlefield National Historic Site. New wetland inventory projects were also approved and funded for Lake Clark National Park and Preserve and for the Boston Harbor Islands National Recreation Area.

Wetlands program staff also worked closely with parks on a broad range of technical assistance projects during the

year. At Lassen Volcanic National Park, staff helped establish a hydrologic monitoring network for a rare fen ecosystem (Drakesbad Meadow) that has been artificially drained since the early 1900's. The monitoring network will be used to characterize existing (drained) hydrology and to document hydrologic response to restoration measures being planned for the site. At Glen Canyon National Recreation Area, wetlands staff helped assess the functional condition of several wetland and riparian areas affected by grazing and provided management recommendations. Wetlands program staff also co-authored a technical report titled "Hydrologic Restoration of a Wet Pine Savanna at Moores Creek National Battlefield." This report documented results of a hydrologic restoration experiment, and showed that after restoration the site could once again support pine savanna habitats comparable to what existed at the time of the battle.

Other notable technical assistance included a functional condition assessment of the Washita River riparian zone at Washita Battlefield National Historic Site, assistance to Great Smoky Mountains National Park in evaluating the potential impacts of proposed development on adjacent wetlands, and development of model wetland mitigation bank procedures for use by regions and parks.

Assistance to parks in the restoration of native fish species and their habitat continued to be one of the major activities of the WRD Fishery Program during 2001 and is one of the major tasks facing the National Park system as a whole. Fisheries Program staff currently oversees 25 fisheries and aquatic resources-related funded projects throughout the NPS. In 2001, funding and study plans were approved for new restoration projects at Rocky Mountain National Park (greenback and Colorado River cutthroat trout), Pictured Rocks National Lakeshore (Coaster brook trout), and St Croix National Scenic Riverway (Eastern brook trout). Funding for native species restoration and protection projects was continued at Golden Gate National Recreation Area, Great Basin National Park, Voyageurs National Park, Great Smoky Mountains National Park and Dinosaur National Monument. Technical assistance and guidance with projects was also provided to Santa Monica Mountains NRA for the possible restoration of a southern steelhead stream within the park, to Point Reyes National Seashore for work pertaining to the restoration of steelhead and salmon habitat, and at Mesa Verde National Park for work involving potential Colorado River endangered fish habitat.

The recovery of endangered warm water fish species in the Colorado River continues to be a high priority issue for National Park units along the Colorado River. The WRD Fishery Program continued to represent NPS interests with their participation on Upper Colorado River Recovery Implementation Program's Biology Committee and the Flaming Gorge Dam Environmental Impact Statement.

Other native fish work included project review and funding approval for a new boat to be used for the gillnetting operations and control of non-native Lake trout in the Yellowstone Lake cutthroat trout protection program and funding of two parks to evaluate the extent of potential impacts on native species (Olympic National Park for Bull trout and Glacier National Park for native cutthroat and bull trout).

The active monitoring and management of fishery stocks and fishing activities within National Park units is often lacking and often been left to the states. However, greater interest and concern is developing among park units about the potential impacts of fishing activities and the condition of their fish stocks. Two new projects seeking to understand the condition of fishery resources were approved for funding during 2001 and continued funding was provided for four additional ongoing projects. These projects address a range of issues from status of native salmon stocks in Lake Clark National Park and Preserve to Horseshoe Crabs at Cape Cod National Seashore and the status of native fish populations at Buffalo National River and Glacier National Park. The extent to which parks are beginning to work with states in developing long-range fishery management plans and coordinated fishery management programs continued to increase as well in 2001. The WRD Fishery Program reviewed new proposals and approved funding for the initiation of cooperative fisheries management plans at Isle Royale National Park and Biscayne National Park while the final draft of an international cooperative plan involving the states of Texas, Coahuila, Mexico, and Amistad National Recreation Area was completed with WRD assistance. A draft Memorandum of Agreement was also negotiated with the State of Florida to develop the cooperative plan for Biscayne National Park..

Marine issues and conservation activities also were a high priority within the WRD Fishery Program during 2001. Milestones included the approval and establishment of a large no-take marine reserve area within the Dry Tortugas National Park and the initiation of an interagency cooperative agreement with the National Marine Sanctuaries Program. The Fisheries Program provided technical assistance to Dry Tortugas National Park in developing their marine reserve proposal and is now providing technical assistance in the process of instituting a long-term monitoring program to determine if desired future conditions are being met. Other marine activities included working with the NOAA and National Marine Fisheries Service to conduct an inventory of marine protected areas as called for in the Marine Protected Area Executive Order and helping to develop a Marine Protected Area Science Center to assist agencies, states and local governments to address marine conservation issues. WRD staff also continued to participate on the National Coral Reef Task Force working groups and provided input for annual reports to the Task Force.

Sampling the fish community with electrofishing gear at Congaree Swamp National Monument (Bobbi Simpson).

An Inventory of the Fishes of Congaree Swamp National Monument

by John Wullschleger - Water Resources Division; Leo Rose - University of South Carolina; Theresa Yednock – Congaree Swamp National Monument; and Bobbi Simpson – Point Reyes National Seashore

Congaree Swamp National Monument, which is located within the floodplain of the Congaree River in South Carolina, protects the largest remaining area of undisturbed bottomland hardwood forest in the United States. While the area within the park boundary is not a true swamp, its diverse aquatic habitats include overflow channels, creeks, sloughs, oxbow lakes and guts. Conditions for aquatic organisms are affected by runoff from highways and agricultural areas, point source discharge of pollutants, fishing and operations of an upstream dam and hydroelectric unit. Until recently, information on fish species occupying these habitats was limited to the results of a 1996 survey which found 34 species at three sites within the park. A complete inventory of fish species had never been conducted and the park was lacking baseline data that could be used to assess changes resulting from the factors identified above.

In 2000, Congaree Swamp obtained NPS NRPP funding for a three-year, comprehensive study to inventory and determine the distribution of fishes within the park. The work is being conducted as a University of South Carolina graduate research project with oversight from the South Carolina Department of Natural Resources. WRD Fisheries Program staff have reviewed and provided technical input on implementation plans and reports. Fish assemblages in habitats throughout the monument are being sampled by electrofishing, supplemented by other gears and methods as necessary to capture fish in certain habitat types. Additional sampling is being conducted outside the Monument to obtain data that will be used to develop an Index of Biotic of Integrity (IBI) for assessing the health of the fish community. Habitat data being collected at all sample sites include substrate, stream channel morphology variables, water temperature, dissolved oxygen, pH, and conductivity. All field data will be developed into park GIS layers.

To date investigators have conducted surveys at 23 sites within Congaree Swamp National Monument and an additional 10 sites outside the park boundary. A total of 53 fish species have been identified from these sites (Table 1). Investigators have completed the initial steps in developing an IBI: species composition at disturbed and undisturbed sites has been described, stressors that may impact the fish community have been identified and data on local fish habitat preference, trophic level and tolerance to pollution have been compiled. In 2002, surveys will be conducted at an additional 30-40 sites within the park. In addition to improving knowledge about fish species presence and distribution, these data will be used to test the prototype IBI to ensure that it provides a robust measure of fish community health for the aquatic habitats of Congaree Swamp National Monument.

Black Canyon of the Gunnison, NPS Photo

DEVELOPMENT OF A WATER QUALITY MONITORING PROGRAM FOR THE NORTHERN COLORADO PLATEAU INVENTORY AND MONITORING NETWORK: PLANNING CONSIDERATIONS

By David Vana-Miller, Water Resources Planning Coordinator and Don Weeks, Hydrologist

Management for the 16-unit, Northern Colorado Plateau (NCP) Inventory and Monitoring Network requested that the Planning and Evaluation Branch formulate a planning approach to the development of a water quality monitoring program, funded by the Natural Resources Challenge through the Water Resources Division (WRD). The funding of this and other network-based water quality monitoring programs is tied to a Servicewide

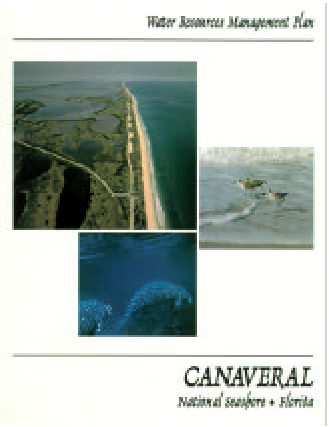
strategic goal calling for a significant reduction in water pollution in park units nationwide. Specifically, the objective is to improve the quality of impaired waters in parks and preserve the quality of pristine park waters (e.g., special resource waters). These water quality monitoring programs are keyed to the concept of fully integrating the design and implementation of water quality monitoring with the network-based vital signs monitoring program. Each network must have a WRD-approved water quality monitoring plan before implementation of their monitoring networks.

PEB's response was designed to aid in the development of that required monitoring plan by outlining steps in a planning process that would provide a solid foundation for the design of the NCP program or any other network-based water quality monitoring program. The most important early steps in developing a comprehensive monitoring plan are the tasks of identifying, summarizing, and evaluating existing information and data sources and the understanding of park hydrologic systems. We formulated a 'concept paper' that detailed those early steps and presented a process for synthesis of available information.

The primary objective was to identify those park waterbodies where water quality monitoring is adequate and expose those waterbodies that need to be monitored or warrant modification of existing water quality monitoring. Additionally, this synthesis should be grounded to the Servicewide strategic goal. In this regard the question became "What constitutes an impaired waterbody?" The determination of impairment can be problematic; however, for our application a rather straightforward definition is available. Each State must publish an impaired waterbodies list in accordance with section 303(d) of the Clean Water Act. To satisfy our primary objective we determined if a particular waterbody was on the 303(d) list (i.e., impaired) or not (unimpaired) and developed a dichotomous, question-based process (see associated Figure) that aided in synthesis and interpretation.

PEB presented the 'concept paper' to the NCP Network's Science Advisory committee in March 2001. Ultimately endorsed by the committee, the 'concept paper' formed the basis for the development of a scope-of-work that calls for the completion of the planning phase of a water quality monitoring plan.

Managing Water Resources at Canaveral National Seashore: A Coordinated Approach.



By Don Weeks, Hydrologist

Canaveral National Seashore (CANA) represents an excellent example of a relatively stable barrier beach backed by a productive lagoon system. The park consists of nearly 60,000 acres within the Mosquito Lagoon watershed, which is the northernmost sub-basin of the Indian River Lagoon Estuary along Florida's East Coast. This estuarine system contains the highest species diversity of any estuary in North America and provides critical habitat for 14 federally listed threatened and endangered species. The far-reaching, ecological importance of this area has been demonstrated by the EPA listing it as an Estuary of National Significance and by the State of Florida designating waters in the park as Outstanding Florida Waters, the highest level of state protection.

Several federal, state, and county agencies provide some layer of water resources management within the Mosquito Lagoon watershed. For example, the National Aeronautics and Space Administration (NASA) owns approximately 40,000 acres of CANA, with the majority of this area jointly managed between the park and U.S. Fish and Wildlife Service. In the establishment of CANA, both NASA and the State of Florida stipulated that the National Park Service must cooperate with the local mosquito control districts to control salt marsh mosquitoes. The challenge for the park is to coordinate with these and other agencies to better share information, minimize duplication of efforts, and address the information gaps. In 1999, CANA began a project,

funded by the Water Resources Division, to better meet this challenge.

The three-year effort by the University of Central Florida, Florida Atlantic University through the Florida Center of Environmental Studies, CANA, and the NPS-Water Resources Division was initiated in 1999 to develop a Water Resources Management Plan (WRMP) for CANA. This project began with a multi-agency scoping workshop to define the planning parameters for the WRMP, introduce the on-going regional programs related to CANA's water resources, and to seek external input on water-related issues impacting the Mosquito Lagoon watershed. Participants included the Florida Department of Environmental Protection, St. Johns River Water Management District, Volusia County, Kennedy Space Center, U.S. Fish and Wildlife Service, U.S. Geological Survey, and the Florida Institute of Technology.

This plan is different from other National Park Service WRMPs in that it contains a strong biological format. The biological theme resulted because of the documented degradation in CANA's aquatic biota, suggesting water resource problems. Examples include: Fibropapilloma (tumor-forming disease) impacting the marine turtle population the last ten years; lobo mycosis (a fungal infection) affecting about 10% of the bottlenose dolphin (*Tursiops truncatus*) population; a 50% reduction in intertidal reefs of the eastern oyster (*Crassostrea virginica*); a 1999 mass *mortality event of horseshoe crabs (Limu*-lus polyphemus); and loss of seagrass habitat.

The project ended in December 2001, with a completed CANA WRMP that has been distributed to the regional participants and other watershed stakeholders. By including, from the beginning, the various federal, state, and county agencies and academic institutions in the WRMP process, the park's ability to establish effective working relationships toward shared objectives is improved. With a completed WRMP, CANA is now working with these agencies and universities to implement strategies contained in the plan.

Restoring Bonneville Cutthroat Trout at Great Basin National Park

by John Wullschleger, Water Resources Division; Neil Darby, Great Basin National Park; and Gretchen Schenk, Great Basin National Park

The Bonneville cutthroat trout (*Oncorhynchus clarki utah*) is endemic to the Bonneville Basin of western Utah, southeastern Idaho, southwestern Wyoming, and eastern Nevada. Populations in the western portion of the Basin, which includes Great Basin National Park, are morphologically and genetically distinct from those found elsewhere because they have been geographically and reproductively isolated since Lake Bonneville receded 8,000 years ago. Native cutthroat trout were eliminated from nearly all of the streams in the Park early in the century due to the effects of over-grazing, water diversion and interactions with introduced trout species.

Resource managers at GRBA have been engaged in native trout restoration since the late 1990s. In 2000, western-strain Bonneville cutthroat were successfully reintroduced to the South Fork of Big Wash and nonnative trout were removed from Strawberry Creek. In 2001, the park applied for and obtained three-years of NRPP funding to conduct follow-up monitoring on the South Fork of Big Wash, reestablish Bonneville cutthroat trout in Strawberry Creek and upper Snake Creek and initiate pre-treatment activi-

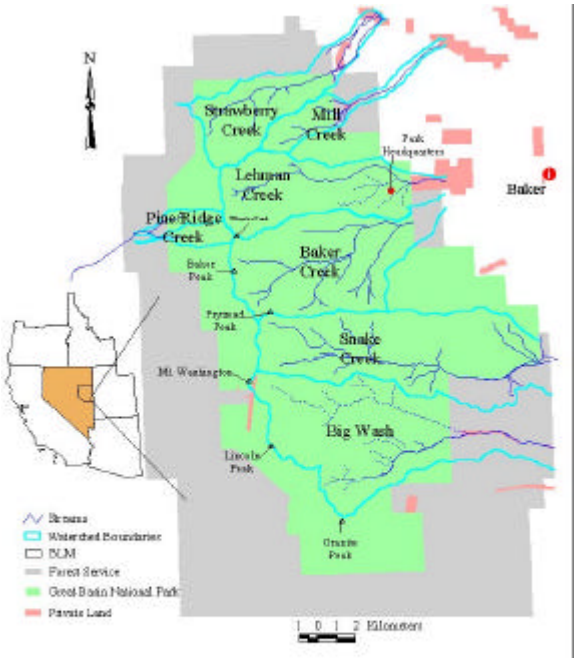


Figure 1. Existing and proposed Bonneville Cutthroat Trout watersheds in Great Basin National Park, Nevada.

Bonneville cutthroat trout from Mill Creek , Great Basin National Park (Neil Darby).

ties on the South Fork of Baker Creek and upper Lehman Creek. Bonneville cutthroat trout will be reintroduced to these last two streams after the term of the NRPP project and with separate funds. For each stream, restoration entails chemical treatment to remove nonnative fishes, determination of the effectiveness of natural barriers in preventing reinvasion, sampling water quality, amphibians, mollusks, fish and stream insects to document responses to chemical treatment and assess post-treatment recovery, and the reintroduction of pure western-strain Bonneville cutthroat trout.

Prior to 1999, the only known population of genetically pure western-strain Bonneville cutthroat trout within the park was located in the Pine / Ridge stream system, on the west side of Wheeler Peak, outside the historic range of the subspecies. Biologists believe that these fish were introduced to the system intentionally by early settlers or gained access via a ditch that was constructed to transfer water between the east and west slopes of the mountain. In 2001, analyses conducted by the Wild Salmon and Trout Genetics Lab at University of Montana and supported by project funds, confirmed the genetic purity of the Pine / Ridge population. Analyses conducted by the same lab, confirmed a second population that was found in Mill Creek in 1999. The Mill Creek population is inside the park and within the historic range of the subspecies.

In addition to genetic analyses of samples from the Mill, Pine and Ridge creek populations, 2001 accomplishments included post-treatment monitoring of Strawberry Creek, baseline (pre-treatment) monitoring of upper Snake Creek, determination of the limits of nonnative fish distribution in Snake Creek, and spawning surveys in Mill Creek and the South Fork of Big Wash. Snake Creek will be chemically treated with antimycin in 2002. This project is benefiting from experience and knowledge obtained during native trout restoration in other parks, notably the successful restoration of brook trout in some of the streams in Great Smoky Mountains National Park. It is anticipated that methods that are developed and refined over the course of this project will have broad application for improving the efficiency and effectiveness of native trout restoration in other National Park units.

Hydrologic Restoration of a Historic Pine Savanna Wetland at Moores Creek National Battlefield

by Joel Wagner, Wetland Program Leader

Moores Creek National Battlefield is located in Pender County on the coastal plain of eastern North Carolina. The battlefield was established to commemorate the decisive 1776 Battle of Moores Creek Bridge, in which less than 1,000 Patriots defeated more than 1,600 Loyalist troops. In the 1920s, a pine savanna wetland at the battlefield was artificially drained and converted to a weed-dominated meadow. This degraded ecosystem represents not only the loss of historic context for the battle, but also a loss of one of the most floristically diverse and increasingly rare plant community types in temperate North America. However, despite drainage and other management activities, portions of the meadow still harbor relic populations of pitcher plants (*Sarracenia* spp.), state threatened species *such as Carolina bog mint (Macbridea* caroliniana), and other pine savanna species.

WRD, the North Carolina Heritage Program, and The Nature Conservancy are now working with park staff to restore the drained meadow back to a pine savanna wetland system. The park's objective is to reestablish the landscape that likely existed at the time of the battle, while preserving the rare native plant species still represented at the site.

In late 1996, WRD installed a hydrologic monitoring network to characterize water table fluctuations under the existing (disturbed) and future (restored) conditions. In 1998 an experimental hydrologic restoration was implemented. The experiment involved plugging a drainage ditch at a location that would simulate its removal. The existing monitoring wells were read throughout the course of the experiment. By the end of 2000, sufficient data existed to determine if plugging the ditch would

Restoration of a Wet Pine Savanna, Moores Creek National Battlefiled, before (top) and after (bottom), NPS photo

restore wet pine savanna hydrologic conditions and to determine potential impacts on rare species.

Results of the experiment were published in "Hydrologic Restoration of a Wet Pine Savanna at Moores Creek National Battlefield, North Carolina" (Woods and Wagner, 2001). The study showed that plugging the ditch caused a statistically significant increase in water levels throughout most of the meadow, and that water levels now fluctuate in the same range as in nearby undisturbed pine savanna habitats. The majority of the upper and lower meadow areas could now support wet to mesic pine savanna communities (given the appropriate fire regime), while mesic to dry savanna conditions prevail on the margins of the meadow where water table depths are slightly lower.

The report includes "depth-duration curves" that describe pre- and post-restoration water table characteristics throughout the site. Maps showing areas with similar post-restoration hydrology are also presented. These maps and analyses will be used to guide future reintroduction of native bunchgrasses and other pine savanna species in habitats with appropriate hydrologic conditions. Recommendations are also provided for permanently eliminating artificial drainage and restoring pre-disturbance pine savanna hydrology at the park. Copies of the technical report can be obtained by contacting the author.

Reference:

Woods, S.W. and J. Wagner. 2001. Hydrologic Restoration of a Wet Pine Savanna at Moores Creek National Battlefield, North Carolina. NPS Water Resources Division Technical Report NPS/NRWRD/NRTR-2001/293. Ft. Collins, CO. 49 pp.

Submerged Aquatic Vegetation Monitoring at Assateague Island National Seashore

By Chris Lea, Assateague Island National Seashore and James Tilmant, WRD Fisheries Program Leader

The importance of submerged aquatic vegetation (SAV) to estuarine ecosystems and as an indicator of ecosystem health has been well recognized. The coastal bays of Maryland and Virginia contain large beds of SAV, which have increased over 3500 hectares in area since 1986 (Orth et al. 1998). Within the coastal bays of Maryland, over 90% of the SAV occurs within Assateague Island National Seashore (ASIS). These beds are crucial to the maintenance of regional biodiversity and ecosystem health. The boundaries and densities of SAV beds in the coastal bays are delineated and mapped from aerial photographs annually by the Virginia Institute of Marine Science. However, monitoring through remote sensing is likely to detect declines in SAV bed size or density only well after stress-causing factors have begun to operate. A monitoring program, which serves as an earlier warning to plant condition and stress levels, is necessary to fully protect this important resource. A three-year pilot project to evaluate methods of monitoring the health of SAV beds in within the park was completed this year.

Several parameters known to affect SAV health were selected for evaluation as potential indicators of stress. Water quality parameters evaluated were total suspended solids, dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll a, and water column light attenuation. Each of these parameters have previously been identified as significant to SAV maintenance and restoration within the Chesapeake Bay estuary (Batiuk et al. 1992) and are likely to be similarly important within the coastal bays of Maryland. ASIS has had a long-term water quality monitoring program in place since the early 1990's that measures all of the selected parameters on a monthly basis at 18 (unvegetated) stations. So, a second primary question of this study was whether the existing water quality monitoring is representative of conditions found over SAV beds within the park. Non-water quality parameters evaluated in-

cluded epiphytic algal biomass (dry weight) on the leaf surfaces of eelgrass, epiphytic chlorophyll a, eelgrass shoot (above ground) biomass, and eelgrass root/rhizome biomass. Within Assateague Island N.S., the SAV beds are dominated by eelgrass (*Zostera marina*). In addition to the above parameters, an experimental methodology to assess epiphyte growth rates and potential epiphytic growth affects on light attenuation at the seagrass leaf surface was tested using artificially suspended Mylar strips.

Study Results – Generally, water quality conditions were found to be very good for SAV within the park. Essentially all of the water quality parameters measured, with the exception of light attenuation within the water column, were well within the published suitable habitat requirement range. Therefore, none of the selected parameters (except possibly light attenuation) appear to be limiting to park SAV beds at the current time. Interestingly, the median value for light attenuation within the water column (K_d) at the long-term monitoring stations (1.56) exceeded the published habitat requirement of less than 1.50 established for SAV growth at 1-meter depth in the polyhaline section of the Chesapeake Bay. The median value for the vegetated stations within the park (1.47) was also very close to the maximum suitable value. This is somewhat difficult to explain, since K_d is usually considered to be an integrator of the other water quality requirement parameters, which were all substantially lower than the median habitat requirement maximum. This situation suggests the need for further research into the relationship between these parameters. Field methods for light attenuation measurements should also be reviewed to ascertain whether very shallow water might introduce bias into light attenuation measurements.

The comparison of water quality conditions at the existing long-term monitoring stations with those occurring at the shallower SAV beds indicated that the current park monitoring may not be sufficient to adequately document SAV bed conditions. Statistically greater concentrations of water column chlorophyll a and total suspended solids were found at the non-vegetated long-term monitoring stations than at the SAV beds. Dissolved inorganic phosphorus (phosphate) was slightly greater at the vegetated beds. Total values for dissolved inorganic nitrogen (DIN) was as about the same for both vegetated and non-vegetated stations, but the proportions of nitrogen species contributing to the DIN appeared different. Light attenuation was the only parameter that appeared to be very similar between vegetated and long-term monitoring stations.

A considerable amount of short-term (two-week or less) variability was found to occur in many of the water quality parameters measured, particularly DIN concentrations. Many “peaks” or “lows” in the concentrations observed would likely not have been detected by the monthly sampling currently done in Assateague’s long-term water quality monitoring program. Temporal variability was also found to be a greater than spatial variability among sampling stations. This suggests that increased sampling frequency is needed to improve the probability of detecting trends in the parameters measured through the National Seashore’s current long-term water quality monitoring program. Any expansion of the program should concentrate on increasing temporal effort. If costs of the program are to remain fixed, consideration should be given to decreasing the number of stations sampled in favor of increasing the frequency of sampling.

Both epiphytic chlorophyll a and the density of epiphytic algae on eelgrass blades was found to remain low throughout the spring growing season and then increase markedly at the end of the growing season (when water temperatures exceed 23° C.). While epiphyte growth would be expected to increase with increasing temperature, the abrupt increases in density seen at this period may also be partly due to the fact that growth of eelgrass leaves slows markedly with the onset of higher temperatures. The previous continuous leaf growth, which produced new uncolonized leaf surface, slows dramatically resulting in epiphyte density increases. Epiphytic growth in response to DIN concentra-

WATER OPERATIONS BRANCH HIGHLIGHTS

By Bill Jackson, PhD, Chief

Rocky Mountain National Park, NPS Photo

Water Operations Branch (WOB) FY 2001 activities were divided between direct technical assistance to parks on hydrology, water quality and data management issues, and support to major servicewide initiatives in the areas of water quality monitoring, water quality inventory and assessment, and information management.

A major emphasis for the Water Quality Program was implementing the servicewide water quality vital sign monitoring element of the Natural Resource Challenge (NRC). A short article describing this new program follows. The water quality program also provided oversight to 12 new Level I water quality inventory projects, 13 WRD funded projects and 32 USGS water quality assessment partnership projects, and it continued to co-manage the NPS national water quality partnership program with USGS. Technical assistance was provided on numerous park issues. Particularly noteworthy was the assistance provided to Kaloko Honokohau National Historic Park to support its' participation in State Land Board hearings on a proposal to re-zone a large parcel of land up-gradient from the park to light industrial use. Considerable assistance also was provided on water quality concerns related to personal watercraft (PWC) use. A reconnaissance-level water quality inventory at Lake Powell related to PWC use is reported on in another of the following articles. At Lake Mead National Recreation Area assistance was provided in developing a Lake Management Plan and EIS, including identification of water quality impairment thresholds.

The Information Management Program continued the preparation of park water quality data inventory and analysis reports. These reports are proving to be especially useful to Networks initiating water quality vital signs monitoring planning. The program also initiated a servicewide water quality data management program to support the new NRC water quality monitoring program and other water quality assessment activities. A cooperative agreement project was initiated with Colorado State University to support the new data management program, including hiring of two Research Associates and the continued conversion of the NPS water quality database to the new EPA-STORET database. Presently over 2.5 million park water quality observations are included in this new national database.

The Hydrology Program provided technical support to numerous issues of servicewide significance. Examples include assistance in drafting the Colorado River Surplus Criteria EIS Record of Decision, which among other things directed development of an experimental flow program for Grand Canyon. A highly successful workshop to develop a physical process monitoring plan to support Elwha River dam removal was organized in cooperation with the Bureau of Reclamation. Assistance also was provided to Congaree Swamp National Monument to help the park advocate scientifically credible floodway delineation upstream from the park as part of a process to evaluate the appropriateness of a major development proposal. Ground water protection issues were addressed at several parks including Zion National Park, Cumberland Island National Seashore and Guadalupe Mountains National Park, and source water protection plans were prepared for Arches National Park, Canyonlands National Park, Hovenweep National Monument, and Natural Bridges National Monument. WOB facilitated the National Riparian Team's conducting a riparian functionality and condition analysis on Salt Wash Creek in Canyonlands National Park as part of a court-ordered impairment determination. In addition, a riparian and rangeland condition analysis was prepared for Glen Canyon National Recreation Area by a Natural Resource Program Center interdisciplinary team.

Funding of the Natural Resource Challenge shows clear public support for our natural resource protection mission and has created exciting opportunities for WOB and parks to advance our programs and to work together to address park water resource management issues. I'm pleased with WOB's accomplishments in 2001, and look forward to an even more dynamic 2002 as some of our new program pieces fall into place and mature. As always, please call if we can help!

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Assessing Salt Creek's Riparian Condition in Canyonlands National Park

By Rick Inglis, Hydrologist

Salt Creek is a rare, green jewel hidden away in the vast expanses of the red sandstone canyons in southeastern Utah. The creek and its riparian zone are the subject of a major management challenge for the NPS. Canyonlands NP is preparing an Environmental Assessment for vehicle use in about 12 miles of Salt Creek Canyon in the Needles District. The EA is a result of public concerns over whether NPS is adequately maintaining the creek and its riparian zone in an "unimpaired" condition as required by the NPS Organic Act. The current use of the road is guided by the Backcountry Management Plan, which established a permit system and a daily limit on the number of vehicles in Salt Creek. A court decision in 1998 ruled (and has been appealed since then) that vehicles upstream of Peakaboo Springs cause permanent resource impairment.

WRD assisted park staff in conducting a reconnaissance evaluation of the riparian zone. It was recommended that the entire length of Salt Creek adjacent to the road have its riparian condition formally evaluated using the Bureau of Land Managements "Proper Functioning Condition" methodology. Additionally, an unimpacted reference reach would be assessed for comparison. The PFC methodology integrates vegetation, hydrologic and geomorphic aspects of riparian zones in order to determine overall riparian condition and function. To help insure objectivity and technical credibility, the park asked the National Riparian Service Team, an interagency group based in Oregon, to assist them in by applying the PFC assessment method to Salt Creek and its riparian-wetland resources. The results of the assessment will be beneficial for completion of the EA on road management.

The team first conducted a PFC assessment based on the 1953 aerial photos of Salt Creek. It was determined that, in 1953, all reaches of Salt Creek were in non-functional condition. Their best guess is the poor condition of Salt Creek in 1953 was probably due to the continuous season-long livestock grazing present at that time. When grazing was removed in the 70's, Salt Creek began to recover. However, other uses such as recreation can also affect the stability of riparian-wetland areas and must be considered in management plans.

The team next assessed functionality of the three reaches on Salt Creek using the guidelines *provided in technical reference Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science* for Lotic Areas. (Prichard et al., 1998). The team visited the sites on the ground the week of May 21-25, 2001 and finalized a checklist for each reach.

The reach between the tributary from Angel Arch upstream to the Upper Jump was rated proper functioning condition. This was the reference reach. All the items on the PFC checklist were found to be in a working order. While there was evidence of past impacts from the presence of the road, the riparian area has recovered and will accommodate relatively frequent high flows such as 5-, 10-, and 20-year events.

The other two reaches were rated as functional—at risk. The major reason was the lack of adequate riparian-wetland vegetation to protect banks and dissipate energy. This lack of vegetation was the direct result or impact from the presence of the road. Stretches of Salt Creek where the road has been closed are starting to recover. Stretches where the road is still used, the riparian-wetland resource continued to be impacted and recovery was much slower.

Alternatives in the EA for Salt Creek above Peekaboo Springs are: 1)vehicles permitted, daily limit on numbers, 2) vehicles permitted part-year (Oct-Nov), daily limit , 3) realign parts of road out of channel/riparian area, daily limit, and 4) vehicles prohibited.

Management will decide on one of the alternatives being prepared by the EA in compliance with the requirements of the court. The PFC assessment was an important basis for the analysis and comparison of impacts of alternatives in the EA. The team had assessed canyon reaches with and without vehicles, so sound, scientific merit was applied for the comparison of alternatives.

Deployment of datasondes in Moraine Creek ,Rocky Mountain National Park., NPS Photo

Assessment of Continuous Multiparameter Water Quality Monitors

by Pete Penoyer, Hydrologist

Water quality monitoring is being integrated with Park Vital Signs monitoring under the Natural Resource Challenge. Significant developments in hardware and software by water quality equipment vendors facilitate deployment of sophisticated instruments that collect field measurements of 10 or more water quality parameters. These measurements may now be recorded continuously at remote sites and monitored in real time using radio, cellular telephone, or satellite telemetry. Use of such instrumentation is likely to become an integral part of the Park Service's GPRA goal of monitoring and assessing long term changes or trends in water quality at their facilities.

The water quality monitors (datasondes) consist of a bundled set of sensors with various susceptibilities to instrument drift and sensor fouling depending on the condition of the natural waters. WRD is recommending that a basic set of four field measured water quality parameters be collected service wide for purposes of data consistency and comparability. Understanding the problems and obstacles that can occur and the level of effort required in making quality field measurements to acquire representative data is only obtained with the hands on experience that a demonstration of such instruments will provide.

WRD has arranged for three major instrument vendors to provide a 6-month demonstration of their continuous monitors (datasondes) in various water bodies at four Parks to assess the application, feasibility, and ease of use of continuous water quality monitors under long-term deployments. Park staff working closely with either WRD personnel or in some cases with local USGS offices have deployed multiple monitors to evaluate and compare instrument capabilities in a side-by-side deployment. Information obtained from the assessment of these instruments and the experiences relayed by Park staff will be used in developing water quality monitoring guidance to Parks. Information on equipment performance gathered from this demonstration should be useful to Networks in their monitoring program design. It is anticipated that Network staff will use this information in their water quality monitoring programs to make better-informed instrument procurement decisions and to improve the design of their monitoring systems.

Kaloko-Honokohau National Historical Park Resources Protected in Precedent-Setting Decision

By Roy Irwin, PhD, Contaminants Specialist

A request was made to the Hawaii Land Use commission in 2001 to re-zone a parcel of land up-gradient from Kaloko-Honokohau National Historical Park (KAHO) to accommodate a proposed industrial park development. KAHO intervened in the zoning change to ensure that best available technology was employed to help prevent damage to Park water resources from wastewater and storm water. One concern was that the industrial park's planned sewage disposal system (a standard septic field) would result in contamination of park water resources. In February 2002, the Hawaii Land Use Commission approved the re-zoning but placed strong conditions on the development of the site. The Park feels that the conditions placed on the project by the Commission were adequate to address NPS resource protection concerns, and that they should set a precedent for future development along the Kona Coast. As it now stands, developers can only develop 45% of the lots until such time as hook-up to the regional sewage system can be provided. Both the Park and the developers are now working in an expedited way to facilitate hooking into the regional sewage treatment plant. The 45% of lots that could be developed now must have advanced septic systems in order to achieve higher levels of nutrient treatment, similar to the system being developed by the park for its visitor's center.

The NPS Water Resources Division assisted the park and the regional solicitor by developing and presenting expert testimony to the Commission on the potential for water quality impacts to park ponds. The Park reported that the commissioners strongly rebuked project advocates for shoddy environmental studies and for inappropriately trying to attack the credibility of NPS experts. Overall, the decision by the Commission is considered a major resource protection "victory" for the park.

Many interesting water quality issues were debated in what turned out to be an adversarial courtroom setting, including the following:

Effects of additions of nitrogen to Freshwater Park ponds:

NPS expert testimony demonstrated that the opposition had not proven that 50% increases in nitrate concentrations in groundwater coming into the ponds allegedly "would not change the biology in the ponds." Not only had it not been proven, but it was shown to be highly unlikely.

Effects of additions of nutrients to Coral and other Marine Benthic Resources: NPS expert testimony demonstrated that the opposition had not proven that large increases in nitrate concentrations in near shore coral reef habitats allegedly "would not have any adverse biological effects in such habitats." Not only had it not been proven, but NPS experts demonstrated that nutrients were already exceeding State of HI water quality standards in the water column AT THE BOTTOM in coral reef habitats, according the opposition's own data.

Bio-availability of Dissolved Organic Nitrogen (DON) in Park ponds: NPS expert testimony demonstrated that the opposition had not proven that dissolved organic nitrogen in the ponds allegedly "could be used by phytoplankton in the absence of significant inorganic nitrogen, and therefore (sic) the ponds were not nitrogen limited." NPS testimony documented not only that had this concept not been proven, but that the predominance of DON in the absence of inorganic forms of nitrogen might encourage the growth of selected nuisance or toxic algae.

Sampling at Lake Powell for Contaminants from Motorized Watercraft

By Mark VanMouwerik, Colorado State University

In the summer of 2001, in response to a request from Glen Canyon National Recreation Area, WRD staff organized and participated in sampling Lake Powell water for contaminants from motorized watercraft. This sampling was in support of an Environmental Impact Statement GLCA is currently writing for the operation and management of personal watercraft at the lake. Since impacts will probably be keyed to the degradation of existing water quality, sampling was required to get some idea of what current water quality even is for the contaminants of interest.

Four sample areas were chosen to represent different use areas relative to PWC. (It should be noted that sampling did not differentiate between contamination from PWC and that from any other engine or boat class.) Knowles Canyon, closed to boat traffic for a concurrent USGS study, was the control area. Moki Canyon represented a high-use side canyon area. Wahweap Bay represented a high-use, open-water area. Bullfrog Marina represented a very-high-use area. Three locations were sampled at each area, and two depths – 3 meters (m) and 0.5m – were sampled at each location. All 24 samples were analyzed for the hydrocarbons benzene, toluene, ethylbenzene, xylenes (collectively, BTEX), 24 different polycyclic aromatic hydrocarbons (PAHs), and the gasoline additive, methyl tert-butyl ether (MTBE). In addition, four samples were analyzed for four additional gas additives.

Sampling occurred on a busy weekend, prior to the July 4 holiday. Results showed the BTEX concentrations to be the highest, followed by MTBE and then the PAHs (excepting the lightest compounds, most of these were below laboratory detection limits). The four additional gas additive compounds were below detection limits. Results suggest that the overriding source of the contamination measured was from motorized watercraft. Benzene was the only compound where concentrations exceeded State of Utah numeric criteria for the protection of water quality. These exceedances occurred in the Bullfrog Marina and Moki Canyon areas. Some mixing of contaminants into the deeper (3m) layer was observed in the open-water samples.

Possible future monitoring at Lake Powell could be designed to improve our understanding of baseline conditions for these contaminants and also of the contaminant inputs from PWC specifically.

Sample collection using the portable and disposable glove box in Knowles Canyon. (control area)

Sample collection at the fueling dock, Bullfrog Marina.

The National Park Service – U.S. Geological Survey Water Quality Assessment and Monitoring Partnership Program Update: 76 partnership projects implemented in 56 national park units so far

By Barry Long, Hydrologist

In 1998, the National Park Service (NPS) and U.S. Geological Survey (USGS) initiated a water quality partnership program with support from the Clean Water Action Plan. Initially, the USGS budget targeted $2.5 million for the NPS-USGS partnership in fiscal year 1999. At present, over $2.1 million per year is allocated for partnership projects. As per the direction in the initiative, USGS District Offices and individual parks collaborate closely to refine project statements from NPS Resource Management Plans. Submitted project proposals are ranked by an interagency work group, and selected for funding. The projects selected address the highest priority NPS water quality issues identified by park managers. They include investigations of nutrient transport in groundwater; nutrient, sediment and metal transport and loading in streams; atmospheric deposition in streams and lakes; microbiological contamination in recreational waters; organic contamination in stream and lake sediments; and aquatic biological health. In addition, fixed-station monitoring and technical assistance projects are implemented to address park needs related to providing baseline water quality data and advice on specific water issues. Perhaps the most beneficial result of the partnership is the interaction of park staff with USGS scientists. Through the activities of the partnership, new relationships are established which provide opportunities for future collaborations. Also, the partnership is producing tangible products for park managers, including: data for resource decision-making, information for interpretation purposes, monitoring plans for park staff, and professional reports with detailed results. Because of this success, our water quality partnership with USGS is being used as an example for agency collaborations in other resource areas.

Currently, the following professional reports from the NPS-USGS water quality assessment and monitoring partnership program are available from participating USGS District Offices, Earth Science Information Centers, and USGS web pages. Several reports in preparation or review will be published soon. In addition, NPS-USGS program coordinators are preparing a fact sheet, map, presentation, and digital photo file to highlight the activities of the program, review issues of regional and national scope, and promote interagency data access and sharing.

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Boughton, G.K. 2001. Metal loading in Soda Butte Creek upstream of Yellowstone National Park, Montana and Wyoming: A retrospective analysis of previous research; and quantification of metal loading, August 1999. U.S. Geological Survey Water-Resources Investigations Report 01-4170. 68 p.

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Gregory, M.B. and E.A. Frick. 2000. Fecal-coliform bacteria concentrations in streams of the Chattahoochee River National Recreation Area, Metropolitan Atlanta, Georgia, May-October 1994 and 1995. U.S. Geological Survey Water-Resources Investigations Report 00-4139. 8p.

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Lenz, B.N., D.M. Robertson, J.D. Fallon, and R. Ferrin. 2001. Nutrient and suspended-sediment concentrations and loads and benthic-invertebrate data for tributaries to the St. Croix River, Wisconsin and Minnesota, 1997-99. U.S. Geological Survey Water-Resources Investigations Report 01-4162. 57 p.

Mahler, B.J. and P.C. Van Metre. 2001. Effects of oil and gas production on Lake Meredith sediments, 1964-99. U.S. Geological Survey Fact Sheet 072-01. 6 p.

Payne, G.A. 2000. Water quality of lakes in Voyageurs National Park, northern Minnesota, 1999. U.S. Geological Survey Water-Resources Investigations Report 00-4281. 12 p.

Peterson, J.C. 1999. Semivolatile organic compounds in streambed sediment from the Richland Creek basin, Arkansas, 1999. U.S. Geological Survey Open-File Report 99-268. 13 p.

Peterson, J.C., B.E. Haggard, and W.R. Green. 2002. Hydrologic characteristics of Bear Creek near Silver Hill and Buffalo River near St. Joe, Arkansas, 1999-2000. U.S. Geological Survey Water-Resources Investigations Report 02-4024. 36 p.

Rice, K.C., S.W. Maben, and J.R. Webb. 2001. Water-quality data of soil water from three watersheds, Shenandoah National Park, Virginia, 1999-2000. U.S. Geological Survey

Open-File Report 01-236. 17 p.

Vaill, J.E. 2000. Traveltime and dispersion of contaminants in the Yampa River from Steamboat Springs to the Green River, northwestern Colorado. U.S. Geological Survey Water-Resources Investigations Report 99-4239. 8 p.

The NPS-USGS partnership program is administered out of the USGS Headquarters in Reston, Virginia and the NPS Water Resources Division in Fort Collins, Colorado. If you have any questions or comments regarding the partnership program, please contact Mike Focazio from USGS at (703) 648-6808, or Barry Long from NPS at (970) 225-3519.

Natural Resources Challenge Water Quality Monitoring – FY 2001 Program Accomplishments

By Bill Jackson, Supervisory Hydrologist and Gary Rosenlieb, Hydrologist

In FY 2001, the Water Resources Division (WRD) received a budget increase of $1,275,000 for the Water Quality Monitoring component of the Natural Resource Challenge program. This program was specifically intended to track and support the attainment of NPS Strategic Goal Ia4, Water Quality. Strategic Goal Ia4 is oriented towards reducing the number of water bodies in parks with impaired water quality. Preliminary estimates are that at least 116 parks have water bodies officially recognized by states as being "impaired." The new program is also intended to help parks insure that pristine or "unimpaired" water quality in parks is being protected.

To implement this new program in FY 2001, WRD determined that planning and design of the program should be implemented in full integration with the NPS Park Vital Signs Monitoring program. This is because water quality is a key vital sign in determining overall aquatic ecosystem health. It was thought that by factoring in priorities for park vital signs monitoring in the determination of water quality monitoring priorities, it would be possible not only to meet the monitoring objectives of the Service's water quality management program, but to support the broader Park Vital Signs Monitoring program goal of assessing the status of park ecosystem (esp. aquatic ecosystem) health. By fully integrating the design of these programs, considerable cost efficiencies have and will continue to be realized in staffing, planning and design, administration, implementation, data management, and reporting.

Full program funding was allocated to 12 park vital signs networks in FY 2001. In addition, funds supported a cooperative agreement with Colorado State University to assist in the development of an NPS servicewide water quality data management program within the Environmental Protection Agency STORET national water quality database. To assist Networks in implementing this new program in 2001, WRD:

·Developed a program implementation and funding allocation plan

·Developed guidance for network water quality monitoring program planning, and helped initiate a prototype planning project for the Northern Colorado Plateau network

·Approved 12 network work plans and funding transfers

·Attended 10 region, network or park vital signs monitoring workshops to assist in program planning

·Prepared draft technical guidance for water quality monitoring protocols, recommended core parameters, detailed monitoring plans (including QA/QC), and water quality data management

·Initiated a project to better describe state clean water act standards in parks and to better characterize state-listed impaired park waters

·Field tested and evaluated multi-parameter water quality probes for possible use by parks in conducting water quality monitoring.

·Completed planning for a fall, 2001 servicewide water quality vital signs monitoring workshop to be hosted by WRD

·Reviewed program accomplishments and accounted for all program funding in a report to the Office of Management and Budget

All 12 park vital signs networks fully committed their water quality funding to compilation of background information and detailed program planning. Network planning approaches included personnel hiring, in-house allocation of staff, university cooperative agreements and U.S. Geological Survey Interagency Agreements. In addition, some equipment acquisitions were made. The following activities were initiated, and in some cases completed, by all networks:

·Network water quality planning workshops

·Historic Data compilations and analyses

·Information on state-listed impaired waters and park "outstanding" waters

·Documentation of significant water quality stressors/

threats

·Synoptic inventory studies in support of detailed statistical design

·Database management and GIS support programs

No additional networks will receive water quality monitoring funding in 2002, but plans are for 5 new networks to receive funding in 2003. Additional information on this new program, including links to draft technical guidance, is available at http://www1.nature.nps.gov/im/monitor/handbook.htm.

Properly Functioning Condition assessmentof several drainages within GLCA

by Joel Wagner and Michael Martin

An interdisciplinary team consisting of a soil scientist, wetland scientist, hydrologist, and terrestrial ecologist from the NPS Natural Resource Program Center (NRPC) was asked by Glen Canyon National Recreation Area to assess resource conditions at several sites on Navajo Point, which is at the southern end of the Kaiparowits Plateau. Focus was placed on riparian zones and associated uplands where domestic livestock grazing has been permitted. The NRPC team was accompanied by the GLCA botanist and range ecologist, and a plant ecologist, hydrologist and mycologist from the adjacent Grand Staircase - Escalante National Monument, which adjoins the Navajo Point area of GLCA.

Degradation of GLCA's riparian habitats is a significant management issue because of the high level of functions and values that these resources provide. Healthy riparian systems improve water quality, maintain proper stream flow, temperature, and cover for fish and other aquatic species, provide food, cover and nesting sites for many bird species, provide migratory routes and food sources for wildlife, and provide habitat for rare, threatened, and endangered plants and animals. In addition, both upland and riparian vegetation play a significant role in erosion control and channel stabilization. Changes in upland vegetation affect infiltration and runoff and therefore directly affect erosion and sedimentation. Riparian vegetation affects channel stability by anchoring soil, transpiring alluvial ground water, and providing flow resistance that reduces velocities and decreases erosion potential. Consequently, a change in vegetation may result in channel instability.

To assess the overall health of grazed systems in this portion of GLCA, five riparian sites were evaluated using the Properly Functioning Condition assessment developed by the BLM. The "proper functioning condition" of a lotic riparian area refers to the stability of the physical system, which in turn is dictated by the interaction of geology, soil, water, and vegetation. A healthy or stable riparian area is in dynamic equilibrium with its streamflow forces and channel processes. In a healthy system, the channel adjusts in slope and form to handle larger runoff events with limited perturbation of the channel characteristics and associated riparian-wetland plant communities. All sites evaluated indicated signs of stress with the exception of one where steep canyon walls restricted access. The levels of stress evaluated ranged from "functional at risk" to "non-functional". Specific management recommendations were developed to improve the condition of each site based on this fieldwork.

BOG SASS, Glenn Canyon NRA, NPS Photo

Water Rights Branch Overview

By Chuck Pettee, Chief

We are continually reminded that much of our water rights workload is directly correlated to the ebb and flow of the economy. The slowing of the economy in the wake of the tragic events of September 11, 2001, has presented a respite from growing water demands, but experts predict that the flow of growth will be back in the not too distant future. While this ebb has relieved a bit of the urgency for water development projects, water administrators have found that we must work diligently through the ebbs to be prepared when the flow returns. The paragraphs below and articles that follow contain some highlights of the Water Rights Branch's (WRB) 2001 activities.

In Nevada, the NPS has been participating in the Nevada State Engineer's (NSE) decision-making process. During the year 2001, the NSE has focused his efforts on hearings to gather technical information on the effects of water development proposals on the ground water flow system that discharges to off-lake springs and rivers in Lake Mead National Recreation Area. The NPS concern is based on the fact that proposed groundwater withdraws are several times the amount of available water according to published reports. As has been our approach, the NPS worked with the water development interests to resolve issues and avoid contested case hearings. The NSE scheduled four hearings involving the NPS in 2001 and early 2002; advance settlements were achieved for three cases and the NPS presented technical testimony for the other one. Generally, the settlements are agreements to implement plans to monitor and manage the proposed withdrawals to avoid or mitigate impacts, if any, to park resources. Early NSE decisions indicate that, consistent with our settlements, he favors an incremental approach to additional water development coupled with data collection and analysis to determine if the next incremental step should be taken.

NPS continues to participate in general adjudications. We added seven settlement agreements to the growing list of resolved adjudication issues. Additionally, the settlement agreement with the State of Utah for Zion NP was confirmed in a final decree by the court in the Virgin River adjudication. The claims for Crater Lake NP in Oregon's Klamath River basin adjudication went to hearing without settlement. The only testimony offered at the hearing was by the NPS in support of its proposed entitlement and quantification, and by the State of Oregon, which did not conflict with the NPS testimony. The hearing officer recommended approval of the park rights as proposed by NPS.

While the State of Nevada has a process for considering information and making decisions, California has no administrative process for resolving potential conflicts amongst groundwater users in the California Desert. However, the United States has extensive public lands in the area so water development and transport projects would typically require a BLM National Environmental Policy Act process in route to a federal right-of-way permit. In lieu of a State process, NPS was able to work through this federal administration process to develop a plan to protect resources at Mojave National Preserve.

As always, any successes accrued by the WRB would not be possible without the professional work of park management and staff. We encourage field managers to call on the WRB whenever water rights issues are, or could be, affected by management decisions or proposals by park neighbors.

Mojave National Preserve, NPS Photo

Park Water Rights on CD-ROM

By Jeff Albright, Hydrologist

The Water Rights Branch maintains a set of service-wide files (the "Docket Files") that house official documentation related to water rights and water uses within national park units. Docket Files contain the following types of data and information specific to individual parks: legal water right filings and related correspondence between NPS and state agencies; history of development and acquisition of water rights by NPS; technical specifications for park water supply systems; terms and conditions of water use under state water right permits; and historical water use data. Approximately 60,000 pages of material, organized into folders and filed by park, are stored in the Docket Files.

Over the last few years all of the documents contained in the Docket Files were digitally scanned then archived into an electronic filing system that essentially duplicates the content and organization of the original paper files. The electronic version was created because the files include originally signed documents and other records that would be difficult to replicate if the originals ever become lost or damaged. The electronic system thereby serves as backup to the paper filing system; as new documents are added to the paper files over time they will also be scanned and incorporated into the electronic files.

The electronic version of the Docket Files also facilitates information sharing with parks. Electronic copies of water rights documentation for any park can be placed onto CD-ROM and mailed to the park. Park staff can then use the internet browser on their desktop pc to view (and print) their water rights documentation. The Water Rights Branch plans to produce and distribute CD-ROMS to individual park units over the next year or so. Meanwhile, parks are welcome to contact the author of this article to request expedited processing if they have an immediate need or interest in getting their CD-ROM. It is hoped that parks will find the information useful in making water management decisions and for researching historical documentation related to park water uses.

Zion Water Rights Decreed

By William R. Hansen, Hydrologist

Instream flows and ground water at Zion National Park, including the East and North Forks of the Virgin River and Weeping Rock, are forever protected after the signing of an interlocutory decree by Judge Shumate on November 29, 2001. The decree confirms water rights described and recognized in the Zion National Park Water Rights Settlement Agreement signed by the NPS, the State of Utah (Utah), and Kane and Washington County Water Conservancy Districts in December 1996 and the Proposed Determination published on September 27, 2000. The decree is the final step in confirming water rights for Zion National Park in the Virgin River Adjudication (Area 81).

The decree recognizes a federal reserved water right to all the unappropriated flows in and above the park and allows existing uses to continue. This is the first NPS federal reserved water right recognized in Utah. The decree also recognizes state appropriative water rights within the boundaries of Zion National Park and subordinates to a small amount of water development above the park. The decree prohibits the construction of proposed dams on the East and North Fork of the Virgin River and a transbasin diversion to Cedar City and specifies diversion limits and periods, bypass flows, and ground water protection zones. The prohibition on dams became effective upon the completion of a land exchange between the U.S. Bureau of Land Management (BLM) and the Washington County Water Conservancy District when the District acquired title to BLM lands at the site of the proposed Sand Hollow Reservoir.

The historic agreement and final decree confirms that state and federal government rivalries can be resolved by using scientific data to solve complex water right issues. The momentum created by the Zion National Park Water Rights Settlement has been used to finalize four additional settlements for Cedar Breaks National Monument, Golden Spike National Historic, Hovenweep National Monument, and Rainbow Bridge National Monument.

T

wo Dimensional Computer Modeling of Green River At Dinosaur National Monument and Canyonlands National Park

By Eric Moser, Hydrologist

The National Park Service developed two-dimensional numerical models (RMA2) for two reaches of the Green River in Utah, to provide hydraulic information to resource experts. One of the models was of a four-mile reach of the Green River within Stillwater Canyon, Canyonlands National Park. This model was used to assess the feasibility of breaching levees, built up by encroaching salt cedar, to inundate floodplain area that has been disconnected from the main river channel.

Since the 1930's the Green River has narrowed in response to climatic variation and decreased flood magnitudes caused by the Flaming Gorge dam. Salt cedar may not initiate channel narrowing, but may stabilize river deposits and prevent scour of the river's bank. Cross sections of excavated salt cedar stems, growing on levees in Fort Bottom, indicate successive depositional events since the 1940's, of over six feet. Breaching the levees would allow the river, at higher stages, to inundate floodplains once again. One benefit would be the creation of backwater habitat for Razorback sucker (Xyrauchen texanus) larvae. To assess the potential for habitat improvement, fish biologists need information on the depth, area and velocity of flow in the backwater areas.

The Stillwater Canyon reach was surveyed by the NPS, Water Rights Branch, in 1998 using control points established by GPS. Floodplains and channel boundary topography was surveyed by transit traverses from the control points. The active channel was surveyed, at a flow of 18,000 cubic feet per second (cfs), using an acoustic Doppler current profiler coupled with real-time position data provided by the GPS base station.

From the survey data a Triangular Irregular Network (TIN) was created. The TIN describes the topology of the area and provides a basis on which to build a mesh for two-dimensional hydraulic modeling.

Figure 1 shows the finished mesh of the Stillwater Canyon reach. RMA2 can account for complex flow patterns in river bends, or an eddy. The model results are depth of flow, velocity of flow and direction of flow at each node, or corner of a mesh. The model was finished under contract with Colorado State University in 2001.

The reach was modeled at two flow rates, 18,000 cfs, and 24,000 cfs, the latter value being the approximate average annual peak at the USGS stream gage at Green River, Utah, the closet gage to the reach. There is no indication that the levees are eroding. A flow of 40,000 cfs is required to generally overtop the levees in the model reach, which represents a stage of nearly five feet greater than the 24,000 cfs flow that was simulated. The largest post-dam peak flow at the Green River gage is less than 50,000, suggesting that natural removal of the levees is not probable.

The amount of land inundated is independent of breach geometry, but dependent on stage. The site of breaching was the downstream end of a 180° bend in the modeled reach, which had the largest area of disconnected floodplain. At 18,000 cfs, 30 acres was inundated (Figure 2) and at 24,000 cfs 45 acres was inundated. The total volume of water in the inundated area was 82 and 176 acre-feet at 18,000 cfs and 24,000 cfs respectively. Maximum depths of water in the floodplain at 18,000 cfs were about five feet, and about eight feet at 24,000 cfs. Velocities were

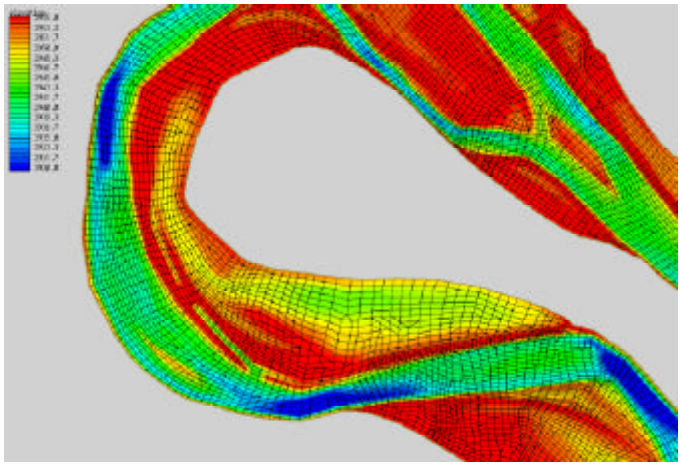


Figure 1. Completed mesh showing elevation contours

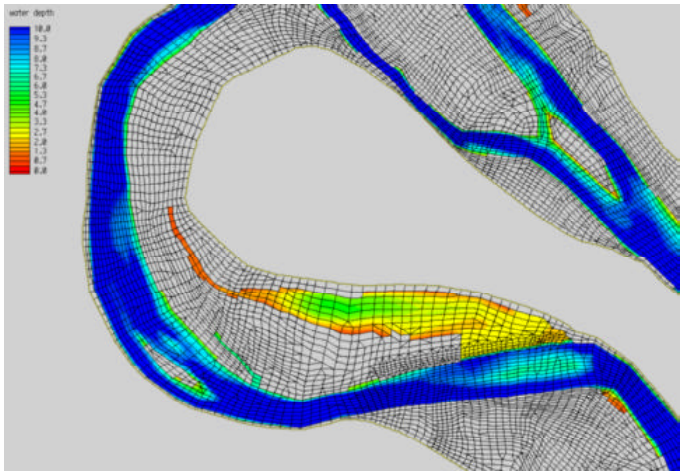


Figure 2. Water depth at 18,000 cfs with a levee break

Efforts to Protect Water Rights and Resources at Lake Mead National Recreation Area

Overview

by Dan McGlothlin, Supervisory Hydrologist and Bill Van Liew, Hydrologist

The water resources of Lake Mead National Recreation Area (LAME) include Lake Mead on the Colorado River, tributary streams that flow into the lake, and springs that discharge on adjacent lands along the shores of the lake. The Virgin River flows into the Overton Arm of Lake Mead NRA from the northeast and the Muddy River flows in from the northwest. An area of eight named springs and additional areas of diffuse seepage occur on lands on the west side of the Overton Arm, including the large-volume, warm-water Rogers and Blue Point Springs. This area of springs supports unique desert flora and fauna.

The watershed for the Virgin River and Muddy River includes a large area of eastern and southeastern Nevada, which drains generally southward toward the Colorado River at Lake Mead, and encompasses 29 individual hydrographic basins. This watershed is characterized by a vast regional ground-water flow system in fractured carbonate rocks and unconsolidated basin-fill sediments, and by the interbasin movement of this ground water, which discharges to the Muddy River, the Virgin River, and regional large-volume, warm-water springs. This system has been termed "The Colorado Regional Ground-Water Flow System of Nevada" or simply the "Colorado System" by USGS.

The demand for water supplies in desert basins north of LAME has increased greatly in the last decade in response to rapid population growth in Las Vegas and the surrounding region. Nevada reportedly now consumes its full entitlement to the Colorado River, making ground-water development in the Colorado System a more likely option to support additional growth in southern Nevada. Increased ground-water withdrawals have the potential to capture flows through the Colorado System, which are the source of base-flow to rivers and the warm-water spring discharges. This could reduce or eliminate the streamflows and springflows and impair associated water-dependent biological resources at LAME. Therefore, NPS utilizes Nevada water rights procedures to ensure rights for Lake Mead NRA resources are fully considered in water allocation decisions. The decisions also rely upon available scientific information.

The following articles review some of the activities that took place in 2001 concerning efforts to protect water-related resources of LAME. The articles address water demands brought by additional energy supply needs for southern Nevada, hydrologic analyses to evaluate the source of springflow at Rogers and Blue Point Springs, data collection efforts to quantify surface water - ground water interactions along the Muddy River, and development of a numerical ground-water flow model that can be used as a predictive tool to estimate potential effects from pumping.

Accelerated Energy Development in Southern Nevada Increases Demand for Groundwater

by Dan McGlothlin

The demand for electricity in southern Nevada, as throughout the western United States, is increasing as growth in the region continues to strain power reserves. National news reports in the past year have highlighted the effects of electrical power shortages, particularly in California, and the urgency to develop additional energy sources. In southern Nevada, several independent power producers are stepping in to develop new energy for the region. Situated along the Interstate 15 corridor between Las Vegas and Mesquite are seven proposed power generation facilities. All share at least one common design characteristic – the use of groundwater from the Colorado System. The combined effect of the seven, should they be constructed, will be an additional 22,000 acre-feet per year (afy) of withdrawals from the regional groundwater-flow system near Lake Mead NRA. Some are water-cooled plants that require about 7,000 afy, others utilize water-efficient, air-cooled technology that requires about one-tenth the amount of water.

Water purveyors and energy project developers have inundated the Nevada State Engineer (SE) with numerous water right applications and requests for prompt approvals to develop the Colorado System. Energy development in Nevada has a strong political interest, thus, there is a heightened sense of urgency facing water resource managers. Amid concerns that southern Nevada may soon be facing critical shortages, the SE issued Ruling 5008, granting permits to the Las Vegas Valley Water District (District) in response to the District's request to expedite the development of up to 2,200 afy of groundwater in the vicinity of Apex Industrial Park. Other pending applications seek much larger quantities from the flow system and have not been acted upon.

There remains considerable uncertainty regarding effects the projects will have on park resources. Scientific information is lacking to adequately understand the amount of

Predictive Numerical Ground-Water Flow

interbasin flow in the system. Most power projects are relatively short-lived in their planning, from 25 to 45 years. The effects of pumping, however, may take much longer to manifest themselves. Even so, a comparison of existing groundwater rights to the estimated regional water budget shows that total existing rights are nearly two times the amount of available supply. Factoring all pending groundwater applications, including those for power generation purposes, the potential total of approved rights is pushed to about sixteen times the available supply. From a sustainability perspective, even without the energy development, potential groundwater development would ultimately deplete springs and streams in the region.

The State Engineer, in Ruling 5008, appears to have struck a balanced approach to the demand for groundwater from the regional groundwater-flow system. The State Engineer cited evidence indicating a power crisis "is on the horizon for Southern Nevada". To address the effects of pumping stresses on existing rights and resources, the SE concluded that "only by gradual, staged development can the additional science be obtained which will allow a better understanding of the carbonate-rock aquifer(s) and the effect new appropriations will have on interbasin flows and the direction of groundwater movement" and instituted requirements for monitoring and mitigating the effects of pumping. It is evident that the SE is taking a deliberate, cautious approach for permitting increased withdrawals from the aquifer. The decision may also indicate a preference for the way in which power is generated. The permitted amount of groundwater was limited to 2,200 afy, an amount sufficient to develop additional energy from several air-cooled plants but not from water-cooled plants.

With the SE's approach as backdrop, NPS has applied a similar adaptive approach to negotiate the stipulated withdrawal of protests to groundwater applications. The approach was employed to secure withdrawal of NPS protests in a non-energy development situation in July 2001. Conceptually, the parties agree that NPS rights and resources of Lake Mead NRA must be protected from any adverse impact attributed to groundwater pumping. This is accomplished through monitoring at determined locations for the early detection of impact, establishing action criteria, and implementing mitigation requirements, if needed. Technical information exchange is provided through a technical review panel, and the SE is invited to assist in resolving areas of technical disagreement.

At this writing, NPS is pursuing this approach with energy projects and associated water rights applicants, including Calpine/Moapa Band of Paiutes, PGE/Moapa Valley Water District, and Cogentrix/Vidler Water Company & Lincoln County. Stay tuned.

Evaluation of the Source of Springs in Lake Mead National Recreation Area

by Jennifer Back, Hydrologist

The source of water for many large regional springs in southern Nevada has been well documented by numerous investigators. For example, springs with regional water sources were identified at Muddy River Springs and Ash Meadows. However, the source of water for springs in the Lake Mead NRA is not as well documented because of complex local geology and limited hydrogeologic information.

Recent studies have suggested various sources of water for springs in the Lake Mead NRA. Prudic and others (1993) suggested flow to Rogers and Blue Point Springs is from the north towards the Mormon Mountains and Beaver Dam Wash. Laney and Bales (1996) suggest recharge is a mix of subsurface flow from the Muddy Mountains to the west and the regional carbonate aquifer to the north. Pohlman and others (1998) suggest that recharge is from the region surrounding Lake Mead, including the Muddy Mountains and the Morman Mountains, and not from the regional carbonate aquifer.

In an effort to improve upon the work that has already been done in this area, a thorough examination of discharge, temperature, precipitation, water chemistry and isotopic data from the region surrounding Lake Mead was completed. The data were analyzed to identify correlations between rainfall and discharge. Temperature data was collected to identify possible seasonal variation and potentially deep flowpaths. Chemistry was compared to springs and wells outside the hydrographic basin of Rogers and Blue Point to identify wells or springs with similar characteristics. Isotopic data was evaluated to determine

whether observed values could be produced in the general vicinity of Lake Mead.

Correlations in annual discharge and precipitation data suggest some contribution from local rainfall. Comparison of discharge data at Rogers Spring to regional springs in the Muddy River Springs area showed that variability in discharge at Rogers falls well within the range of variability observed at known regional springs.

Springs of regional origin exhibit temperatures above mean annual air temperature and little seasonal variation. Rogers and Blue Point Springs exhibited less than 0.5ú F difference between measurements made in winter and late summer months. In addition, the water temperature of both Rogers and Blue Point Springs, about 86ú F, is nearly 20úF greater than mean annual air temperature. The relatively high temperature suggests that water discharging at Rogers and Blue Point Springs has circulated to great depths.

The stable isotope composition of water from the nearby Muddy Mountains is heavier than Rogers and Blue Point Springs (Pohlman and others, 1998). The Mormon Mountains also reflect relatively heavier isotopic composition than Rogers and Blue Point Springs. Therefore, a third isotopically depleted source of water from higher elevation or colder climate must contribute as well.

The chemistry of Rogers and Blue Point Springs is generally more concentrated than the chemistry of water in the Colorado System. It is likely that the chemistry of Rogers and Blue Point Springs has been influenced by the dissolution of minerals from the Muddy Creek formation and halite beds located near the springs. The chemistry cannot be used independently to identify the source of springs in Lake Mead NRA, but it does support the concept of chemical evolution of groundwater in a regional flow system.

The results of these analyses indicate that rainfall in the nearby Muddy Mountains likely contributes to discharge at Rogers and Blue Point Springs. However, other sources from outside the Lake Mead NRA must contribute to the discharge of these springs. Isotopic, chemical and temperature data reflect water recharged outside the region surrounding Lake Mead, and possibly from the Colorado System.

Muddy River Gain/Loss Run

by Bill Van Liew, Hydrologist

NPS is working to ensure that ground-water development in southern Nevada is sustainable. To estimate the water budget and thus determine the sustainable yield of the Authority, and the Moapa Valley Water District. The gain/loss run was conducted in late winter because evapotranspiration is at a yearly minimum and most diversions from the river for human uses (e.g. irrigation) are inactive. Discharge and field water-quality parameters were measured at 24 locations in the Muddy River Springs Area and along the entire course of the Muddy River at specific times on February 7, 2001, by individual crews stationed at pre-determined locations along the river. The USGS prepared and implemented a quality assurance plan, to facilitate consistency and accuracy of data collection.

Results indicated that the uppermost 2 miles of the Muddy River (i.e. in the area of the Muddy River Springs) are a dominantly gaining reach. Ground water supplies most of the river's flow in this reach. The next 15 miles downstream exhibit some losing reaches (i.e. where river water percolates down into the ground-water system) and some gaining reaches where intermittent tributaries enter the river, but no dominant pattern of gain or loss was observed. The most downstream 10 miles of river have been so dominantly affected by diversion to a reservoir, and by irrigation in the valley bottom and return flows to the river, that gain/loss interpretations could not be made.

The gain/loss run successfully illustrated the general degree of groundwater – surface-water interaction along the Muddy River, and improved estimates of the sustainable yield of the Colorado System. It also illustrated that Federal, State, and private parties can work together successfully and efficiently to gather information of interest to all.

Model Developed

by Bill Van Liew, Hydrologist

In addition to the studies that are ongoing to refine estimates of the sustainable yield of the Colorado System, NPS is working to ensure that ground-water development does not deplete the discharge of the water resources of Lake Mead NRA. It has proved very difficult, however, to make accurate predictions of the magnitude and timing of future depletion of Lake Mead NRA water resources from ground-water development, because of the multiple proposed and existing pumping locations and rates, the geologic complexity of ground-water flow through the fractured, faulted rocks of the Colorado System, the lack of ground-water monitoring information in many areas, and the time lag between when ground-water pumping occurs and the when the effects (i.e. the drawdown cone) reach the springs or rivers and decrease their flow.

To address this problem, a three-dimensional predictive numerical ground-water flow model has been developed by GeoTrans, Inc., under contract with the United States Fish and Wildlife Service (FWS) and the NPS. The model is being used to estimate the potential effects of groundwater pumping from the southern part of the Colorado System ("the Lower Colorado System") on the water resources of the FWS Moapa Wildlife Refuge and the NPS Lake Mead NRA. The model uses the finite-difference method, with the ModFlow 96 computer code. It encompasses an area of approximately 300 square miles across 10 individual hydrographic basins. Currently, the model area excludes the eleventh basin in the Lower Colorado System, the Virgin Valley. Studies are ongoing, however, to include the Virgin Valley in the model domain and to improve the model input. Current WRB project work is focused on improving the state of knowledge of the complex hydrogeologic framework, refining water-budget estimates, and refining the transient calibration by including results from recent groundwater pumping.

The model is a very powerful predictive tool. It can be used to estimate the magnitude of effects from any existing and/or proposed new ground-water withdrawals from the regional flow system, either alone or in any combination, for any time period. It also can be used to illustrate how long it will take for water levels (and thus flows) to recover after pumping ceases. This tool and the results that can be generated with it are proving very useful to NPS. To date, the model has been used in negotiating settlement of protests, in constraining adaptive ground-water management plans, and as evidence in an administrative hearing before the Nevada State Engineer.

The Cadiz Project - An Exercise in Decision-Making in the California Desert

By Chuck Pettee

The Cadiz Ground Water Storage and Dry Year Supply Project (Project) is proposed by the Metropolitan Water District of Southern California (District) for a desert basin that is located near Mojave National Preserve (Preserve) and other wilderness areas administered by the Bureau of Land Management. The project would divert water from the Colorado River in years when there is surplus river flow and store it underground beneath private property owned by Cadiz, Inc. (the put). During dry years, the stored water and any available indigenous ground water would be withdrawn from the ground and sent to the District's service area (the take). This is one piece of the puzzle being pursued by the District in response to their need to reduce their dependence upon the Colorado River.

While a project that takes no more water than it puts would not cause impacts to propagate very far, this Project proposes to take more water than it puts which introduces the potential for causing impacts to propagate further away. There is potential for many other types of impacts due to this Project but this article will focus only on the water quantity issue.

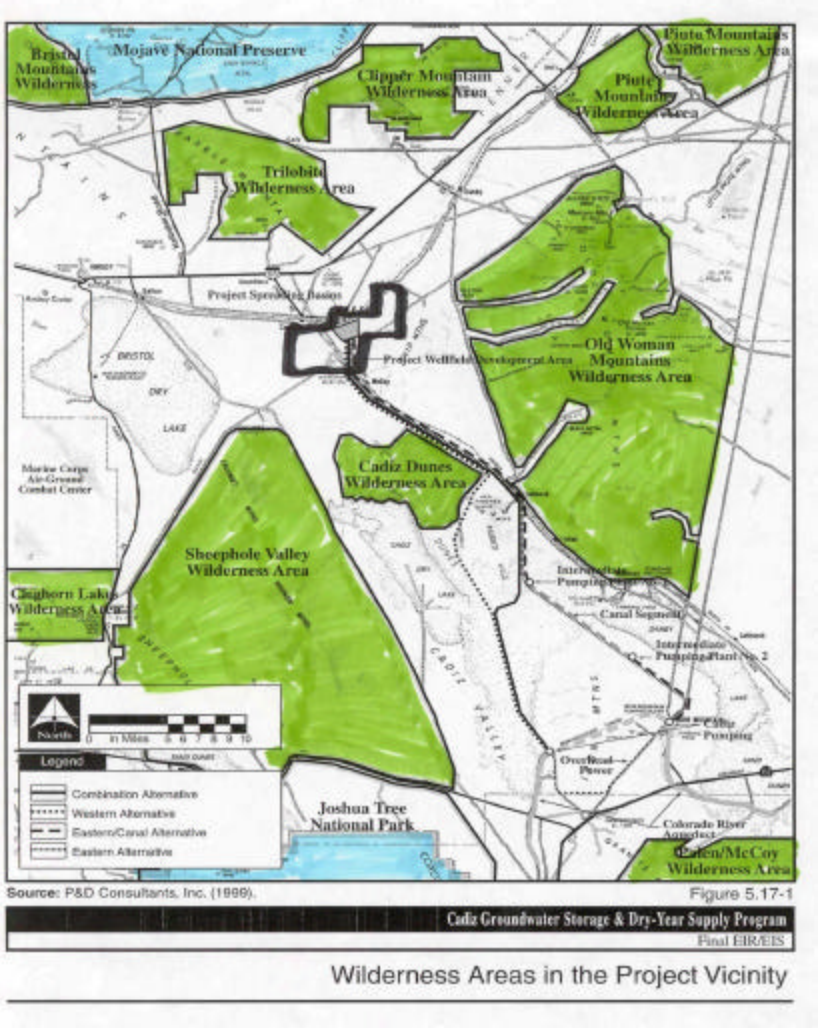
The Project will develop water under California water law, which gives Cadiz, as landowner, the right to withdraw all the ground water they can reasonably use. If competing, State-law based, water uses interfere with each other, they must share the water shortage in a correlative manner. Under Federal law, the California Desert Protection Act created the Preserve and many wilderness areas and expressly reserved water for those purposes. Thus, the potential exists for conflict between the project, which will lower ground water levels, and spring flow at the Preserve and wilderness areas, if the impact to ground water levels extended to the spring sites. There is no regulation or case law that describes how to resolve conflicts between Federal reserved water rights and California groundwater ownership water rights.

The proposal brought to light issues about the administration of California desert ground water development proposals, including how they are raised, how options are considered, and how decisions are made. There is no provision in California or Federal law requiring landowners to give notice that ground water is going to be pumped. However, when a state or federal action is required there is a requirement, under the California Environmental Quality Act and the National Environmental Policy Act respectively, to conduct a public review process. In this case, a state agency, the District, was proposing to store and develop water, and a federal agency, the Bureau of Land Management, was proposing to grant a right-of-way permit to allow canals and pipelines to cross federal lands. As a result, the administrative process in which this proposal was raised was a combination of the Environmental Impact Review (EIR) and Environmental Impact Statement (EIS) processes. These processes both allow for public participation, assessing impacts and alternatives, and identifying potential mitigation measures, but the decision-makers aren't necessarily objective bystanders. In the EIR, the decision-maker is the Project proponent and in the EIS it is the BLM, sister bureau to the NPS, the two managers of the major competing water use in the Project area. The decision to proceed had to be by consensus of the District and BLM. This meant the Project would have to develop enough water to the make it worthwhile to the District while at the same time have no impact on the Preserve and wilderness area water resources.

We needed to know if the Project would impact springs and the answer was not forthcoming. After months of technical data analysis and discussions amongst the parties, the differing expert opinions could not be resolved. In many western jurisdictions this dispute could be resolved administratively by a State Engineer or other independent decision-maker with the responsibility to protect the public interest. Often, the United

States Geological Survey is viewed as an independent source of expertise but they too were a party to the disagreement. All of the administrative decision-makers were also parties to the disagreement. The only other avenue available would be a court proceeding but none of the parties wanted to pursue that route.

The Project, with a modified limitation on indigenous groundwater withdrawal, was put back on track when the District accepted the risk associated with the technical uncertainty (i.e. that if their view of the potential for interference is found to be wrong, they would get less water than planned) and committed to operate the Project to prevent interference. To ensure that this intent was undertaken in a cost effective and technically adequate manner, the parties turned their technical expertise toward developing a Ground Water Monitoring and Management Plan. According to the Plan, the effects of pumping will be tracked by installing and operating an adequate monitoring system, the monitoring system will be managed to adapt to changing data needs and to develop predictive models for forecasting effects, and mitigation measures are identified to ensure that realistic and effective cures are available in the event interference is anticipated. If the effects propagate toward the Preserve and wilderness area springs in a way that indicates the Project would eventually cause interference, corrective actions, including reduced or cessation of pumping, could be implemented in time to prevent interference. Implementing the agreement and plan will require a considerable workload on the part of all of the parties; the plan will be effective only if this follow-through is adequate.



Wilderness Areas in the Project Vicinity

Support Provided to Regions, Parks, and Other NPS Organizational Units

ALASKA REGION

Planning & Evaluation Branch

Developed a draft wetland mitigation bank document to be used by Alaska parks. This draft document outlines the process to compensate for unavoidable wetland impacts from projects in Alaska parks.

Introduced the "concept paper" prepared by the NPS-Water Resources Division on vital signs water quality network monitoring to AKSO in Anchorage.

Cape Krusenstern National Monument

Provided policy and technical review of the 1991 Operating Plan for the Delong Mountain Transportation System (Red Dog Mine).

Denali National Park and Preserve

Provided regulatory review and approved a wetland Statement of Findings for "Construction of an Access Road to Spruce #4 Inholdings in Kantishna."

Assisted park staff with wetland policy and compliance issues related to cutting fire protection perimeters around park structures.

Served as COTR for the completion of a WRD funded project involving the digitization of National Wetland Inventory maps for 16 quads at 1:40,000 and placing the digital data on the NWI web site.

Glacier Bay National Park and Preserve

Provided technical review and funding approval for a detailed study plan for an NRPP funded project addressing recreational and commercial fishery harvest occurring within the park.

Provided technical review and comment for a NRPP Fisheries Monitoring funding proposal.

Assisted Park staff in the technical review and evaluation of an instream flow analysis (provided by a contractor) for assessing the impacts of a proposed hydroelectric plan on Falls Creek near Gustavus.

Katmai National Park and Preserve

Provided technical assistance and funding approval for an Alaska Support Office / Katmai national Park and Preserve effort to initiate the development of a Water Resources Management Plan (WRMP).

Lake Clark National Park and Preserve

Completed and published the Lake Clark National Park and Preserve Water Resources Scoping Report (Technical Report NPS/NRWRD/NRTR-2001/292).

Provided WRD project oversight and finalized the task order for the FY01 WRD funded project titled "Complete National Wetlands Inventory Mapping – Phase II."

Provided WRD project oversight and finalized the task order for the FY02 WRD funded project titled "Complete National Wetlands Inventory Mapping – Phase III."

Provided technical review and funding approval for a Lake Clark Sockeye Salmon study for Lake Clark National Park and Preserve.

Wrangell-St. Elias National Park and Preserve

Provided regulatory review and approved a wetland Statement of Findings for the "Ten-Year Mining Plan of Operations: Big Eldorado Creek Claim Group."

Traveled to Wrangell-St. Elias National Park to assist in the review of the Park's fishery program. While in the park also assisted in the field inventory and sampling of fish within the tributaries of the Chitina River System.

Yukon-Charley Rivers National Preserve

Provided regulatory assistance to the Alaska Support office concerning wetland compliance for the restoration of a degraded road bed.

Water Operations Branch

Provided Park Service staff with information on persistent organic pollutants (POPs).

Aniakchak National Monument

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Cape Krusenstern National Monument

Reviewed and suggested revisions to "1991 Operating Plan for the Delong Mountain Transportation System (Red Dog Mine Haul Road) and Seaport Facility."

Reviewed and summarized information on a newly released NPS study entitled "Heavy Metals in Mosses and Soils on Six Transects Along the Red Dog Mine Haul Road Alaska."

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Denali National Park & Preserve

Provided technical review and comments to Park on "Abandoned Mines Restoration and Implementation Plan for the Removal of Hazardous Conditions in the Katishna Mining District."

Gates of Artic National Park & Preserve

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Katmai National Park & Preserve

Provided brief summary of Baseline Water Quality Data Inventory and Analysis Report prior to release for use in Water Resources Management Plan.

Kenai Fjords National Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Klondike Gold Rush National Historical Park

Provided consultation on a proposal by the Park to stabilize the riverbanks of the Taiya River based on previous assessments by WRD.

Assisted with the development of project statement addressing erosion problems near the Dyea townsite.

Wrangell-St. Elias National Park & Preserve

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Reviewed preliminary findings (Phase I) of the State of Alaska on follow-up metal contamination studies focusing on Native berry harvesting areas surrounding the port facility used for shipment of metal concentrates from the Red Dog mining operation.

Reviewed Floodplain Statement of Findings for project in Park.

Sitka National Historic Park

Completed draft report summarizing streamflow and diversion data collected cooperatively with Sheldon Jackson College for the Indian River.

Assisted park in the initiation of an appraisal for water rights owned by Sheldon Jackson College on the Indian River.

Multi-Park

Provided comments regarding proposed legislation designed to streamline the water right application process.

INTERMOUNTAIN REGION

Planning & Evaluation Branch

Assisted in the formulation of a "concept paper" that provided an initial planning format for establishing a Northern Colorado Plateau-wide "vital signs" water quality monitoring network, which is being funded (beginning in FY01) through the National Resource Challenge.

Participated in a NPS Inter-Regional Colorado River Water Resources Summit in Salt Lake City, Utah. Helped identify strategies to improve NPS effectiveness in addressing threats to river-dependent resources and to improve communication and coordination between park units on

Represented NPS at meetings of the Upper Colorado River Recovery Program (UCRRIP) Biology Committee. Reviewed and provided comments on UCCRIP flow recommendations for Colorado pikeminnow (*Pytchocheilus* lucius) and razorback (*Xyrauchen texanus*) sucker in the Gunnison River. Reviewed and provided comments on draft final Recovery Goals for Colorado pikeminnow, razorback sucker, humpback chub (*Gila cypha*) and bonytail (*G. elegans*).

Represented NPS interests in the Flaming Gorge Dam EIS process, including meetings of the Cooperating Agencies and the Interdisciplinary Team.

Amistad National Recreation Area

Assisted with the completion and publication of the Amistad National Recreational Area (Texas) Water Resources Scoping Report (Technical Report NPS/NRWRD/NRTR-2001/295).

Represented the WRD and provided technical assistance to Amistad National Recreation Area staff in the development of a draft Binational Cooperative Fisheries Management Plan for Amistad Reservoir.

Carlsbad Caverns National Park

Conducted a survey of methods for euthanizing exotic fish and amphibian species for purposes of restoring habitat for *native species, including roundnose minnow (Dionda* episcopa) and greenthroat darter (*Etheostoma lepidum*).

Devils Tower National Monument

Provided regulatory review and technical comment on the Internal Draft GMP/EIS and drafts of the wetland SOF for the project "Expand Existing Headquarters and Relocate Parking Area."

Dinosaur National Monument

Evaluated and documented the condition of several riparian/wetland ecosystems affected by grazing in the Blue Mountain area of the park. Provided a trip report documenting the condition of these resources and the potential for improved management and restoration.

Provided technical review of the Investigator's Annual Report and approved continued funding for a WRD funded study to assess the response of Colorado pikeminnow (*Ptychocheilus lucius*) in Lodore Canyon to changes in Flaming Gorge Dam operations and to determine their relationship to the population in the Green & Yampa rivers.

Represented the WRD in an onsite meeting and subsequent discussions of appropriate solutions to bank erosion on the Yampa River at Deerlodge Park.

Represented the WRD in a meeting to review progress and results of a 2D hydrological model that is being used to assess flow impacts on the Green River in Dinosaur National Monument.

Glen Canyon National Recreation Area

Participated on an NRPC team to assess the functional condition of several riparian-wetland areas and associated uplands on the Kaiparowits Plateau. Assistance includes preparation of a trip report documenting results of the assessments and evaluating the potential for restoration of degraded sites.

Provided WRD oversight, technical review, and approval for the final report of a WRD-funded project titled "Wetland Inventory and Classification using Multispectral Videography." The objectives of the project were to acquire high-resolution airborne multispectral imagery of the Escalante, San Juan, and Colorado River corridors within the park, in order to map riparian and in-stream resources as well as to identify wetlands and hanging gardens in the canyon walls. The final report included a CD-ROM with Arcview data and the 3-band multispectral imagery. The study also resulted in the completion of a masters thesis by a student at Utah State University.

Grand Canyon National Park

Provided policy review and assistance to the Denver Service Center and the park for two draft EAs for "Improvements for Desert View Wastewater Treatment System."

Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway

Continued design studies and analyses for reclamation of the Snake River Gravel Pit. Work included analyses of hydrologic data, topographic data, soil chemistry and texture, topsoil seedbank characteristics, and willow establishment experiments. Worked with park staff to solicit and secure additional funding and construction management services from the Wyoming Abandoned Mine Lands program (WY-AML). Began working with park staff, WY-AML's engineering consultants, and other project cooperators on the final reclamation design.

Provided policy review and technical comments on the draft "Environmental Assessment: Snake River Pit Reclamation Plan."

Great Basin National Park

Provided technical review and approved WRD project funding for a project to remove nonnative fish species and *reestablish Bonneville cutthroat trout (Oncorynchus clarki* utah) in streams within Great Basin National Park.

Guadalupe Mountains National Park

Provided assistance in conducting stream surveys to identify habitat requirements of Rio Grande cutthroat trout (*Oncorynchus clarki virginalis*).

Provided technical review and WRD project oversight on an NRPC-funded rainbow trout population study in McKittrick Creek, Guadalupe National Park. Traveled to Indian Creek, Lincoln County, New Mexico to assist in field studies of a native Rio Grande cutthroat trout

population in this creek which is similar in habitat to McKittrick Creek.

Lake Meredith National Recreation Area and *Alibates Flint* Quarries National Monument.

Provided policy and technical review for the Oil and Gas Management Plan/EIS (Draft #2 for NPS Policy Review).

Little Bighorn Battlefield National Monument

Provided review and comment on a draft letter to the Corps of Engineers regarding the Tour Road Rehabilitation Project.

Mesa Verde National Park

Represented the WRD in a step-down workshop to identify long-term research, inventory, monitoring, and restoration needs for Mesa Verde National Park and Yucca House National Monument.

Provided technical review and comment on a funding proposal for a wetlands mapping project at the park.

Organ Pipe Cactus National Monument

Provided wetlands regulatory compliance information to the park for work on the Alamo Wash Bridge.

Padre Island National Seashore

Provided policy and technical review on the "Wetlands Protection" chapter of the Oil and Gas Operators Handbook.

Provided policy and technical review and comment on the "Draft Environmental Assessment, Bird Island Basin Recreational Plan."

Assisted park staff regarding problems with design and construction of a wetland wastewater treatment system.

Provided policy and technical assistance to the park and the region with a Corps of Engineers dredging project that could impact sensitive seagrass beds in the Laguna Madre.

Palo Alto Battlefield National Historic Site

Provided WRD project oversight and technical assistance to park staff regarding implementation of the project "Restore Resaca Wetlands – Phase 2: Restoration Design." Assisted in developing a contract scope of work and a cooperative agreement with Texas A&M University, and consulted with park staff on well installation and topographic surveys.

Pecos National Historical Park

Presented a paper titled "Rehabilitating a Riparian-Wetland Ecosystem along Lower Glorieta Creek, Pecos National Historical Park, NM" in an ecosystem restoration session at the 2001 George Wright Society conference (Denver, CO). The presentation described removal of abandoned reservoirs on the floodplain and creation of a complex of willow flats, emergent wetlands, ponds, and cottonwood galleries.

Worked with park staff to implement post-construction weed control (yellow sweet clover) for the Lower Glorieta Creek riparian-wetland reclamation project.

Petrified Forest National Park

Assisted the region and the park with NPS wetland and floodplain compliance and Corps of Engineers 404 wetland compliance for their GMP revision/EIS.

Rocky Mountain National Park

Provided onsite technical assistance to park staff regarding methods and cost estimates for restoring wetland habitat as part of the "Hidden Valley Creek Wetland Restoration" project.

Represented the WRD in meetings on native cutthroat trout (*Onchorynchus clariki stomias, O. c. pleuriticus*) management and research with park staff and the U.S. Fish and Wildlife Service.

Represented the NPS at a meeting of the Colorado River Cutthroat Trout Conservation Team.

Traveled to the Park to along with USF&W Service fisheries biologist to brief newly appointed ROMO Chief of Resources Management on park fishery issues and the park's fishery program and to discuss potential support for fisheries work in the future.

Represented the WRD at an annual review of fisheries work at Rocky Mountain National Park and helped identify and prioritize work to be done in the coming year.

Provided technical assistance to the Park in the assessment of actions needed to improve a fish barrier on Hague Creek, which will allow the reintroduction of native species above the barrier. Provided fisheries associates funding for Steve Moore (GRSM) to travel to ROMO to view the barrier and make recommendations.

Timpanogos Cave National Monument

Reviewed and provided comment on a macro invertebrate and stream habitat study proposed to assess the long-term impacts of a power generation plant on the American

River at Timpanogos Cave National Monument.

Washita Battlefield National Historic Site

Assessed the condition of the Washita River riparian corridor using the "Proper Functioning Condition" assessment method for lotic areas (Bureau of Land Management Technical Reference TR 1737-15, 1998). Wrote a trip report that documented results of the assessment and provided recommendations for management.

Yellowstone National Park

Provided assistance to the park with wetland compliance for the Wyoming Abandoned Mine Lands 18B project.

Provided policy and technical assistance to the park in developing a draft wetland mitigation banking document.

Provided policy and regulatory assistance to the park with various wetland compliance issues.

Provided technical review and approved funding for an NRPP funded project to develop lake trout control techniques in Yellowstone Lake.

Zion National Park

Served as COTR for the completion of a project involving enhanced National Wetland Inventory mapping, in cooperation with the US Fish and Wildlife Service. Twenty topographic quadrangles were mapped and digital data entered into the park's GIS. Riparian (non-wetland) mapping was also conducted.

Water Operations Branch

Provided assistance in defining possible new environmental requirements for the Integrated Pest Management Program in response to a 9th Circuit Court decision requiring NPDES permits for application of certain pesticides.

Attended meetings of the Northern Colorado Plateau Network, reviewed plans, and made comments in support of Colorado State University's effort to develop a Vital Signs Water Quality Monitoring Program.

Participated in Northern Colorado Plateau Network Coordinator's Technical Advisory Group meeting.

Assisted in the development of Park questionnaires and scoping efforts of the Northern Colorado Plateau Network as part of a Colorado State University project in support of water quality monitoring planning.

Attended a meeting for Sonoran Desert Network, reviewed plans, and made comments in support of the University of Arizona's effort to develop a Vital Signs Water Quality Monitoring Program.

Amistad National Recreation Area

Assisted in the preparation and review of the Water Resources Scoping Report.

Arches National Park

Prepared Source Water Protection Plan for Park's water supply wells.

Performed hydrologic modeling and wrote technical memo with findings for the reconstruction of the entrance road.

Bent's Old Fort National Monument

Provided State of Colorado water quality data for Triennial Water Quality Standards Review.

Big Bend National Park

Prepared scope of work for rehabilitation of water supply wells in the Castolon Area.

Big Thicket National Preserve

Provided advice to Park staff related to NPS-permitted, non-federal, oil and gas operations located adjacent to Park.

Reviewed and commented on a site assessment plan for a presumably contaminated site at an oil and gas operation.

Cany0n de Chelly National Monument

Provided information on well construction to Public Health Officer.

Canyonlands National Park

Reviewed analytical data and historical information from the Atlas Uranium Mill site, participated in groundwater subcommittee conference calls, and kept abreast of the release of limited, new, water quality data while awaiting transfer of the management of the project to the Department of Energy.

Provided continuing assistance to the Park in assessing potential effects of leachate from the Atlas Mine tailings on downstream resources in the Colorado River. Participated in interagency technical discussion meetings on developments at the Atlas site.

Prepared Source Water Protection Plan for Park's water

supply well.

Conducted field assessment of Salt Creek to determine how best to evaluate impairment of water resources by vehicle use. Arranged for the National Riparian Service Team to conduct an assessment of the riparian resources of Salt Creek using Proper Functioning Condition methodology.

Carlsbad Caverns National Park

Advised the Water Rights Branch and Park staff on the potential for utilizing surplus water from Rattlesnake Spring to restore riparian resources.

Chaco Culture National Historical Park

Consulted with researchers from USGS about a data report produced by WRD on the establishment of permanent cross-sections across Chaco Wash, which included procedures for resurveys.

Chiricahua National Monument

Provided technical assistance in construction and testing of new water supply well.

Curecanti National Recreational Area

Interpreted and commented on water and sediment quality data for potential motorboat contamination.

Edited and contributed to a water and sediment quality and aquatic life toxicity study proposal (for NPS-USGS Partnership Project money) for possible effects of motorized watercraft contaminants.

Provided Park staff with summary information on magnesium chloride and other deicers.

Dinosaur National Monument

Reviewed the final report for a USGS project to study pH trends in the Green River.

Provided assessment of spring development associated with an in-holder's grazing allotment.

Assessed bank erosion (which is threatening the only access road) on the Yampa River in Deerlodge Park and recommended alternative solutions for Park management.

El Malpais National Monument

Coordinated WRD wetlands project funding for the development of a restoration plan for Aqua Fria Creek; provided professional on-the-ground geomorphic assessments; and assisted project contractor by surveying four structures as part of the restoration of Aqua Fria Creek.

Florissant Fossil Beds National Monument

Assisted with a public meeting on and a review of the removal or retention of dams; conducted field inspections of the dams.

Glacier National Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Provided technical assistance related to construction of a new well at the Polebridge Ranger Station.

Assisted with design of flow monitoring system for Cleveland Creek at Goat Haunt related to potential development of a small hydroelectric facility.

Assisted staff in the development of a scope of work to guide a contractor in determining flood hazard at several locations.

Glen Canyon National Recreation Area

Facilitated coordination between the State of Utah and Park staff for the interpretation of water quality data relative to State water quality standards.

Coordinated and helped conduct water sampling of Lake Powell for possible contamination from motorized watercraft emissions.

Participated in an interdisciplinary team riparian assessment to determine Proper Functioning Condition of multiple drainages.

Attended interagency meeting to develop a strategic plan for addressing human health issues at Lake Powell. Served on the Technical Advisory Committee tasked with developing bacteria water quality monitoring guidelines and protocols.

Reviewed microbial source tracking project report.

Grand Canyon National Park

Assisted with the drafting of the Colorado River Surplus Criteria EIS Record of Decision; coordinated with the Parks, BOR, and a Solicitor to insure language was included that directed additional experimental flows in Grand Canyon.

Represented NPS on the Colorado River Annual Operat-

ing Plan Work Group to insure that the experimental flow provision was also included in the 2002 Colorado River Annual Operating Plan.

Provided technical assistance in evaluating potential effect of developing regional water supplies on South Rim springs.

Represented NPS on the Grand Canyon Experimental Flow Planning Ad-Hoc Group of the Grand Canyon Adaptive Management Program.

Served as a formal peer reviewer for Grand Canyon Monitoring and Research Center research proposals.

Great Sand Dunes National Monument & Preserve

Provided State of Colorado water quality data for Triennial Water Quality Standards Review.

Grand Tetons National Park

Provided advice and flow records for analysis of riparian conditions at Gros Ventre Campground area.

Provided technical assistance related to construction of new water supply well at Moran Junction.

Conducted second-year, vegetation experiment survey and coordinated with consultant on final restoration grading plan design.

Guadalupe Montains National Park

Provided advice regarding potential for impact to Park resources from groundwater withdrawals in the Dell City area.

Hovenweep National Monument

Prepared Source Water Protection Plan for Park's water supply well.

Provided advice and written report regarding source of water that is undermining the foundation of Square Tower.

Lake Meredith National Recreation Area

Provided final comments and edits for the Water Resources Section of the Oil and Gas Management Plan.

Provided advice to DSC planning team related to interpretation of NPS floodplain guidelines with respect to non-federal oil and gas operations.

Lyndon B. Johnson National Historical Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Mesa Verde National Park

Provided technical assistance to Park staff in evaluating contaminant migration and potential impacts to Park resources by an existing groundwater plume related to the historical release of gasoline containing hazardous compounds (BETX, MTBE) by concessionaire(s).

Met with Colorado Department of Labor and Employment Oil Inspection Section personnel to discuss corrective measures being proposed by concessionaire to clean up groundwater plume. Advised Park on adequacy of remediation being considered.

Reviewed Park-wide planning effort to restructure their Natural Resources Management Program, which incorporates ongoing, post-fire restoration and monitoring. Submitted comments and suggested priorities as a follow-up to a workshop in the Park.

Assisted Park staff in organizing a study to monitor the possible effects of the recent Bircher Fire on the water quality of the Mancos River.

Natural Bridges National Monument

Prepared report on Source Water Protection Plan for Park's water supply well.

Navajo National Monument

Coordinated project and funding calls for the initiation of Level 1 Water Quality Inventory.

Padre Island National Seashore

Interpreted and commented on water and sediment quality data and on bioassay data in relation to a proposal to dispose of dredged material from the Intracoastal Waterway inside the Park boundary.

Interpreted and commented on soil and groundwater data for contamination at a gas well site and a saltwater injection well site.

Commented on a Site Assessment Action Plan for a contaminated gas production facility.

Site visit to observe demonstration of "quick look" assessment methods developed by USGS for oil and gas sites. Prepared trip report and photo documentation of what was learned during demonstration to facilitate use at other

parks potentially impacted by oil and gas operations.

Petrified Forest National Park

Provided a filed assessment of proposed projects to stabilize cultural sites.

Pipe Spring National Monument

Investigated hydrogeology related to spring flow reduction.

Assisted in developing design and reconstruction of Tunnel Spring.

Advised management on several water resource issues surrounding the Monument. Assisted Park staff by maintaining backup copies of spring flow records and published reports about the Park's water resources.

Rocky Mountain National Park

Planned and conducted high precision surveys of monitoring wells, river stage gages, and topographic and hydrologic features in Moraine and Horseshoe Parks.

Reviewed project proposal for preliminary studies for wetland restoration at Hidden Valley.

Visited Lilly and Sprague Lakes and made hazard assessments.

Established a demonstration site on the Big Thompson River in Moraine Park to test a variety of vendor's multiparameter water quality sondes during a six-month equipment demonstration period. Deployed sondes and revisited site to perform monthly recalibrations.

Organized training for Park staff on the use of multiparameter probes in continuous water quality monitoring.

Participated in discussions with Park staff on pros and cons of deicers.

Attended meetings and provided GIS coverages to Colorado River Watch Group during the planning/design phase of a volunteer water quality monitoring program.

Timpanogos Cave National Monument

Served on an interagency team (USFS, BOR) to evaluate and report on river restoration needs associated with dam removal on the American Fork River.

Interpreted and commented on metals data for sediment quality.

Tonto National Monument

Prepared draft report on hydrogeology and potable water supply for Park.

Tumacacori National Historical Park

Issued "Draft Baseline Water Quality Data Inventory and Analysis Report," documenting water quality data retrievals from six Environmental Protection Agency databases.

Washita Battlefield National Historic Site

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Conducted a riparian assessment of the Washita River using Proper Functioning Condition procedures to assist in the Park's ongoing restoration efforts.

Walnut Canyon

Coordinated project and funding calls for the initiation of Level 1 Water Quality Inventory.

Wupatki National Monument

Coordinated project and funding calls for the initiation of Level 1 Water Quality Inventory.

Completed technical report regarding spring restoration assessment conducted in FY00.

Yellowstone National Park

Provided technical assistance to Park concerning remedial actions in the form of reviews and comments on multiple documents (Draft 2001 Work Plan, Draft McLaren Pit Response Action EE/CA) and Technical Memorandums (Aquatic Monitoring) related to remedial measures proposed for cleanup of the New World Mining District.

Visited New World Mining District to inspect FY01 remedial actions and to review progress made by the US Forest Service in cleanup and construction of a mine waste repository.

Attended restoration meetings and stakeholder technical sessions to address specific surface and groundwater issues and supplied Park with trip reports assessing progress of remediation and other technical and programmatic issues related to New World Mining District cleanup efforts.

Conducted technical review and provided comments on the construction of a waste rock repository for the New World Mining District restoration program.

Recommended Best Management Practices and provided interpretation of the Stormwater Phase II Rule for a parking lot project.

Zion National Park

Participated in the Virgin River Restoration Workshop.

Conducted investigation and prepared a report regarding the potential for impact from pumping wells outside Park boundary (Instone Founders LLC). Testified at hearing.

Provided fiscal and technical management and guidance for WRD Funded Project - Assessment of Bacterial Water Quality and Threats to Recreationists.

Reviewed Floodplain Statement of Findings for project in Park.

Water Rights Branch

Aztec Ruins National Monument

Assisted park in evaluating water rights associated with land acquisitions.

Arches National Park

Initiated Hydrogeology Study to determine connectivity between park water sources and adjacent private ground water wells.

Initiated quantification of state and Federal reserved water rights.

Canyonlands National Park

Installed a second stream gage on Green River to assist hydraulic modeling efforts.

Completed hydraulic model for the Fort Bottom area on the Green River.

Coordinated a meeting for WRD Park staff and researchers regarding resource needs and management of Green River.

Prepared final report on Green River 2D modeling.

Capitol Reef National Park

Initiated quantification of Federal reserved water rights.

Colorado National Monument

Reviewed Colorado water right resumes for Water Division 5 to determine if protests were necessary to protect park water rights and resources.

Dinosaur National Monument

Conducted pebble count survey and completed analysis of bed shear in 20-model reach.

Maintained stream gage on Green River to assist hydraulic modeling efforts.

Completed hydraulic model for the Island Park area on the Green River.

Coordinated a meeting for WRD, Park Staff and researchers regarding resource needs and management of the Green River.

Prepared final report on Green River 2D modeling.

Glen Canyon National Recreation Area

Assisted park review proposal for a dam on the Escalante River.

Grand Canyon National Park

Participated in settlement discussions and status conferences for the LCR (LCR) Adjudication.

Finalized stipulations with State Parties to resolve water rights in the LCR Adjudication.

Briefed park staff and management, the SOL, the Department, and DoJ on water right issues in the LCR adjudication.

Assisted park in developing and continuing the spring monitoring program on the South Rim.

Provided assistance to the park in coordinating water resource and water rights issues with the Grand Canyon Trust and the Havasupai Tribe.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Provided funding to USGS and a contractor to collect springflow, geologic, and biologic information about South Rim Springs.

Assisted SOL and DoJ in the preparation of a General Agreement with non-industrial users in the LCR.

Provided technical assistance to develop an interagency agreement with the BoR and a draft report evaluating water supply alternatives.

Provided assistance on the development of Special Use Permit conditions to sell water to Tusayan.

Grand Teton National Park

Researched Wyoming statutes for requirements concerning ditch easements and maintenance.

Hovenweep National Monument

Reviewed Colorado water right resumes for Water Division 7 to determine if protests were necessary to protect park water rights and resources.

Established agreement with Division Engineer to report annual water uses for Federal reserved rights at springs.

Assisted park in preparing annual water use reports for the Water Commissioner.

Hubble Trading Post National Historic Site

Participated in settlement discussions and status conferences for the LCR Adjudication.

Finalized stipulations with State Parties to resolve water rights in the LCR Adjudication.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Provided funding to the USGS to continue a well monitoring program to monitor water levels and protect water rights in the LCR basin.

Briefed staff and management, the SOL, the Department, and DoJ on water rights issues in the LCR adjudication.

Assisted park in reviewing documents to join the Ganado Water Users Association.

Assisted SOL and DoJ on the preparation of a General Agreement with non-industrial users on the LCR.

Mesa Verde National Park

Reviewed Colorado water right resumes for Water Division 7 to determine if protests were necessary to protect decreed water rights.

Continued support and oversight for park operation of a stream gage on the Mancos River.

Established agreement with Division Engineer to report annual water uses for Federal reserved rights at springs.

Assisted park in preparing annual water use reports for the Water Commissioner.

Natural Bridges National Monument

Revised draft agreement for quantification and protection of Federal reserved water rights.

Petrified Forest National Park

Participated in settlement discussions and status conferences for LCR Adjudication.

Finalized stipulations with State Parties to resolve water rights in the LCR Adjudication.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Provided funding to the USGS to continue a well monitoring program to monitor water levels and protect water rights in the LCR Basin.

Assisted SOL and DoJ on the preparation of a General Agreement with non-industrial users on the LCR.

Briefed staff and management, the SOL, the Department, and DoJ on water rights issues in the LCR adjudication.

Pipe Spring National Monument

Assisted with request for information concerning the water use agreement between the NPS, local cattlemen, and the Kaibab Indian Tribe

Evaluated water right implications of decline in spring discharge

Evaluated water right applications near park to determine impacts of diversions on park water rights.

Rainbow Bridge National Monument

Assisted park in coordinating Tribal review of the proposed water rights agreement with Utah.

Finalized a water rights settlement agreement with the State of Utah to recognize Federal reserved water rights.

Saguaro National Park

Assisted SOL in the resolution of water rights issues on the San Pedro River Adjudication.

Assisted SOL and DoJ on motions leading to the final decree of water rights for four springs in the San Pedro River Adjudication.

Sunset Crater Volcano National Monument

Participated in settlement discussions and status conferences for the LCR Adjudication.

Revised draft stipulations with State Parties to resolve water rights in the LCR Adjudication.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Briefed staff and management, the SOL, the Department, and DoJ on water rights issues in the LCR adjudication.

Provided funding to the USGS to continue a well monitoring program to monitor water levels and protect water rights in the LCR Basin.

Assisted SOL and DoJ in the preparation of a General Agreement with non-industrial users on the LCR.

Coordinated the preparation of water rights abstracts and settlement language for a water rights agreement between the United States and the City of Flagstaff.

Timpanagos Cave National Monument

Revised draft settlement agreement with Utah for Federal reserved and state appropriative water rights.

Coordinated review of draft water rights settlement agreement by the Forest Service.

Prepared future consumptive use estimates for the park.

Walnut Canyon National Monument

Participated in settlement discussions and status conferences for the LCR.

Finalized stipulations with State Parties to resolve water rights in the LCR Adjudication.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Provided funding for the crest-stage gaging program with the city of Flagstaff to determine the frequency and magnitude of high flows in Walnut Creek.

Provided funding to the USGS to continue a well monitoring program to monitor water levels and protect water rights in the Little Colorado River Basin.

Briefed staff and management, the SOL, the Department, and DoJ on water rights issues in the LCR Adjudication.

Assisted SOL and DoJ in preparation of a General Agreement with the non-industrial users on the LCR.

Coordinated the preparation of water rights abstracts and settlement language for a water rights agreement between the United States and the City of Flagstaff.

Assisted park and the regional lands office evaluate land exchange proposals by Warren Smith.

White Sands National Monument

Assisted park, region, and the SOL finalize land transfer and water rights protection agreements with the State of New Mexico and White Sands Air Force Base to protect the water supply from Dog Canyon.

Wupatki National Monument

Participated in settlement discussions and status conferences for the LCR Adjudication.

Finalized stipulations with State Parties to resolve water rights in the LCR Adjudication.

Provided contract administration of USGS studies to finalize a geohydrology report for the C-Aquifer.

Provided funding to the USGS to continue a well monitoring program to monitor water levels and protect water rights in the LCR Basin.

Briefed staff and management, the SOL, the Department, and DoJ on water rights issues in the LCR Adjudication.

Assisted SOL and DoJ in preparation of a General Agreement with the non-industrial users on the LCR.

Coordinated the preparation of water rights abstracts and settlement language for a water rights agreement between the United States and the City of Flagstaff.

Zion National Park

Assisted SOL and DoJ prepare for hearing and final decree of water rights on the Virgin River Adjudication.

Assisted park in evaluating water rights applications to determine consistentency with the Zion Water Rights Agreement and to evaluate impacts of diversions on park water rights.

Assisted park in preparing information to supplement NPS protest and assisted SOL in developing NPS case for Instone Founder's hearing,

Multi-Park

Assisted region and parks in the development and implementation of the Colorado River technical and steering committees and the first Colorado River Summit.

Bent's Old Fort National Historic Site

Evaluated water rights applications filed in Water Division 2 to determine impact of diversions on park water rights.

Big Hole National Battlefield

Continued providing oversight for a stream gage on the North Fork Big Hole River.

Provided funding to the USGS to collect stream discharge data.

Submitted water use report for park as required by the Montana Water Rights Compact

Bighorn Canyon National Recreation Area

Submitted water use report for park as required by the Montana Water Rights Compact.

Assisted park in responding to State of Wyoming's questions concerning ownership of an irrigation right.

Black Canyon of the Gunnison National Park

Evaluated water rights applications in Water Division 4 to determine impact of diversions on park water rights.

Assisted park and Region with negotiations for the quantification of a Federal reserved water right.

Assisted the DoJ file water right application in Division 4, Colorado Water Court for the Gunnison River.

Participated in the Aspinall Unit Operations meetings.

Hosted public meetings in Gunnison and Delta, Colorado to present basis of water right application and solicit public comments.

Conducted briefings for Department and Regional Office.

Participated in meetings with DoJ and SOL attorneys and other Federal agencies in an effort to develop a consistent Department interpretation of the Park's water right claim.

Prepared database of protests received regarding NPS application for water rights.

Florissant Fossil Beds National Monument

Evaluated water rights applications in Water Division 1 to determine impact of diversions on park water rights.

Glacier National Park

Evaluated water right applications to determine impacts on park water rights pursuant to the Montana Water Rights Compact.

Submitted water use report for park as required by the Montana Water Rights Compact.

Provided guidance concerning reporting requirements under Montana Water Rights Compact for a planned micro-hydroelectric plant.

Great Sand Dunes National Monument

Installed network of water level gages on Sand Creek to determine live stream terminus during spring runoff.

Assisted park in the continuation of studies in the Sand Creek area and the western portion of park.

Funded studies to conduct aquifer tests and geophysical work on Medano Creek.

Evaluated water rights applications in Water Diversion 3 to determine impact of diversions on decreed water rights.

Assisted park and SOL in reviewing and revising legislation to create Great Sand Dunes National Park and Preserve.

Little Big Horn Battlefield National Monument

Continued support and oversight for park operation of a stream gage on the Little Bighorn River.

Submitted water use report for park as required by the Montana Water Rights Compact.

Rocky Mountain National Park

Evaluated water rights applications in Water Divisions 1 and 5 to determine impacts of diversions on park water rights.

Evaluated draft augmentation plan for Lily Lake.

Yellowstone National Park

Evaluated non-NPS water right applications to determine impacts on park rights pursuant to the Montana Water Rights Compact.

Attended Yellowstone Controlled Groundwater Technical Oversight Committee meeting.

Assisted the USFS with negotiations to purchase land and water rights from Royal Teton Ranch.

Prepared a revised diversion schedule for Reese Creek.

Assisted park in retrofitting fish screens used in water diversion structures on Reese Creek.

Cooperated with the Montana Bureau of Mines and Geology on mapping of geology and collecting streamflow data for streams in the Yellowstone Controlled Groundwater Area.

Evaluated boundary of reserved lands adjacent to the Yellowstone River.

Initiated study with Colorado State University to determine accuracy of data collected at the upper Reese Creek flume.

Submitted water use report for park as required by the Montana Water Rights Compact.

Collected streamflow and water quality data for Soda Butte Creek in support of the Montana Water Rights Compact.

Evaluated petition to change place of use for water diverted from Reese Creek.

Amistad National Recreation Area

Prepared water rights section for Water Resources Scoping Report.

Carlsbad Caverns National Park

Initiated investigations to determine the dependence of cave resources on Capitan Aquifer.

Pecos National Historical Park

Initiated quantification of water rights associated with acquired properties.

Big Bend National Park

Prepared a preliminary assessment of an acquisition of Rio Grande River water rights.

Multi-Parks

Assisted region and parks in the development and implementation of the Colorado River technical and steering committees and the first Colorado River Summit.

MIDWEST REGION

Planning & Evaluation Branch

Arkansas Post National Memorial

Provided policy review and comment on Arkansas Post National Memorial draft GMP/EIS.

Buffalo National River

Provided technical review and approved continued funding for an NRPP funded study to evaluate effects of elevated nitrogen on aquatic invertebrates in the Buffalo River.

Reviewed and approved an implementation plan for an NRPP funded study of fish distribution and water quality in the Buffalo River and its tributaries.

Cuyahoga Valley National Recreation Area

Advised U.S. Bureau of Reclamation staff regarding NPS wetland protection procedures as they apply to a CERCLA remediation issue at the Krejci Dump Site.

Grand Portage National Monument

Provided policy and technical review of the water-related sections of the draft General Management Plan/ Environmental Impact Statement

Isle Royale National Park

Assisted park the development of a project statement for the development of a Water Resources Management Plan.

Pictured Rocks National Lakeshore

Initiated the development of a Water Resources Management Plan.

Saint Croix National Scenic River

Provided project oversight and technical review of a study implementation plan for a GRD Disturbed Lands Restoration Project (restoring brook trout habitat) at Saint Croix National Scenic River.

Scotts Bluff National Monument

Provided policy and technical review on a Wetland Statement of Findings for the Monument Valley Pathways project.

Sleeping Bear Dunes National Lakeshore

Provided technical assistance to park staff regarding methods for investigating apparent deterioration of wetland conditions at Mill Pond. Options presented included analysis of historic aerial photos and installation of water level gages.

Continued the development of the Sleeping Bear Dunes National Lakeshore Water Resources Management Plan.

Provided project oversight of the USGS-BRD work on a WRD-funded project to develop a zooplankton IBI.

Participated in discussions and conference calls pertaining to water level / discharge issues on the Crystal River.

Voyageurs National Park

Provided WRD oversight and assisted park staff and the University of Minnesota, as needed, in the development of a Water Resources Management Plan for the park, including participation in the WRMP scoping meeting at the park.

Provided policy and technical review comments on the water resources section of the draft Voyageur's National Park General Management Plan.

Reviewed and approved the final study plan for a funded project titled "An Assessment Program to Evaluate the Long-term Effects on Wetland Changes for Large Lakes." Also reviewed and approved the interim progress report for second year funding.

Assisted the park in drafting a fisheries management agreement with the Minnesota Department of Natural Resources (MDNR).

Participated in a meeting to develop a cooperative fishery management agreement between the Park and MDNR.

Provided technical review and approved for a study of muskellunge (*Esox masquinongy*) in Shoepack Lake.

Water Operations Branch

Attended the Heartland Network Aquatic/Riparian Workshop to provide WRD input and guidance in that Network's planning of its Vital Signs Monitoring Program.

Badlands National Park

Conducted floodplain/channel survey and performed hydraulic modeling and floodplain analysis.

Buffalo National River

Assisted Park staff in obtaining multiparameter instrumentation to deploy in conjunction with the USGS at a new monitoring site on the Bear Creek tributary where a water development project is under consideration.

Organized training for Park staff on water quality multiparameter instrumentation used in continuous water quality monitoring.

Consulted with Park staff on Pond Breach and Resultant Sediment Outwash and suggested other emergency response contacts.

Cuyahoga Valley National Park

Participated in several discussion sessions related to the final stages of settlement for the Krejci Superfund site.

Fort Union Trading Post

Assisted Park management in a consultant search to address bank erosion on the Missouri River within the Park's recently acquired viewshed.

George Washington Carver National Monument

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Herbert Hoover National Historic Site

Conducted a field assessment of riparian resources while participating in a Park workshop to create a watershed management plan.

Indiana Dunes National Lakeshore

Assisted Park staff in obtaining multiparameter instrumentation to deploy in conjunction with the USGS at a new monitoring site at Long Lake.

Isle Royale National Park

Continued to serve as project officer and provide technical assistance and report review for WRD-funded studies entitled "Investigation of Processes Influencing Elevated Fish Mercury Levels in Isle Royale National Park" and "A survey of unionid mussels in the aquatic systems of two National Park Service units.

Advised Park and Regional staff on studies needed to assess diesel spill in small creek.

Keweenaw National Historical Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Ozark National Scenic Riverways

Provided assistance regarding the local hydrogeology and potential impacts of proposed lead mining in the water-

shed of the Park.

Saint Croix National Scenic Riverway

Reviewed progress report for monitoring of trace metals associated with urban runoff to the St. Croix National Scenic Riverway.

Provided assistance regarding construction of a water supply well.

Moderated small group quality assurance/quality control and detail study plan meeting and wrote up consensus notes for the mercury study.

Reviewed and provided Park with QA/QC requirements for the phosphorus project.

Sleeping Bear Dunes National Lakeshore

Provided guidance on digitizing water quality data for compatibility with new STORET and associated metadata requirements.

Voyageurs National Park

Scouted sites for USGS-BRD study of snowmobile emissions and water quality. Also discussed with Park staff the possible effects of release of houseboat graywater on lake water quality.

Water Rights Branch

Buffalo National River

Provided funding and technical oversight to support hydrologic and biologic studies on Bear Creek.

Provided assistance to the park, SOL, and DoJ in coordinating and responding to concerns related to the Searcy County for a permit under consideration by the Corp of Engineers.

Sleeping Bear Dunes National Lakeshore

Assessed water rights framework for protecting Crystal River flows from Glen Lake.

Voyageurs National Park

Provided comments to park staff on Water Resources Scoping Report.

Wind Cave National Park

Assessed Norbeck Reservoir right for possible conversion to instream use.

Theodore Roosevelt National Park

Analyzed effects of proposed diversion and assisted in responding to North Dakota State Engineer on the potential to impact Little Missouri River flows in the park.

NATIONAL CAPITAL REGION

Planning & Evaluation Branch

Chesapeake and Ohio Canal National Historical Park

Completed and published the Chesapeake and Ohio Canal National Historical Park Water Resources Scoping Report (Technical Report NPS/NRWRD/NRTR-2001/291).

George Washington Memorial Parkway

Provided technical review and approved funding for a WRD-funded project entitled "Potomac Gorge Wetland Inventory, Mapping and Description".

Harpers Ferry National Historic Park

Provided technical review and approved funding for a WRD-funded project entitled "Enhanced Wetlands Inventory, Delineation and Mapping."

Water Operations Branch

Chesapeake and Ohio Canal National Historical Park

Provided review of Water Resources Scoping Report.

Assisted area office staff with planning of long-term I&M water monitoring in the area.

NORTHEAST REGION

Planning & Evaluation Branch

Provided technical review of a contractor's report "Addendum to Wetland Assessment for Natural Resource Survey, George Washington's Ferry Farm, Stafford County, VA."

Co-authored a manuscript on the development of a Indicators of Biological Integrity Indices (IBI) for Mid-Atlantic drainages.

Acadia National Park

Provided technical review and comments on the report "Wetland Habitats: Northeast Creek, Mt. Desert Island, Maine."

Allegheny Portage Railroad National Historic Site

Provided policy and regulatory assistance to park staff regarding NPS wetland compliance procedures related to proposed land acquisition adjacent to the park.

Boston Harbor Islands National Recreation Area

Provided technical review and approved funding for a WRD-funded project entitled "Wetland Habitat Mapping of Boston Harbor Islands National Recreation Area."

Continued work on the development of a water resources scoping report for Boston Harbor Islands NRA.

Cape Cod National Seashore

Provided technical review and approved funding for research proposals related to restoration of the Hatches Harbor salt marsh, protection of interdunal wetlands from the effects of potential water table drawdowns, and restoration of Pilgrim Lake and Salt Meadow.

Continued to compile and summarize literature on river herring (*Alosa aestivalis* and *A. pseudoharengus*) to assist in identifying impacts of delayed outmigration.

Provided technical review and approved funding for a BRMD funded study entitled "Survey of Spawning Populations of Horseshoe Crabs, *Limulus polyphemus*, within Cape Cod National Seashore".

Colonial National Historical Park

Provided policy and technical review of the draft "Environmental Assessment, Shoreline Management, Colonial National Historical Park, Jamestown Island, Virginia."

Participated in a work session at the park regarding wetland-related technical information needed for the Jamestown Island Master Plan/Environmental Impact Statement. The plan/EIS will address facilities to accommodate the 400th anniversary celebration of the Jamestown Settlement in 2007. Also reviewed and commented on subsequent contract scopes of work and products.

Provided policy review and comment on a draft "Land Exchange Language and Restrictions" document related to several proposed easements and land exchanges at the park. The purpose of the review was to assure that these proposed actions will be consistent with Director's Order #77-1: Wetland Protection.

Delaware Water Gap National Recreation Area

Provided comments to the park regarding restoration on a possible purchase property.

Provided technical review and assistance on regulatory and water quality issues arising from a proposal from Westfall Township to significantly expand a wastewater treatment facility located approximately 2.5 miles upstream of the northern boundary of the national recreation area.

Eisenhower National Historic Site

Provided WRD oversight and technical review for a WRD-funded study of the potential biological impacts of increased flow depletions and groundwater augmentation on biota in Marsh Creek.

Fire Island National Seashore

Continued discussions with the Denver Service Center concerning the Barrett Beach restoration project.

Gettysburg National Military Park

Provided NPS wetland compliance information to the park for their historic scene restoration and wetland restoration projects.

Provided policy and technical review and comment on the wetland Statement of Findings for the "Codori-Trostle Thicket Rehabilitation" project. Approved the wetland Statement of Findings for signature which then certified the technical adequacy of the wetland analyses and consistency with Servicewide procedures for implementing Executive Order 11990 – "Protections of Wetlands."

Johnstown Flood National Memorial

Provided policy and technical review and comment on the Draft Boundary Study, Internal Review Draft EA.

Martin Van Buren National Historic Site

Provided policy and technical review and comment on a "Boundary Study Environmental Assessment" for the park.

New River Gorge National River

Provided policy and regulatory assistance to the Denver Service Center with wetland compliance questions concerning the new Sandstone Orientation Visitor Center.

Richmond National Battlefield Park

Provided WRD project oversight and assisted the USGS with development of workplan and initiation of the development of the Water Resources Management Plan.

Saratoga National Historical Park

Working with the park, completed the cooperative development of the Saratoga National Historical Park Water Resources Management Plan.

Saugus Iron Works National Historic Site

Provided policy and technical review and comment on a draft General Management Plan and Environmental Assessment.

Shenandoah National Park

Provided technical review and approved funding for a NRPP funded project at Shenandoah National Park addressing the affects of acid deposition on park fish populations.

Upper Delaware National Scenic and Recreational River

Assisted park staff in determining wetland compliance requirements (Section 404 of the Clean Water Act and NPS Director's Order #77-1) for a proposed highway bridge that would span the river.

Weir Farm National Historic Site

Provided technical assistance and compliance advice regarding repair of a failing historic dam. Options including use of coffer dams and drainage pumps were discussed, and wetland compliance requirements associated with these options were presented.

Water Operations Branch

Acadia National Park

Reviewed and commented on the State of Maine Department of Environmental Protection's Report of Findings for a lead-contaminated area (soil and adjacent stream).

Provided Park staff with information on creosote, CCA, and other wood treatment products.

Allegheny portage Railroad National Historic Site

Provided guidance on digitizing water quality data for compatibility with new STORET and associated metadata requirements.

Cape Cod National Seashore

Provided assistance regarding potential impact of groundwater withdrawals from wells at the North Truro Air Base.

Colonial National Historical Park

Reviewed and commented on two draft proposals for funding for hydrologic and groundwater investigations.

Reviewed water quality plan for pond adjacent to Colonial Parkway in Williamsburg.

Delaware Water Gap National Recreation Area

Provided review and comment on Westfall Township NPDES wastewater permit application and water quality model results.

Reviewed and commented on a project proposal to develop groundwater monitoring and an educational exhibit.

Inspected the completed WRD funded project for dam removal and stream restoration at Pool Colony and made recommendations for controlling runoff in parts of the restored area.

Assisted Park staff in evaluating several locations for a proposed public beach access, using standardized hydrologic techniques.

Provided water quality data in support of analysis to justify upgrading the Delaware River to HQ-WWF as part of Pennsylvania's Special Protection Waters Program.

Fire Island National Seashore

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Developed a scope of work to cap flowing artesian wells in a wilderness area.

Provided Park with an interpretive review of DDT sediment sample data.

George Washington Memorial Parkway

Provided summary information on organic components in deicers.

Advised staff on possible risks associated with the application of biosolids by adjacent landowners.

Hopewell Furnace National Historic Site

Coordinated project and funding calls for the initiation of Level 1 Water Quality Inventory.

Lowell National Historical Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Saugus Iron Works National Historic Site

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Salem Maritime National Historic Site

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Saratoga National Historical Park

Provided technical comments on draft Water Resources Management Plan.

Shenandoah National Park

Prepared draft source water protection plan for the Big Meadows area.

Provided final design specifications for proposed channel stabilization structures in order to complete 404 permit application.

Provided interpretation of the applicability of Clean Water Act Section 303d and the Virginia State Water Quality Standards to Park streams.

Upper Delaware Scenic and Recreational River

Assisted and consulted with Park staff in the review of a work plan addressing proposed exploration borings for new bridge construction across the Delaware River.

Provided summary information on deicers.

Valley Forge National Historical Park

Conducted an evaluation of the hydrology of a watershed that contributes moisture into the foundation of historic Lord Stirling's Quarters, accelerating deterioration of the building.

Made a site visit and provided advice related to an unstable reach of Valley Creek that is eroding cultural resources.

Water Rights Branch

New River Gorge National River

Provided comments on a draft water resources management plan for New River Gorge National River, Gauley River National Recreation Area, and Bluestone National Scenic River.

Cape Cod National Seashore

Monitored progress of ongoing work to address effects of groundwater withdrawals on aquatic resources.

Reviewed proposed permit conditions for consistency with Director's Order No. 35A.

PACIFIC WEST REGION

Planning & Evaluation Branch

Provided review and comment on a National Science and Technology Council overview paper concerning the information base available to support restoration efforts for Pacific Salmon.

Represented DOI on a West Coast Marine Reserves Coordinating Committee under the Packard Foundation supported Communication Partnership for Science and the Sea (COMPASS). This committee completed a strategic action plan to assist West Coast states in the development and protection of marine reserves.

Provided policy and technical review and comment on a draft of the Executive Order for creation of the new Northwest Hawaiian Islands Marine Sanctuary.

Big Hole National Battlefield

Contacted the Montana Department of Fish, Wildlife and Parks (MDFWP) to identify measures needed to protect Arctic grayling (*Thymallus arcticus*) in within the Park.

Requested that MDFWP conduct a survey for young of the year arctic grayling in the North Fork of the Big Hole River within the Park (a survey was completed by MDFWP in October 2001).

Death Valley National Park

Participated in field visits to view the different spring systems and collection systems in the Furnace Creek area. Participated in meetings to develop alternatives and evaluate the affected environment for the Furnace Creek Water Collection System EIS.

Golden Gate National Recreation Area

Advised Presidio Trust staff on preparation of a bid package for wetland restoration.

Conducted an on-site technical review and discussion of a GRD-funded steelhead habitat restoration project on Eskoot Creek.

Lake Mead National Recreation Area

Provided policy and technical review and comment for the Wetlands/Floodplains Statement of Findings for the "Las Vegas Wash Stabilization Project" project. Approved the wetland Statement of Findings for signature which then certified the technical adequacy of the wetland analyses and consistency with Servicewide procedures for implementing Executive Order 11990 – "Protections of Wetlands."

Lassen Volcanic National Park

Assisted park staff in developing a proposal for the restoration of a rare fen ecosystem (Drakesbad Meadow). Worked with park staff and a Colorado State University cooperator to install a hydrologic monitoring network designed to characterize the existing (drained) Drakesbad Meadow hydrology and to document hydrologic response to future restoration actions.

Provided policy and technical review and approved a wetland Statement of Findings titled "Repair and Rehabilitate Main Park Road and Manzanita Lake Campground Entrance Road, LAVO." WRD signature certified the technical adequacy of the wetland analyses and the project's consistency with Director's Order #77-1: Wetland Protection.

Provided policy and regulatory assistance to the Denver Service Center concerning NPS and Corps of Engineers wetlands compliance for impacts to roadside ditches.

Mojave National Preserve

Provided technical review and comments on a proposal titled "Perform Baseline Hydrologic and Biological Inventory of Wetlands."

Provided NPS wetland compliance information to the park regarding vegetation removal and dredging of Lake Tuendae.

Provided technical review and approved funding for a WRD-funded project entitled "Inventory of Water and Biological Resources to Facilitate Restoration Prioritization."

Mount Rainier National Park

Participated in a "vital signs" scoping workshop to identify the water resources-related "vital signs" for consideration in the park's long-term inventory and monitoring program.

National Park of American Samoa

Provided technical review and editorial assistance in the publication of a technical report pertaining to the aquatic macrofauna of Laufuti Stream, National Park of American Samoa.

North Coast/Cascades Inventory and Monitoring Network

Participated in a conference to discuss approaches to biogeochemical indicators "vital signs" monitoring in for NPS/USDA Forest Service units located in the Cascades.

Represented the NPS at a meeting of the Puget Sound Water Quality Action Team to explore possibilities for linking water-related components of the North Coast/Cascades Inventory and Monitoring Program to existing monitoring activities within the Puget Sound Watershed.

North Cascades National Park

Provided technical review and comment on a funding proposal by North Cascades National Park to develop and Environmental Impact Statement to assess management options to deal with fish stocking by the State in backcountry lakes of the park and adjacent national recreation areas.

Olympic National Park

Advised park staff regarding Clean Water Act (Section 404) and NPS Director's Order #77-1 compliance requirements related to periodic channel manipulation in Finley Creek to protect park infrastructure. The park is seeking longer-term solutions through the GMP process that would alleviate the need for in-channel maintenance.

Held discussions with the park for a plan regarding lakeshore management at Lakes Ozette and Crescent. This would include educating landowners by providing information on permits (local, State, Federal), streambank erosion control, points of contact, etc.

Reviewed and provided input on a proposal to collect data needed to develop an ecologically sound approach to bank stabilization on the Hoh and Quinault rivers.

Oregon Caves National Monument

Provided technical review and comments in regards to a proposal to conduct a survey of native trout.

Pinnacles National Monument

Provided assistance to the park with wetland compliance issues concerning a landfill adjacent to Chalone Creek.

Provided wetland compliance information to the park for their EA on "Management of Bear Gulch Cave for Protection of the Townsend's Big-Eared Bat."

Point Reyes National Seashore

provided technical review and approved continued funding for a WRD-funded project entitled "Wetlands Inventory and Mapping."

Provided policy and technical review and comment on the Environmental Assessment, Biological Assessment, & wetland Statement of Findings for the McClure Dairy Barn and Resource Enhancement Project.

Met with park staff and conducted a site assessment of several stream and fish habitat restoration projects, including two potential coastal impoundment removal projects, steelhead habitat restoration projects on three park streams and a future wetlands/coastal marsh restoration project.

Redwoods National Park

Continued to coordinate technical assistance from Olympic National Park fisheries staff in developing a creel survey for Redwood Creek and the Smith River (ongoing).

San Juan Island National Historical Park

Assisted in the development of an Upland Aquatic/ Nearshore Marine Ecosystems conceptual model in support of the development of a "vital signs" monitoring program for the North Coast/Cascades Inventory and Monitoring Program.

Santa Monica Mountains National Recreation Area

Provided WRD oversight, approved the Investigator's Annual Report and released the second year funds for the WRD funded project titled "Restoration of Lower Malibu Creek Riparian Wetlands: Eradication of *Arundo donax*."

Discussed alternatives for sediment control for the Solstice Canyon Project with the Denver Service Center.

Yosemite National Park

Assisted staff in addressing NPS wetland compliance for the park's Fire Management Plan.

Assisted park staff in determining wetland inventory needs and estimated costs for wetland delineation work for a project to reconfigure trails and bridges at Yosemite Falls.

Provided policy and technical review for the final wetlands delineation report for the Campground Redevelopment Project.

Water Operations Branch

American Memorial Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Big Hole National Battlefield

Conducted hydrologic and topographic survey, performed hydrologic analysis, and produced technical report.

Cabrillo National Monument

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Channel Islands National Park

Provided an analysis of the suitability of a drinking water source for the endangered Island Fox.

Craters of the Moon National Monument

Provided advice on rehabilitation of springs and construction of new wells for potable water.

Death Valley National Park

Provided technical and regulatory analyses for disposal of reject water from Cow Creek reverse osmosis treatment plant.

Reviewed and commented on PMIS 64928 - Develop Water Resources GIS.

Participated in EIS process for water development in the

Furnace Creek area.

Golden Gate National Recreation Area

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Provided field surveys, contour maps, and volume calculations on a dam to be removed from Tennessee Valley. Conducted field training to staff of several Pacific West Parks on topographic surveys, using Park-owned total stations.

Provided advise on choosing laboratories for chemical analyses.

Great Basin National Park

Reviewed and commented on PMIS 65148 - Digital Hydrology Theme Creation.

Performed emergency riparian damage assessment in response to a spring development activity and prepared a technical memo with findings.

John Muir National Historic Site

Assisted with designing storm water drain near John Muir's gravesite with engineers from the Pacific West Region and county public works agency by integrating comments from the Park Superintendent, reviewers from the Region, and a citizen watershed planning group.

Implemented a project statement to evaluate the stability of John Muir's gravesite by collecting field measurements and photographs.

Kaloko-Honokohau National Historical Park

Served as WRD project officer on new USGS project to study groundwater contaminants. Led small group quality assurance/detailed project planning meeting and wrote up consensus agreement.

Served as an expert witness, assisting Park staff in State Land Use Commission hearings on the expansion of an industrial park upgradient of KAHO. Prepared and presented expert testimony on contaminants, risk assessment, and study design issues.

Assisted Solicitor and other expert witnesses in preparing question-answer format testimony on water quality issues in freshwater ponds and the near-shore marine environment, specifically nitrate limitation, study design methods, QA/QC, biological effects, and avian botulism.

Completed statistical analyses and presented information to other witnesses and to the Commission on the following: violations of State of Hawaii Water Quality Standards in near-shore waters, water soluble pesticides, the need for nutrient addition bioassays relative to dissolved organic nitrogen, and many other technical issues.

Provided comments on an Environmental Analysis for the development of an industrial park.

Lake Mead National Recreation Area

Developed portions of the Lake Mead Lake Management Plan as it relates to personal watercraft use and water quality impairment.

Commented on an early draft of a lake management plan / EIS.

Provided fiscal and technical management and guidance for WRD Funded Project - Identify Numerical Criteria to Protect Existing Higher Water Quality.

Developed sections of a funded project plan - Identification of Numerical Criteria to Protect Existing Higher Water Quality in Lake Mead National Recreation Area.

With Park staff, attended meeting with Nevada Water Quality Bureau to discuss antidegradation provisions for Lake Mead.

Communicated to Park staff the significance of some new findings on endocrine disruption compounds and pharmaceuticals.

Reviewed EPA draft report on mercury in fish tissue.

Advised Park on contaminants issues related to wetlands construction in or near Las Vegas Wash.

Lake Roosevelt National Recreation Area

Advised Park staff on several emerging contaminants issues.

Mojave National Preserve

Provided advice to staff related to the construction of a proposed new maintenance facility near Hole-in-the-Wall Campground and inspected the nearby Group Campground for potential flood hazard.

Assisted staff in the review, evaluation, and interpretation of technical reports and related data on Colosseum Mine site to prevent attempts of mining company (LAC Minerals) to recover their bond and exit the site while groundwater contamination still existed and before regulatory

cleanup criteria had been achieved.

Mount Rainier National Park

Provided staff with information on deicers.

North Cascades National Park

Advised Park staff on options for obtaining additional environmental toxicology training.

Reduced topographic survey data from previous year and produced preliminary topographic maps.

Provided guidance on digitizing water quality data for compatibility with new STORET and associated metadata requirements.

National Park of American Samoa

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Olympic National Park

Provided channel design criteria for removal of gravel from a bridge crossing.

Attended geo-chemical workshop and provided specialized advice on choosing monitoring methods and trying to be consistent with Forest Service methods.

Provided advice regarding erosion by the Hoh River into the access road embankment and campground.

Provided advice related to aggradation problems with Finley Creek. Assisted in planning for new bridge.

Made a site visit and provided advice related to several issues regarding Lake Ozette.

Participated in a monitoring workshop related to Elwha River restoration project and helped draft a physical process monitoring plan.

Provided a briefing to city officials and fishery biologists on sediment transport conditions anticipated during and following dam removal.

Participated on the 75% Value Study Engineering Team for the Elwha River Restoration Project.

Pinnacles National Monument

Evaluated on-the-ground accomplishments on implementing a watershed plan for the analysis of Chalone Creek.

Conducted site investigation to locate new water supply well near west entrance. Assisted staff in developing scope of work and contract documents for well drilling.

Obtained, entered, reformatted, and QA/QCed a variety of water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Point Reyes National Seashore

Reviewed water quality monitoring project report and plan.

Pu'uhonua o Honaunau National Historical Park

Reviewed Floodplain Statement of Findings for project in Park.

Redwood National Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

San Juan Island National Historical Park

Participated in Park's Vital Signs Monitoring Workshop and provided advice to Park regarding hydrologic monitoring.

Santa Monica Mountains National Recreation Area

Made a site visit and provided advice related to the replacement of a bridge and road embank-ment stability.

Provided analyses of the severity of contamination of DDT in soils.

Sequoia National Park

Supervised the preparation of pump sampling equipment for a short-term loan to a researcher studying water quality from post-fire conditions.

War in the Pacific National Historical Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Whiskeytown-Shasta-Trinity National Recreation Area

Reviewed historical information and a consulting engineer's recent report on the hydrogeology of the Iron Mine Superfund Site, advised Park on groundwater flow issues, and assessed potential for impacts to the Park from the site.

Assisted Park staff in obtaining multiparameter water quality instrumentation to demonstrate the capability of equipment from various vendors and obtain continuous monitoring information from Whiskeytown Lake.

Whitman Mission National Historic Site

Provided technical assistance to Park staff in preparation of a contractor's scope of work that met State of Washington requirements for groundwater monitoring at a gasoline release site.

Yosemite National Park

Reviewed several National Fire Program Strategic Planning Documents and the watershed sections of the YOSE Fire Management Plan.

Assisted Park staff and Denver Service Center staff in the ongoing planning process related to flood reconstruction and implementation of the Park's GMP.

Advised Park staff on numerous issues including removal of a small dam and hydraulic considerations associated with road redesign.

Participated in public meetings and provided advice related to the proposed removal of Cascade Dam.

Performed survey, conducted hydrologic modeling, and provided detailed information and recommendations related to the development of a new trail system and bridge for the Yosemite Falls area.

Participated in a public meeting and provided advice for the removal of the Happy Isles Bridge.

Provided advice relating to the replacement of the Wawona Bridge and regarding repair of exposed sewage pipeline crossing the Tuolumne River.

Provided Park staff with information on environmental effects of fire control chemicals.

Reviewed Floodplain Statement of Findings for project in Park.

Water Rights Branch

Crater Lake National Park

Assisted park and SOL in water rights settlement discussions with the Upper Klamath Basin ranchers.

Assisted Park and DoJ in preparation and review of documents for settlement of the Park's in-stream Federal reserved water rights claims.

Prepared draft proposal order for settlement of the Park's out-of-stream Federal reserved water rights claims.

Assisted park evaluate water conservation measures.

Evaluated the reliability of the Park's Annie Creek water supply by comparing estimates of natural flow to diversion rates allowed by water rights.

Mount Rainier National Park

Evaluated water rights for possible change to instream use.

North Cascades National Park

Evaluated proposed administrative rule for park water rights and coordinated comments with SOL.

Whitman Mission National Historic Site

Assisted park resolve the Doan Creek diversion issue.

Death Valley National Park

Monitored Devil's Hole pool level and discharge of Nevares, Texas, and Travertine Springs.

Evaluated Nevada water right applications and filed protests to protect park rights and resources.

Compiled and exchanged monitoring data with Department of Energy and Barrick Bullfrog in accordance with established conditions of water permits.

Provided recommendations regarding monitoring alternatives considered by the park for Inn Tunnel and Travertine Springs.

Assisted park with initiation of an automated water level recording station at Travertine Springs Well.

Continued multi-year USGS study of evapotranspiration at Death Valley saltpan and Grapevines Springs area.

Participated with other Federal agencies in the annual coordination meeting on water rights and resources issues in the Death Valley Region.

Coordinated NPS data collection activities with USGS Death Valley regional ground water flow model project.

Continued contract for expert hydrogeology assistance in overseeing the USGS Death Valley groundwater flow model project and provided review comments to USGS on draft steady state model report.

Prepared analyses of impacts to Grapevine Springs due to proposed groundwater pumping in Sacrobatus Flat and completed successful negotiation to withdraw NPS protest (Adams).

Briefed superintendent and staff on water right protection concerns for Grapevine Springs and Furnace Creek areas.

Researched Nevada State Engineer's records for information on Barrick Bullfrog rights and assisted in formulating a response to Barrick on the continuation of its monitoring program.

Assisted in reviewing alternatives for modification of the Furnace Creek Water supply system.

Coordinated with SOL on the existing water use agreement (AmFac) and potential effects of changing water diversion requirements.

Golden Gate National Recreation Area

Assisted with implementation of water right conditions for Muir Beach Community Services District on Redwood Creek.

Great Basin National Park

Evaluated Nevada water right applications and filed protests to protect park rights and resources.

Assisted in preparing recommendations for rehabilitating damaged resources at Young Canyon Spring.

Assisted park with its negotiations of spring restoration for Young Canyon Spring with neighboring landowner.

Lake Mead National Recreation Area

Participated in multi-agency field exercise to collect streamflow gain/loss data for the Muddy River above the park.

Briefed park management and Associate Director on the implications of Nevada State Engineer Ruling No. 5008.

Planned and conducted hydrogeology field reconnaissance tours of the Muddy River, lower Meadow Valley Wash, Tule Desert and Virgin River areas with representatives of water development interests and Department Bureaus.

Provided funding to USGS to continue discharge monitoring at Rogers and Blue Point Springs.

Evaluated Nevada water right applications and filed protests to protect park rights and resources.

Completed analysis of history of land acquisitions for Rogers, Blue Point and Kelsey's Springs and a portion of the Muddy River.

Conducted reconnaissance of lower Virgin River with park and USGS representatives to evaluate sites that may be suitable for installing a streamgage within the park.

Completed agreement with Las Vegas Valley Water District and Southern Nevada Water Authority to withdraw NPS protests of groundwater applications in Coyote Spring Valley.

Participated with SOL and FWS in negotiations with Coyote Springs Investment, LLC, to withdraw NPS protests of groundwater applications in Coyote Spring Valley.

Acquired services of experts in numerical ground water flow modeling, hydrogeology, and aqueous geochemistry to assist NPS with preparations for Nevada State Engineer hearing on Coyote Springs Investment, LLC groundwater applications.

Presented testimony at Nevada State Engineer hearing on the potential effects of groundwater withdrawals proposed by Coyote Springs Investment, LLC.

Completed USGS study of gravity and seismic-reflection data in support of hydrogeologic framework study of the California Wash area, Nevada.

Conducted field reconnaissance of the Overton Wildlife Management Area and met with Nevada Division of Wildlife to review Muddy River water right protection concerns.

Developed conceptual hydrogeologic framework for the lower Colorado Ground-Water Flow System of southeastern Nevada.

Developed a numerical ground-water flow model for a portion of the lower Colorado Ground-Water Flow System of southeastern Nevada.

Prepared comprehensive review comments on conceptual hydrogeologic framework and numerical ground-water flow model prepared in support of applications by

Moapa Band of Paiutes Indian Tribe.

Prepared review comments on environmental assessments and environmental impact statements prepared in support of energy development projects in southeastern Nevada.

Participated with SOL in negotiations between Moapa Band of Paiutes Indian Tribe, The Calpine Corporation, and NPS and FWS to determine possibilities for settlement of protests of groundwater applications for the Moapa Paiute Energy Center.

Participated with SOL in exploratory discussions with Lincoln County and Vidler Water Company for the Toquop Energy Project to determine possibilities for settlement of NPS protests of groundwater applications.

Participated with SOL and BLM in exploratory discussions with Moapa Valley District and PG&E/National Energy Group to determine possibilities for settlement of NPS protests of groundwater applications.

Lassen Volcanic National Park

Conducted a review of Headquarters Spring water right to determine if the right may be converted for existing uses.

Responded to a request for information on Beresford-Woodsen water right.

Mojave National Preserve

Assisted with conversion of NPS rights to existing uses.

Reviewed water rights transferred from grazing permit to NPS.

Assisted with resolution of issues of concern in the final EIR/EIS for the proposed Cadiz Groundwater Storage and Dry –Year Supply Program to withdraw groundwater from the Fenner basin.

Assisted with the preparation of Groundwater Management and Monitoring Plan for the Cadiz project.

Pinnacles National Monument

Assessed potential for converting surface water rights to ground water sources pursuant to conjunctive water use statute.

Point Reyes National Seashore

Initiated a review of water rights in the Olema Creek watershed to determine if rights may be converted to instream uses.

Sequoia and Kings Canyon National Parks

Evaluated water rights for Merritt Spring and existing uses by the park and a neighboring landowner.

Multi-Park

Reviewed water rights applications near California park units for potential to impact park rights and resources.

Submitted Reports of Licensee and Progress Reports for California parks.

Drafted maps of California park units outlining the area of concern for new water right applications.

Reviewed Hawaii water resources bulletins for applications having potential to impact park resources.

SOUTHEAST REGION

Big Cypress National Preserve

Provided policy review and comment on Hydrostation Landing Platforms Environmental Assessment for the Preserve.

Reviewed and commented on the Environmental Assessment and wetland Statement of Findings for the final park review document for the “Scenic Corridor Visitor Safety Highway Improvements” project. Approved the wetland Statement of Findings for signature which then certified the technical adequacy of the wetland analyses and consistency with Servicewide procedures for implementing Executive Order 11990 – “Protections of Wetlands.”

Represented WRD at an alternatives development meeting for the Oil and Gas Management Plan/EIS.

Biscayne National Park

Provided review and comment on a funding proposal being developed by Biscayne National Park to survey lobster populations and to conduct aerial overflights to develop a recreational boating census methodology.

Continued to provide technical assistance to Biscayne National Park in developing a cooperative fisheries management plan.

Blue Ridge Parkway

Reviewed and accepted the final products resulting from a WRD-funded project entitled “Inventory and Map Blue Ridge Parkway Wetland Areas”.

Buck Island Reef National Monument

Provided a policy review and comment on the draft briefing documents developed for the Secretary's review of the Buck Island Reef National Monument expansion and creation of Virgin Islands National Monument.

Canaveral National Seashore

Assisted park staff and the University of Central Florida in the technical review and approval of a WRD-funded Water Resources Management Plan for Canaveral National Seashore.

Chattahoochee River National Recreation Area

Advised park staff on: 1) how to protect wetlands within pipeline/utility easements from damage during periodic maintenance; and 2) how to address NPS wetland protection requirements for future easement requests.

Dry Tortugas National Park

Participated in a VERP Workshop to identify "indicators and standards" to be monitored to achieve the new desired future conditions outlined in the Dry Tortugas National Park's revised General Management Plan.

Fort Frederica National Monument

Provided policy and technical review and comment on the park General Management Plan and Environmental Impact Statement (internal draft).

Great Smoky Mountains National Park

Assisted in evaluating the potential impacts of a proposed development at the Ravensford site (Cherokee Tribe school and associated facilities) on adjacent wetlands in the park. Provided a list of local, qualified hydrologic consultants, reviewed study designs and contract scopes of work, and reviewed and commented on initial study results.

Gulf Islands National Seashore

Provided technical review and comments on the draft project report "Wetland Delineation and Hydrologic/ Community Survey of the Davis Bayou Area of Gulf Islands National Seashore."

Assisted the park with wetland compliance issues concerning replacement of the carpenters' building on Santa Rosa Island.

Contacted various coastal parks and summarized recent literature on the effects of artificial reefs and structure on fish and shellfish communities to assist identifying appropriate responses to a proposal to establish artificial reefs within park waters.

Jean Lafitte National Historical Park & Preserve

Provided wetland compliance information to the new natural resource specialist at the park.

Provided policy and technical review and comment on the draft FONSI for the project "Marsh Restoration Through Canal Backfilling."

Kings Mountain National Military Park

Traveled to Kings Mountain National Military Park, per a technical assistance request, to begin the initial efforts in preparing a Water Resources Scoping Report for the park.

Mammoth Cave National Park

Provided technical review and approved continued funding for an NRPP funded study of the plankton in the Green River downstream of Green River Reservoir.

Moores Creek National Battlefield

Co-authored a draft technical report titled "Hydrologic Restoration of a Wet Pine Savanna at Moores Creek National Battlefield, North Carolina" (Technical Report NPS/ NRWRS/NRTR-2001/293). The report compares the hydrology of the savanna before and after a hydrologic restoration experiment was implemented in late 1998. Results show that after full restoration, the site will once again support a complex of wet, mesic, and dry pine savanna habitats comparable to what was believed to exist at the time of the battle.

Natchez Trace Parkway

Provided policy and technical review and approved two wetland Statement of Findings for the 3P13 project. One SOF was for "3P13 Old Agency Road" and the other for "3P13 West." Approval of the wetland Statement of Findings for signature certifies the technical adequacy of the wetland analyses and consistency with Servicewide procedures for implementing Executive Order 11990 – "Protections of Wetlands."

Provided policy and technical review on the draft supplemental EIS for the "Old Agency Road" (Section 3P13) project.

Provided policy and technical review for the wetland delineation report for 5 road sections (Rice Road, Airport Road, Big Bayou Pierre, Coles Creek, Natchez 3-X) at the park.

Provided policy and technical review for the wetland delineation report for the Multi-Use Trail/Section 3X.

Water Operations Branch

Provided water quality data in Access format for all parks in the Cumberland/Piedmont Network in support of Vital Signs Water Quality Program planning process.

Prepared seamless, hydrographic base-layer (encompassing 138 USGS Catalog Units at 1:100,000-scale) from the National Hydrography Dataset for the Cumberland/Piedmont Network.

Andersonville National historic Site

Evaluated opportunities for funding and implementing a field water quality inventory.

Big Cypress National Preserve

Participated in an alternatives generation meeting for an oil and gas management plan / environmental impact statement.

Biscayne National Park

Participated in an alternatives generation meeting for an oil and gas management plan / environmental impact statement.

Attended meeting updating Dade County progress in remediation of ammonia contamination from South Dade Landfill. Advised Park on well location and other technical issues.

Big South Fork National River and Recreation Area

Provided continued assistance for the completion of NEPA requirements for contaminated mine drainage remediation projects.

Canaveral National Seashore

Provided review comments on the draft Canaveral Water Resources Management Plan.

Provided Park staff with summary information on cadmium toxicity.

Chattahoochee River National Recreation Area

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Congaree Swamp National Monument

Assisted Park staff in reviewing floodplain information related to a proposed development along the Congaree River near Columbia, South Carolina.

De Soto National Memorial

Interpreted and commented on one-year's worth of quality data for stormwater entering the Park.

Everglades National Park

Continued to provide staff with information related to contaminants and study design issues.

Gulf Islands National Seashore

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Reviewed wetland delineation project report.

Mammoth Cave National Park

Provided staff with information on mercury fate and effects related to proposed new power plant in the area and also information on various other metals.

Moores Creek National Battlefield

Provided review and technical comments for a wetlands restoration report.

Ocmulgee National Monument

Performed geomorphic analysis, provided advice for managing stormwater runoff, and produced a technical report.

Shiloh National Military Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Vicksburg National Military Park

Obtained, entered, reformatted, and QA/QCed additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Virgin Islands National Park

Made a site visit and provide advice to the Park and Denver Service Center planners regarding flood hazard in the Cinnamon Bay developed area.

Provided data management and downloading capability for an erosion study and assisted in the use of WRD field equipment. Advised Park on a demonstration project proposed by a researcher to educate the public about the erosion problems on the island.

Provided Park with information related to sewage and nutrient enrichment of coral reefs.

Provided guidance on digitizing water quality data for compatibility with new STORET and associated metadata requirements.

Water Rights Branch

Blue Ridge Parkway

Provided assistance to park in evaluating the potential for authorizing the use of a reservoir on the Moses T. Cone Estate by the town of Blowing Rock.

Obed Wild and Scenic River/Big South Fork National River and Recreation Area

Evaluated Fairfield Glade proposal to divert and store water and assisted in preparing comments to the Corps of Engineers.

Assisted park in leading a discussion among water development interests and Federal, state and county governments on regional water supply planning issues in the Big South Fork watershed.

Briefed park staff on water right protection strategies for both parks.

Continued multi-year study by the USGS of historic flow regimes for Obed Wild and Scenic River.

Initiated a multi-year paired-basin study by USGS to investigate the effects of small and medium-sized impoundments on streamflow.

SERVICEWIDE

Developed a new 3-year Interagency Agreement between the NPS and the U.S. Fish and Wildlife Service to continue cost-sharing and cooperative work on National Wetland Inventory mapping and wetland-related "special studies" in NPS units.

Prepared a report for an Inspector General's Office audit of the 20% fee money wetland inventory projects underway at Timucuan Ecological and Historic Preserve, Sequoia National Park, Point Reyes National Seashore, Yosemite National Park, Jean Lafitte National Historical Park and Preserve, and Lake Clark National Park and Preserve.

Represented the NPS in Federal Geographic Data Committee (Wetlands Sub-committee) meetings on creating a federal standard for mapping western riparian areas. Coordinated NPS review of the proposed standard as presented in "A System for Mapping Riparian Areas in the Western United States" (U.S. Fish and Wildlife Service, 1997).

Initiated a program review regarding the status of wetland restoration projects that the NPS has committed to as part of compliance with Director's Order #77-1:Wetland Protection.

Prepared a report on wetland restoration on NPS lands for the Committee for Defining and Tracking Wetland Gains and Losses. This report concentrated on tracking wetland gains for the Clean Water Action Plan for reversing the historic pattern of wetland losses in the U.S.

Provided NPS review of the Federal Register (Vol. 66, No. 11, dated 1/17/01, pgs. 4550-4575) regarding the Final Revisions to the Clean Water Act Regulatory Definition of Discharge of Dredged Material; Final Rule.

Provided NPS review of the Federal Register (Vol. 66, No. 32, dated 2/15/01, pg. 10367) regarding Further Revisions to the Clean Water Act Regulatory Definition of "Discharge of Dredged Material"; Delay of Effective Date.

Provided NPS review of the Federal Register (Vol. 66, No. 147, dated 7/31/01) "Notice of Availability of Draft Programmatic EIS for the Nationwide Permit Program."

Coordinated the development and review of the "Freshwater Resources Management" chapter of the draft RM-77 (Natural Resources Management).

Developed a staffing proposal for the 13 new "water resources professionalization" positions proposed in FY02 based upon an assessment of Servicewide water-related needs and technical assistance requests on an I&M network-by-network basis.

Coordinated NPS participation on the national Coral Reef Task Force working groups and attended the Steering Committee meetings. Within the Ecosystem, Science and Conservation working group participated in the development of a scientific paper on titled "A Rationale for Minimum 20% No-Take Reef Protection" which was presented at the 9th International Coral Reef Conference in Bali.

Provided a coordinating role for NPS participation in the implementation of a new Executive Order on Marine Protected Areas.

Participated on an Interagency Panel concerning fishery research needs of the Federal Agencies sponsored by the American Fisheries Society at the NOAA Auditorium in Silver Springs, Md.

Provided technical review and comment on the aquatic/marine sections of three Servicewide I&M Program prototype park annual monitoring reports.

Participated as co-lead on developing and holding a joint marine park/marine sanctuary manager's workshop for manager's of marine parks in close proximity to National Marine Sanctuaries.

Participated in a workshop to identify research needs for evaluating the impact of Snowmobiles sponsored by the Biological Resources Management Division.

Participated in an USGS/BRD-Client workshop on coral reef research needs and helped evaluate the BRD coral reef program activities.

Participated in a National I&M Program Vital Signs Monitoring Workshop. Presented a talk on the need for "Integration across natural resource program areas: what does it mean and how do we do it."

Supported the implementation of Servicewide Goal 1a4 of NPS Strategic Plan by summarizing progress to date, and recommending changes to the Technical Guidance for the Servicewide Strategic Planning Committee, amending Technical Guidance for reporting to the goal, reviewing fiscal plans and expenditures for the goal, developing and posting to the Web lists of 288 parks that must report to goal 1a4 and parks that have 303d listed water bodies, and developing an analysis of proposed new goal for the monitoring and reporting of water quality as related to desired condition.

Provided program leadership, coordination, and administration for the first year of the Natural Resource Challenge Water Quality Vital Signs Monitoring Program. Developed first year program guidance and distributed funding to twelve NPS Monitoring Networks.

Provided support for the initiation of the NPS Water Quality Vital Signs Monitoring Program by coordinating the development of field technical guidance for the implementation of field monitoring, reviewing and providing comments when appropriate on individual Network plans, giving a summary presentation at the Servicewide Vital Signs Workshop in Phoenix, helping design and stage a Servicewide Water Quality Workshop, and presenting the NPS approach to Vital Signs Monitoring at EPA's Western States Nonpoint Pollution Conference in San Diego.

Selected four, core water quality field parameters and prepared guidance on field measurement methods, instrumentation, available sensor technologies and their capabilities that would be recommended for implementation and use in water quality monitoring under the Natural Resource Challenge Vital Signs Program.

Organized, coordinated with Park staff, provided training, and began implementation of a six-month demonstration of three vendor's multiparameter water quality instruments at four parks to gather technical information about water quality monitoring to support the Natural Resource Challenge Vital Signs Program.

Developed a detailed guidance document for long-term, I&M aquatic monitoring detailing a step-by-step process for monitoring Networks to use in developing a detailed study plan including a Quality Assurance Project Plan.

Developed a consolidated Natural Resources Program Center Study Plan Guideline for competitive projects.

Continued to coordinate NPS-USGS Water Quality Program as part of the Clean Water and Watershed Protection Initiative (Clean Water Action Plan) funded by Congress. Reviewed final work plans for fifteen project proposals selected for program funding. Facilitated communication between USGS Districts and Parks on planned project activities. Prepared program call for FY02 Partnership Projects. Planned and coordinated interagency work group meeting to review, rank, and select project proposals for funding in FY02. Served as co-chair of the work group for the NPS-USGS Partnership Program. Created catalog of digital photos from Partnership field studies in National Parks.

Represented the National Park Service as an official member of the National Water Quality Monitoring Council. Attended a public meeting in Denver involving the discussion of water quality data elements sponsored by the NWQMC and actively participated in the Water Information Strategies Work Group.

Maintained and updated a geo-referenced park boundary digital database for use in GIS-based water resources analyses and queries; provided copies of this database to groups within the NPS, USGS, EPA, Census Bureau, and the private sector; and posted copies of the database on the NPS GIS Web Site to better service requests for the data.

Prepared documentation of water resource-related data systems for the Natural Resource Data and Information Systems Handbook.

Prepared a water quality GIS tutorial/exercise in ArcView and Excel to train NPS staff on how to integrate water quality data into their GIS.

Gave water quality inventory presentation at Natural Resource Data Management Workshop in Madison, WI.

Represented the NPS at a National Hydrography Dataset and Hydrologic Unit Boundary Delineation Symposium in Salt Lake City, Utah.

Submitted request for completion of the high-resolution National Hydrography Dataset for targeted USGS Catalog Units containing multiple National Park units to the DOI High-Priority (A-16) Base Data Program.

Attended public hearing in Denver and provided written comments on the National Water Quality Monitoring Council's proposed standard "Data Elements for Reporting Water Quality Results of Chemical and Microbiological Analytes."

Enhanced software to convert completed Baseline Water Quality Data Inventory and Analysis Reports to Microsoft Word files to 1) facilitate incorporation into the I&M Data Browser and Synthesis, 2) provide additional copies of the reports upon request (including from the Internet), and 3) to store the reports more efficiently. To date, 134 Baseline Water Quality Data Inventory and Analysis Reports have been converted to Microsoft Word documents.

Prepared a poster for the George Wright Society Meeting in Denver, documenting the status of the Baseline Water Quality Data Inventory and Analysis Report effort and the conducting of Level 1 water quality inventories.

Initiated a new project under the NPS Cooperative Agreement with Colorado State University to establish the status and trends of impaired, threatened, and outstanding national/state resource waters in the National Park System.

Helped coordinate WRD participation in interagency fire management issues by attending the Los Alamos Interagency Wildfire Workshop, NRPC Fire Technical Advisory Group meetings, and the Fire Program Strategic Planning Meeting.

Developed draft Director's Order and Procedural Manual for Floodplain Management, Draft Executive Order for Floodplain Management, and NPS Floodplain Management Policies.

Provided advice and consultation to Denver Service Center, Regional Offices, Support Offices, and Parks on interpretation of Floodplain Management Policy and Procedures.

Presented information on motorized watercraft emissions and water quality at the NPS Snowmobile Effects on Wildlife: Monitoring Protocols Workshop in Denver and at the Annual River Management Society Meeting in Minneapolis.

Initiated an investigation of the impacts of snowmobiles in parks by developing a Request for Research Proposal entitled "Investigation of the Occurrence and Significance of Snowmobile-Caused Hydrocarbon Contaminants in Soil and Water for Selected Units of the National Park Service" and soliciting a proposal from the USGS CERC, coordinating internal and external review comments of the proposal, and coordinating the administrative functions of funds transfer.

Developed and maintained data bases for managing information on NPS reviews of water rights applications and protests.

Presented case studies on threats to instream flows at annual meeting of River Management Society.

Publications/Contributions

Planning & Evaluation Branch

Bohnsack, J.A., B. Causey, M. P. Crosby, R. B. Griffis, M. A. Hixon, T. F. Hourigan, K. H. Koltes, J. E. Maragos, A. Simons, and J. T. Tilmant. 2001. A Rationale for Minimum 20 – 30 % No Take Protection. Proceedings of the Ninth International Coral Reef Symposium, Bali, Indonesia. October 23 - 27, 2000. 6pp.

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Cooper, D.J., S.W. Woods, R.A. Chimner, and L.H. MacDonald. 2000. Final Report to the National Park Service: Effects of the Grand Ditch on Wetlands of the Kawuneeche Valley, Rocky Mountain National Park, Colorado. Dept. of Earth Resources, Colorado State University, Ft. Collins, CO.

Daniels, R., K. Riva-Murray, D. Halliwell, D. Vana-Miller, and M. Bilger. *In press.* An index of biological integrity for Mid-Atlantic drainages. Trans. Am. Fish. Soc.

Darby, N. W. and T. B. Williams. 2000. Ecosystem planning approach for reintroducing Bonneville cutthroat trout to Great Basin National Park (Nevada). Poster Presentation: National Park Service West by Northwest 2000 Resources Management Conference. March 13 – 17, 2000. San Diego, CA. (Poster).

Grabner, K., G. Willson, E. Schneider, S. Jenkins, and R. Guyette. 2000. Vegetation Dynamics of the Riparian Corridor, Jacks Fork and Current Rivers, Ozark National Scenic Riverways, Missouri. USGS - Northern Prairie Wildlife Res. Center and University of Missouri, School of Natural Resources. 34 pp. + app.

May, C.J. 2001. Mapping riparian resources in semiarid watersheds using airborne multispectral imagery in the Escalante River Corridor. Masters Thesis, Utah State University, Logan, Utah. 73 pp. + app.

Neale, C.M.U. and C. J. May. 2001. Monitoring the riparian corridor for the Escalante, San Juan and Colorado Rivers within the Glen Canyon National Recreational Area using airborne multispectral digital imagery. Dept. of Biological and Irrigation Engineering, Utah State University, Logan, Utah. (includes CD - ROM of Arcview data) 17 pp. + app.

Skiles, R. F.. 2001. Restore Endangered Big Bend Mosquitofish Habitat. Final Report to the Water Resources Division, National Park Service. Big Bend National Park, Texas. 27 pp.

Vana - Miller, D., C. Martin, and L. White. 2001. Water Resources Management Plan, Saratoga National Historical Park (New York) . Saratoga National Historical Park, Stillwater, NY. 69 pp.

Vana - Miller, D. and D. Weeks. 2001. Concept Paper for the Northern Colorado Plateau Inventory and Monitoring Network Water Quality Monitoring Program.

Walker, G.L. 2001. Inventory, groundtruthing, and mapping of high elevation wetlands and construction of a GIS database for the Blue Ridge Parkway. Final Project Report submitted to NPS Water Resources Division by Dept. of Biology, Appalachian State University, Boone, NC.

Roman, C.T., N.E. Barrett, and J.W. Portnoy. 2001. Aquatic Vegetation and Trophic Condition of Cape Cod (Massachusetts, USA) Kettle Ponds. *Hydrobiologia* 443: 31 - 42.

Roman, C.T., N.E. Barrett, and J.W. Portnoy. 2000. Aquatic Vegetation and Trophic Condition of Cape Cod National Seashore (Massachusetts) Kettle Ponds. Project Technical Report submitted to NPS Water Resources Division. 61 pp.

Spaulding, M. L. and A. Grilli. 2001. Hydrodynamic and Salinity Modeling for Estuarine Habitat Restoration at Herring River, Wellfleet, Massachusetts. Technical Report, Ocean Engineering Department, University of Rhode Island, Narragansett, RI. 93 pp.

Usrey, F.D. 2001. Macroinvertebrate Community Assessment of the Mid - Reaches of the Buffalo National River. M.S. Thesis. Department of Biology, University of Central Arkansas, Conway, AR. 59 pp. + app.

Walters, L., A. Roman, J. Stiner, and D. Weeks. 2001. Water Resources Management Plan: Canaveral National Seashore (Florida). University of Central Florida, Orlando, FL and Canaveral National Seashore, Titusville, FL. 223 pp. + app.

Woods, S. W. and J. I. Wagner. 2001. Hydrologic Restoration of a Wet Pine Savanna at Moores Creek National Battlefield (North Carolina). Tech. Report NPS/NRWRD/NRTR - 2001/293. NPS Water Resources Division, Denver, CO. 49 pp.

Weeks, D.P., 2001. Lake Clark National Park and Preserve (Alaska) Water Resources Scoping Report. Tech. Report NPS/NRWRD/NRTR - 2001/292. NPS Water Resources Division. Denver, CO. 64 pp.

Weeks, D.P., 2001. Chesapeake and Ohio Canal National Historical Park (District of Columbia/Maryland), Water Resources Scoping Report. Tech. Report NPS/NRWRD/NRTR - 2001/291. NPS Water Resources Division. Denver, CO. 62 pp.

Young, D., C. A. Woody, and J. Margraf. 2001. Spawning Distribution and Migration of Lake Clark (Alaska) Sockeye Salmon (Oncorhynchus nerka). Poster Presentation: Alaska Cooperative Fish and Wildlife Unit Review. February 27, 2001. Fairbanks, AK. (Poster)

Water Operations Branch

Long, Barry, April 2000, Monitoring Dance Fundamentals: No Partner, Can't Dance, National Water Quality Monitoring Council, Monitoring for the Millennium Conference Proceedings.

Martin, Larry, November 2000, Evaluation of Proposed Water Supply Wells South of Elephant Butte, Utah. Fort Collins, CO.

Martin, Larry, August 2001, Drinking Water Source Protection Plan: Arches National Park, Devils Garden Well. Fort Collins, CO.

Martin, Larry, August 2001, Drinking Water Source Protection Plan: Arches National Park, Headquarters Well No. 3. Fort Collins, CO.

Martin, Larry, January 2001, Drinking Water Source Protection Plan: Canyonlands National Park. Fort Collins, CO

Water Rights Branch

Bassett, R.L. 2001. *Advisory services relating to the oversight* of geochemistry and geochemical modeling. Geochemical Technologies Corporation, prepared under NPS contract. 33 pp.

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GeoChemical Technologies Corporation, prepared under NPS contract. 16 pp + app.

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Gessler, D., and E. Moser. 2001. Two dimensional computer modeling of Green River at Dinosaur National Monument and Canyonlands National Park. Prepared under NPS co-operative agreement with Colorado State University. 52 pp.

HRS Water Consultants. 2001. Sand Creek numerical groundwater model, Great Sand Dunes National Monument, Colorado. Prepared under NPS contract. 45 pp + fig, app.

Langenheim, V.E., J.J. Miller, W.R. Page, and J.A. Grow. *2001. Thickness and geometry of Cenozoic deposits in California Wash area, Nevada, based on gravity and seismic-reflection data.* U.S. Geological Survey Open-File Report 01-393, prepared in cooperation with the National Park Service. 27 pp.

Van Liew, W.P. and J.T. Back. 2001. The potential impacts of proposed ground-water pumping in Coyote Spring Valley on the water resources of Lake Mead National Recreation Area. National Park Service. Fort Collins, CO. Exhibit No. 65, In the matter of applications 63272 through 63276, and 63867 through 63876 filed by Coyote Springs Investment, LLC to appropriate the public waters of the State of Nevada. 18 pp + oversize plate, fig, tbl, app.

Waddell, R.K. 2001. Ground-water modeling of the Muddy River Springs Area and surrounding basins with emphasis on evaluating pending water rights applications in Coyote Spring Valley. GeoTrans, Inc., prepared under contract to U.S. Fish and Wildlife Service and National Park Service. 20 pp + fig.

Williams, J., E., E. Moser, and W.R. Hansen. 2001. Draft—Indian River Water Resources Data Report for Water Years 1999 and 2000, Sitka National Historical Park. National Park Service. Fort Collins, CO. 18 pp.

Water Resources Division Financial Status and Sponsored Projects

By Dan B. Kimball, Division Chief
and Debi Cox, Program Analyst

FY2002 base funding for the Water Resources Division (WRD) was $7,905,000. The figure below illustrates the distribution of total WRD funds among technical assistance, project, and administrative support costs. Technical assistance, which is predominately day-to-day operational support to the parks includes staff salaries, travel, and associated expenses. Administrative support includes program management costs, administrative support, equipment, and supplies and materials Divisionwide. The projects category includes funds supporting WRD-sponsored projects in the areas of general water resources, water quality, wetlands protection, and water rights. Tables 1, 2, 3, 4, and 5 list WRD-sponsored projects for FY2002. Tables 6 and 7 show projects funded through the NPS/USGS Water Quality Monitoring and Assessment Program.

Distribution of WRD 2002 Funding

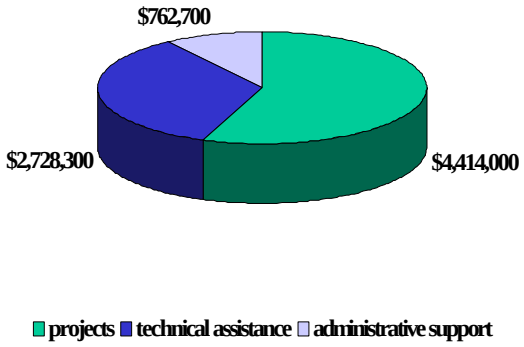

TABLE 1 - FY02 HYDROLOGY, WATERSHED MANAGEMENT, PLANNING
NEW AND CONTINUING PROJECTS

PARK	REGION	PROJECT TITLE	WRD PROJECT COORDINATOR	Funding$(000s) FY02	FY03
HAFO	PWR	Large Scale Groundwater Tracer Test	L. Martin	45.10	0.00
ISRO	MWR	Develop Water Resources Management Plan	Vana-Miller	25.00	25.00
REDW	PWR	Evaluate Watershed and Stream Channel Conditions Related to Disturbance History and Coho Habitat in Mill Creek	Inglis/Tilmant	27.30	20.70
DEWA	NER	Develop Groundwater Monitoring	M. Martin/ L. Martin	41.00	0.00
OLYM	PWR	Analyze Channel Dynamics on the Hoh and Quinault Rivers to Protect Fish and Aquatic Resources	Smillie	35.00	15.00
		SUBTOTAL NEW PROJECTS		173.4	60.70
BUFF	MWR	Delineate and Characterize Karst Ground Water Recharge Zone at Buffalo National River, Arkansas	Penoyer	25.00	0.00
HAFO	PWR	Quantify and Analyze Reservoir Drawdown Effects from Idaho Power Operations to Shoreline Slope Stability Problems	Smillie	18.00	0.00
LACL	AKR	Runoff Components of the Tlikakila Wild River	M. Martin	20.00	0.00
SAGU	IMR	Identify and Map Water Sources and Riparian Areas	L. Martin	18.60	0.00
MULTI	IMR	Assess Water Related Impacts to GLCA, GRCA, and LAME	Jackson/Tilmant	25.00	0.00
		SUBTOTAL CONTINUING PROJECTS		106.6	0.00
		TOTAL NEW AND CONTINUING PROJECTS		280.0	60.70

TABLE 2 - FY02 WATER QUALITY MITIGATION & RESTORATION
NEW AND CONTINUING PROJECTS

PARK	REGION	PROJECT TITLE	WRD PROJECT COORDINATOR	Funding $(000s) FY02	FY03
CATO	NCR	Evaluate Water Quality for all Park Streams	VanMouwerik	17.00	14.00
ACAD	NER	Evaluate Impact of Vehicle Traffic on Water Quality	Rosenlieb	49.90	0.00
SACN	MWR	Historical Trends in Phosphorous Loading from Permitted Point Source Discharges	Irwin	25.00	25.00
GRTE	IMR	Baseline Water Quality Parameters/Land Use Characteristics of Five Snake River Headwater Tributaries	Long	24.90	24.90
ACAD	NER	Assess Current and Historic Atmospheric Deposition of Toxic Contaminants	Penoyer	49.50	0.00
		SUBTOTAL NEW PROJECTS		166.30	63.90
SACN	MWR	Identify Sources of Methyl Mercury in the St. Croix National Scenic Riverway	Irwin	25.00	0.00
CRLA	PWR	Develop Data Management Program for Crater Lake Long-Term Limnological Monitoring Program	Tucker	27.90	0.00
WHIS	PWR	Monitor Water Quality of Willow Creek	Irwin	7.00	0.00
NOAT	AKR	Effect of Climate Change on Nutrient and Carbon Availablity to Arctic Aquatic Systems	M. Martin	25.00	0.00
		SUBTOTAL CONTINUING PROJECTS		84.90	0.00
		TOTAL NEW AND CONTINUING PROJECTS		251.20	63.90

TABLE 3 - FY02 WETLANDS RESTORATION & PLANNING
NEW AND CONTINUING PROJECTS

PARK	REGION	PROJECT TITLE	WRD PROJECT COORDINATOR	Funding $(000s) FY02	FY03
LACL	AKR	Complete National Wetlands Inventory Mapping – Phase 3	Krueger	50.00	0.00
GWMP	NCR	Potomac Gorge Wetland Inventory, Mapping, & Description	Krueger	50.00	0.00
LAVO	PWR	Restoration of Drakesbad Meadow	Wagner	25.00	25.00
PORE	PWR	Hydrologic and Ecological Impacts of Commercial Oyster Farming on the Biota of Drakes Estero	Krueger	25.00	25.00
CACO	NER	Management of Dune Slack Wetlands	Wagner	19.00	12.00
MOJA	PWR	Perform Baseline Hydrologic and Biologic Inventory of Wetlands	Krueger	25.00	25.00
HAFE	NCR	Wetland Delineation for NEPA and Regulatory Compliance	Krueger	13.00	0.00
		SUBTOTAL NEW PROJECTS		207.00	87.00
GRBA	PWR	Spring/Wetland Restoration and Range Improvement	Wagner	23.75	0.00
VOYA	MWR	Design and Assessment Program to Evaluate the Long-Term Effects on Wetland Changes for Large Lakes	Krueger	25.00	0.00
ELMA	IMR	Develop Comprehensive Restoration Plan for Agua Fria	Wagner/Inglis	16.00	0.00
BOHA	NER	Wetlands Habitat Mapping of Boston Harbor Islands	Krueger	9.00	0.00
		SUBTOTAL CONTINUING PROJECTS		73.75	0.00
		TOTAL NEW AND CONTINUING PROJECTS		280.75	87.00

TABLE 4 - UNFUNDED FY02 WATER RESOURCES PROJECTS

PARK	REGION	PROJECT TITLE
BUFF	MWR	Water Quality and Streamflow of Springs in the Buffalo River Basin
WHIS	PWR	Quantify Metals Contamination and Inventory Invertebrate Habitat in Whiskey Creek
GUIS	SER	Identify Impacts to Water Quality and Develop Restoration Plan
GLAC	IMR	Assess Water Quality
YELL	IMR	Create a Spatial Database of Baseline Water Quality Data
HUTR	IMR	Partner with Navajo Nation to Monitor Water Quantity of the Pueblo Colorado Wash to Detect Impacts
BLRI	SER	Restore Riparian Zones in Eleven Tributaries within New River Watershed
GUMO	IMR	Inventory, Assessment & Restoration of Choza Spring, Stream, and Riparian Habitat
CACO	NER	Sedimentation, Nutrient, and Metals Deposition in Kettle Ponds
ROMO	IMR	Assessment of Privies and Dispersed Human Waste Methods on Groundwater Contamination
GRKO	IMR	Riparian Corridor Restoration Planning
ROMO	IMR	Hidden Valley Creek Wetland Restoration
PORE	PWR	Restoration of Horseshoe Pond to a Tidal Estuary
TIMU	SER	Inventory All Impacted Wetlands in Preserve
SAMO	SER	Assess and Map Wetlands to Protect Sensitive Species and Habitats
GUIS	SER	Assess Freshwater Resources and Develop Management Strategy
CACO	NER	Plant Physiological and Biogeochemical Monitoring of Hatches Harbor
DENA	AKR	Determine Physical Hydrology Information Along Proposed North Access Corridor
KEFJ	AKR	Monitor glacial change: Areal Extent and Elevation
OZAR	MWR	Design Groundwatershed Management Plan for the Big Spring Recharge Zone
PORE	PWR	Physical and Biological Assessment of Impoundments Supporting California Red-Legged Frogs
MACA	SER	Develop Water Resource Management Plan
CUVA	MWR	Monitor Leaf Litter Decomposition Rates as Indicators of Ecological Condition: A Pilot Study
SACN	MWR	Geomorphic History of Island Formation
DEVA	PWR	Inventory Grapevine Springs
PAIS	IMR	Evaluating Natural Attenuation
OLYM	PWR	Assess Impact of Tributary Discharge & Changes in Surface Elevation of Lake Ozette on Beach Spawning Sockeye
CAVE	IMR	Determine the Watershed for Rattlesnake Springs
CARE	IMR	Water Resources Management Plan
MEVE	IMR	Hydrogeologic Study
GUIS	SER	Implement Water Quality Program of GUIS Lagoons

Summary of Water Rights Projects Supported by WRD Funds
(Planned for Fiscal Year 2002)

PARK	REGION	PROJECT TITLE (s)	WRD PROJECT COORDINATOR	FUNDING $(000)
ALL	ALL	Support to the Office of the Solicitor	Pettee	160.4
MANY	IMR, PWR	Flow Monitoring to Support Water Rights Activity	Albright	31.2
MOCA	IMR	Assessment of Ground Water Pumping Impacts to Beaver Creek	Moser	4.0
LAME	PWR	Spring Flow Monitoring, Preparation for Administrative Hearings	McGlothlin	476.5
BLCA	IMR	Preparation for Negotiation/Litigation, Adjudication of Colorado Water Division 4	Wondzell	20.0
BUFF	MWR	Investigation of Water Related Values	Hansen	146.0
DEVA	PWR	Devil's Hole and Spring Flow Monitoring, Evapotranspiration Study, and Groundwater Modeling	McGlothlin	292.9
AZ Parks	IMR	Preparation for Negotiation/Litigation, Adjudication of the Little Colorado River Basin in Arizona	Hansen	20.9
GRCA	IMR	Hydrologic Investigation, Spring Protection	Hansen	153.5
OBRI	SER	Stream Flow Monitoring, Surface Hydrology Study	McGlothlin	50.0
CAVE	IMR	Preparation for Negotiation/Litigation, Adjudication of the Pecos River Basin in New Mexico	Moser	4.0
UT Parks	IMR	Preparation for Negotiation/Litigation, Adjudication of Various Areas in Utah	Moser	23.0
YELL	IMR	Implement Reese Creek Water Rights Agreement	Hughes	17.6
		TOTAL FOR WATER RIGHTS PROJECTS		1,400.0

The National Park Service's water rights protection efforts are generally dictated by court schedules, Department of Justice case strategies, water development proposals by private entities, and State administrative actions and schedules. This table lists the allocation of funds necessary to meet these anticipated demands for FY2002. If unforeseen hearing or adjudication needs arise, adjustments to project funding may be necessary.

AWARDS

Don Weeks received a Quality Step Increase in recognition of his exceptional performance in both the completion of water resources scoping reports for Katmai National Park and Preserve (Alaska), Lake Clark National Park and Preserve (Alaska), and Chesapeake and Ohio Canal National Historical Park (District of Columbia / Maryland) and his project oversight / technical contribution in the development of the Canaveral National Seashore Water Resources Management Plan.

Barry Long received the "Clean Water Action Plan Principal's Award 2000" for coordination of the NPS-USGS Water Quality Assessment and Monitoring Partnership Program.

Larry Martin was presented a Star Award to recognize a continued high level of professional excellence.

Jennifer Back received a STAR Award for contributions to the preparation and presentation of testimony during the August 20-29, 2001, Nevada State Engineer Hearing on the potential impacts to Lake Mead NRA water resources from groundwater development in the Coyote Spring Valley; and technical evaluation of the Moapa Paiute Energy Center Project to determine potential impact on park springs.

Brad Gillies received a STAR Award for contributions to the preparation and presentation of testimony by NPS staff during the August 20-29, 2001, Nevada State Engineer Hearing on the potential impacts to Lake Mead NRA water resources from groundwater development in the Coyote Spring Valley.

Jeff Hughes received an On-the-Spot Award for exceptional dedication, team cooperation and contributions to organizational results toward implementing NPS monitoring and enforcement program in the absence of substantial staff and management support.

Jeff Hughes received a Non-monetary Award from Great Basin National Park for high quality customer service provided to the park on numerous water rights issues.

Eric Moser received an On-the-Sport Award for contributions to the development of 2-dimensional flow models for the Fort Bottom and Island Park reaches of the Green River, at Canyonlands NP and Dinosaur NM.

Chuck Pettee received an On-the-Spot Award from Mojave National Preserve for outstanding service and leadership on the Cadiz Groundwater Storage and Dry-Year Supply Program.

William Van Liew received an On-the-Spot Award from Mojave National Preserve for outstanding technical service on the Cadiz Groundwater Storage and Dry-Year Supply Program.

William Van Liew received a STAR Award for: contributions to the preparation and presentation of testimony during the August 20-29, 2001, Nevada State Engineer Hearing on the potential impacts to Lake Mead NRA and other DOI water resources from groundwater development in the Coyote Spring Valley; technical representation of NPS concerns for the Moapa Paiute Energy Center Project's potential to impact Lake Mead NRA water resources; and technical representation of NPS concerns for the Cadiz Groundwater Storage and Dry-Year Supply Program's impact to Mojave NP water resources.

Mark Wondzell received a Quality Step Increase for leadership in developing technical tools and evidence to support the protection of water rights for Black Canyon of the Gunnison NP.

Multiple Water Rights Branch Staff (Jennifer Back, Chris Gable, Bradley Gillies, Jeff Hughes, William Van Liew) received a Time Off Recognition Award for contributions to a successful inter-agency field work exercise on the Muddy River near Lake Mead NRA. Simultaneous discharge and water quality data was collected at 21 transects along a 30 mile reach on the river, to improve our understanding of hydraulic connection between the river and the regional aquifer. This field work was a component in ongoing efforts to protect water-related resources on federally managed lands in the region.