National Park Service
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Natural Resource Program Center

Water Resources Division

2005 ANNUAL REPORT

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Natural Resource Program Center
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Kayaking the Gates of Lodore, Dinosaur National Monument
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The Water Resources Division of the National Park Service is responsible for providing water resources management policy and guidelines, planning, technical assistance, training, and operation support to units of the National Park System. Program areas include water rights, water resources planning, regulatory guidance and review, hydrology, water quality, watershed management, ground water, fishery and marine resources management, and aquatic ecology.

The National Park Service disseminates the results of biological, physical, and social research through the National Resources Technical Report Series. Natural resources inventories and monitoring activities, scientific literature reviews, bibliographies, and proceedings of technical workshops and conferences are also disseminated through this series.

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A Word from the Associate Director Natural Resource Stewardship and Science

Mike Soukup, PhD

This annual report provides a summary of the 2005 accomplishments of the National Park Service's Water Resources Division (WRD). WRD, in partnership with parks and others, provides leadership, technical assistance, and funding support for understanding, protecting, and managing water and aquatic resources of the National Park System. WRD provides its services directly to parks through a broad range of programs in the areas of hydrology and water quality, water rights, watersheds and wetlands, planning, fisheries, and marine resources. Through the application of science in a planning, stakeholder negotiation, policy, regulatory, technical, or administrative context, WRD's programs help our parks succeed in enhancing the overall condition of their water and aquatic resources. In addition to direct support to parks, WRD provides support to regional offices, networks, and the Washington office in addressing water resources issues facing the NPS. WRD is part of the National Park Service Natural Resource Program Center and is located in Fort Collins, CO, with additional offices in Denver, CO, and Washington, D.C.

In 2005, we were fortunate to name Dr. William Jackson as Chief of the Water Resources Division. With the departure of Dan Kimball over two years ago, WRD has had a series of acting Chiefs, and I pleased that Bill has taken the helm on a permanent basis. Bill joined WRD in 1989 as a hydrologist and Chief of its Water Operations Branch, where he helped establish National Park Service programs in the areas of water quality protection, surface- and ground-water hydrology, and watershed management. Bill's vision, sense of fairness, and strong leadership will guide WRD in the years to come.

In recent years, the significant support from Congress for the Natural Resource Challenge has enhanced NPS field capabilities in aquatic resource management and enabled WRD to take on new responsibilities in the areas of program leadership, servicewide program and technical guidance, senior technical support, and management accountability. These new opportunities have substantially enhanced the service's capabilities and effectiveness in critical program areas, such as water quality monitoring, water resource protection, watershed assessment, aquatic biological resources, and coastal and marine resource protection. I am pleased with the professionalism and effectiveness with which WRD has taken on these new leadership challenges, while continuing to provide much needed specialist support to parks in addressing their day to day water and aquatic resource issues.

As you read this report, you'll discern the incredible diversity of water and aquatic resource issues confronted by our National Parks. You will encounter articles on a series of coastal watershed condition assessments supported by WRD, progress monitoring hydrocarbon constituents in Lakes Powell and Mead, invasive lake trout issues at Glacier National Park, the spring floods at Delaware Water Gap National Recreation Area, and channel changes and flow history on the Little Missouri River to name a few. These issues and others are being addressed with technical proficiency and professionalism by the NPS water and aquatic resource staff.

Comments from the Division Chief

Bill Jackson, PhD

In addition to the day-to-day carrying out of the Water Resource Division's (WRD) programs and services in 2005, we also found ourselves in the midst of a review of the National Park Service (NPS) Management Policies. This review provided an opportunity to step back and contemplate the purposes for which the most significant vestiges of this country's natural, cultural, and historic heritage are being preserved; the policies and principles that should guide their management; and how our own programs and positions contribute to that larger mission. As you read this 2005 Annual Report you will learn about the many ways in which WRD contributed to preserving, protecting, and restoring the water and aquatic resources of the National park system.

As in past years, senior-level technical and strategic support to a wide variety of individual park issues remained core to the division's accomplishments in 2005, but we also continued to emphasize innovation and leadership to servicewide initiatives intended to better enable parks to address their water/aquatic resource protection and management issues. A new framework for water resource stewardship planning is being implemented that serves as a model for program management planning under the new NPS planning system. WRD is advancing the use of collaboration and negotiation as a water resource protection tool, especially in complex water rights issues. WRD participated at the interagency level to help NPS become a partner in new collaborative efforts to advance coastal and marine resource protection, including the establishment of seamless networks of marine protected areas and the development of an ocean parks stewardship strategy. Additionally, the division has been heavily committed to providing leadership and technical guidance to the design and implementation of new servicewide water quality monitoring and watershed/park condition assessment programs. As part of this latter initiative we are striving to break out of our "divisional box" to forge an interdisciplinary and inter-organizational approach to the synthesis and assessment of ecological conditions of parks at watershed and landscape scales. All of these initiatives are discussed in detail in articles in this Annual Report.

WRD's bread and butter has always been the direct support we provide to parks dealing with complex water and aquatic resource management issues. Our technical assistance activity is central to our remaining directly relevant to the day-to-day management of park resources, and will remain a top priority for the division as we move forward. A complete listing of support provided to parks, regions, networks, and national offices in 2005 is provided in Appendix A. A few 2005 highlights are bulleted in the sidebar to this article.

As we look ahead to 2006, we continue to be challenged by the increasing burden that fixed costs have on our budget. While WRD will seek both traditional and creative ways to increase support to programs and projects, we will also be looking to more efficiently manage our costs. A formal core operations review in 2006 will help us identify potential ways to increase efficiency in our operations. Despite the challenges, we're also looking forward to some program milestones. We expect the first of the network water quality monitoring programs to become fully

operational in 2006. In addition, we will initiate the first in a series of prototype park (watershed) condition assessment projects in collaboration with several selected regions, networks, and parks. We hope to implement this new project program in all regions by 2007.

Central to all the division's accomplishments has been the vigilance of park and regional office managers and staff in recognizing water resource issues affecting their parks. We thank you for engaging the division in your issues, and it's always a great pleasure working with you.

I hope as you look through this Annual Report you will enjoy reading about the diversity of issues addressed by both WRD staff and the field-based aquatic resource professionals, who receive support through WRD. All of us, working collaboratively with parks, regions, Washington offices, cooperators and partners are, indeed, contributing to NPS's position as a leader in protecting and managing water and aquatic resources of parks and protected areas.

Examples of 2005 Technical Assistance Accomplishments

- Participated in the feasibility assessment, design, and/or implementation of wetland restoration projects at Grand Teton National Park, Rocky Mountain National Park, Padre Island National Seashore, Golden Gate National Recreation Area, Moores Creek National Battlefield, and Channel Islands National Park.

- Through participation on the ground-water technical committee, played a substantive role in the decision by the Department of Energy to move the Moab Mill Site uranium tailings pile off the floodplain of the Colorado River.

- In cooperation with the State of Colorado, The Nature Conservancy, and the Rio Grande Water Conservation District, created and filed a water right claim for Great Sand Dunes National Park and Preserve to protect surface- and ground-water resources as directed by Federal legislation.

- Completed a Water Quality Designated Use and Impairments database, allowing a servicewide assessment and reporting (by surface-water acre and stream mile) of compliance with state water quality standards.

- Published coastal resource / coastal watershed assessments for Padre Island National Seashore, Gulf Islands National Seashore, Cumberland Island National Seashore, Cape Lookout National Seashore, and Timucuan Ecological and Historic Preserve.

- Provided support and leadership to the NPS Ocean Strategy and made substantive progress towards expanding the NPS-NOAA Sanctuary Cooperative

Agreement to include other agencies, helped propose rules for the management of the Dry Tortugas Research Natural Area, and established an NPS ocean parks task force.

- Supported an assessment of natural resource affects stemming from the 2003 breach of the Grand Ditch in Rocky Mountain National Park.

- Made significant strides coordinating with state, federal, and local entities in southern Nevada to improve ground-water modeling and the overall scientific basis needed to protect ground-water dependent resources in Great Basin National Park, Death Valley National Park, and Lake Mead National Recreation Area.

- Conducted a post-flood assessment at Delaware Water Gap National Recreation Area following the April 2005 flood and provided recommendations for restoration of natural resources and repair of damaged park infrastructure.

- Completed hydrogeologic assessments of water supply wells and springs at 16 park units.

WASHINGTON PROGRAM COORDINATION OFFICE

Sharon Kliwinski

In 2005, the Washington, D.C., office went through a major shift with the retirement of Abby Miller, Deputy Associate Director for Natural Resource Stewardship and Science. Abby had been a stalwart in the Natural Resource program, was the program's key link with the budget and strategic planning offices, and played a key role in the implementation of the Natural Resource Challenge. We had great trust in Abby's competence, experience, and vision, and it was difficult to imagine a Washington Office without Abby. But, we were very lucky to have landed Bert Frost as the new Deputy Associate Director. Bert, whose background is in wildlife biology, has brought new strengths to our program operations, and we are pleased that he has stepped forward to take on this significant role as a leader in the natural resource arena.

In the Washington Office, and throughout the nation, NPS employees have been keeping a close eye on an effort to revise the basic policy document that implements the Organic Act and governs operation of the national parks. This re-evaluation of National Park Service Management Policies has brought to the forefront the continuing tension between the need to preserve park resources and the desire to make them available to the broadest possible public. Within the service, this rewrite of the management policies has been met with an intensified evaluation of who we are as National Park Service employees and what we see as the future of the National Park System. As the revision process continues, the Natural Resources office will

continue to play an important role in shaping and defining future policies.

PLANNING AND EVALUATION BRANCH HIGHLIGHTS

Mark Flora, Chief

Planning and Evaluation Branch (PEB) activities in FY05 were focused upon providing servicewide policy and guidance for the protection of wetlands, fisheries, and marine resources; providing programmatic oversight and funding accountability for WRD and NRPC-funded projects; implementing "pilot" development of our new suite of water resources planning products that better respond to needs created from the implementation of the new Park Program Planning Standards and Resource Stewardship Planning; expanding our efforts in developing coastal resources / coastal watershed condition assessments; and providing direct support to NPS units in the areas of water resources planning, wetlands restoration, fisheries management, and marine resources protection.

In the policy and regulatory arena, PEB staff worked directly with the DOI Assistant Secretary for Policy, Management and Budget, the White House Council on Environmental Quality, and various interagency working groups in order to include NPS programs in the development of a U.S. Oceans Action Plan. Continuing support was also provided to the NPS Office of Strategic Planning in the development of servicewide technical guidance for NPS Strategic Plan goals relating to "wetland land health" and "marine and coastal processes." In addition, PEB staff have been active in guiding NPS efforts to assure compliance with Executive Orders 11990 (Wetlands Protection) and 13158 (Marine Protected Areas), providing an NPS perspective to the U.S. Coral Reef Task Force and the Marine Protected Area Interagency Committee, working with the Aquatic Nuisance Species Task Force, and recommending strategies to streamline wetland compliance procedures for Federal Highways road projects within national parks.

During the course of FY05 PEB staff provided programmatic oversight, technical review, and guidance for 85 active WRD or NRPC funded projects relating to water resources planning, wetlands protection and restoration, fisheries management, and marine resource protection. Included in this effort is providing fiscal oversight, accountability, and quality control for approximately $8.1 million of Natural Resource Challenge funding (multi-year total) allocated to support these projects. In addition, the PEB also provided 1) technical advice and policy review and served as lead for the regulatory review of 15 wetlands statement of findings, 2) servicewide review and comment on 15 EIS/EA environmental compliance documents, and 3) policy review of the water related aspects of 19 NPS planning documents, including General Management Plans, Special Resource Studies, and other planning studies.

Accomplishments during the year were numerous, and several are highlighted in the following short articles. During FY05, the PEB provided oversight for the development of Water Resources Management Plans at Voyageurs National Park, Mammoth Cave National Park, and Isle Royale National Park and Water Resources Information and Issues Overview Reports at Missouri National Recreational River, Sequoia-Kings Canyon National Parks, Denali National Park and Preserve, and Saint-Gaudens National Historic Site. Of particular note during FY05 were PEB's efforts to re-engineer PEB's Water Resources Planning Program (www.nature.nps.gov/water/planning.htm). While this program has been highly successful in completing over 65 water related planning documents

during the 12 years of its existence, recent changes in NPS park planning standards have required revisions to our water related planning products to support new planning requirements, including the development of park-specific *Foundation for Park Planning and Management* documents, *General Management Plans*, and *Resource Stewardship Strategies*. Efforts in FY05 included the preparation of a "pilot" Water Resources Foundation Report for Golden Gate National Recreation Area and the initiation of Water Resources Stewardship Reports for Point Reyes National Seashore and Denali National Park and Preserve.

During the year, PEB's Wetlands Protection and Restoration Program participated in wetlands restoration activities for the Snake River Gravel Mine (Grand Teton National Park / John D. Rockefeller Memorial Parkway), the Glacier Creek Livery and Hidden Valley wetland restoration projects (Rocky Mountain National Park), and the development of a plan to address the removal of exotic shrubs and promote channel and floodplain recovery at Canyon de Chelly National Monument. The PEB also participated in wetland restoration feasibility assessment, design, and/or implementation efforts at Padre Island National Seashore, Golden Gate National Recreation Area, Moores Creek National Battlefield, and Channel Islands National Park.

In FY05, PEB's Fisheries Management and Marine Conservation Program participated in the Upper Colorado River Endangered Fishes Recovery Implementation Program; represented the NPS in the Flaming Gorge EIS affecting Dinosaur National Monument and Canyonlands National Park; assisted in the development and review of marine protection strategies for Dry Tortugas National Park; assisted in the planning for native trout restoration in Great Basin National Park, Great Sand Dunes National Park, and Rocky Mountain National Park; and participated in the development of Fisheries Management Plans for Biscayne National Park and Isle Royale National Park. In addition, a new program to assess the condition of coastal resources and coastal watershed moved from its "pilot" phase into a "production" phase with the completion of coastal resources and coastal watershed condition assessments for Cumberland Island National Seashore, Padre Island National Seashore, Gulf Islands National Seashore, Cape Lookout National Seashore, and Timucuan Ecological and Historic Preserve. In addition, funding was allocated for 15 additional assessments for NPS units located in Alaska, California, the Great Lakes, and the Caribbean.

PEB staff members are also proud of the numerous opportunities we have had during this year to directly serve parks by providing technical support at the request of regional, network, and park staffs. In FY05, the PEB provided project oversight and/or technical assistance to all seven NPS regional offices, 12 Inventory & Monitoring Program Network offices, and 97 individual units of the national park system. The Planning and Evaluation Branch is proud to be part of the National Park Service and looks forward to being of continued service to the units of the National Park system throughout FY06!

Assessing Coastal Watershed Conditions in the National Parks

Kristen Keteles, Coastal Watershed Condition Assessment Coordinator, Texas A&M University
Cliff McCreedy, Marine Management Specialist, Planning & Evaluation Branch

Over 55% of the US population now occupies the coastal zone. As a result, population pressures on water and land resources and consumption of marine resources are taking their toll on coastal ecosystems. Coastal watersheds face many threats which may have dramatic impacts on the functioning and integrity of coastal park ecosystems or reduce quantity and quality of wildlife habitat. In order to evaluate these threats and increase the scientific understanding of coastal park conditions, the NPS Watershed Condition Assessment Program is providing assessments of coastal parks through the Natural Resource Challenge. As of FY05, WRD has initiated condition assessments of 41 ocean and Great Lakes parks, with more planned for FY06 and 07.

Scientists review and synthesize existing information to determine the status of coastal park resources, including water quality, habitat condition, invasive and feral species, extractive uses, physical impacts from resource use and coastal development, and other issues affecting resource health. Working through universities in the Cooperative Ecosystem Studies Units, WRD plans to complete assessments of 52 ocean and Great Lakes parks, utilizing expertise in physical and biological sciences, including oceanography, water quality, marine and estuarine sciences, and geographic information systems.

As of FY05, final reports have been published for Padre Island National Seashore, Cape Lookout National Seashore, Timucuan Ecological and Historic Preserve, Gulf Islands National Seashore and Cumberland Island National Seashore. In addition to characterizing the relative health of coastal park resources and revealing factors that may cause impairment, these reports clarify needs for field studies to more fully evaluate conditions and identify information gaps. WRD coordinates closely with parks and the NPS I & M Networks to integrate these assessments into park and servicewide databases and vital signs monitoring. The coastal condition assessment reports could be used to guide more intensive assessments aimed at further elucidating known park problems, identifying pollution sources or other resource stressors, and developing restoration or cooperative watershed management strategies in parks and nationwide. Completed reports have yielded some important findings:

Cape Lookout National Seashore (North Carolina) Generally, park waters were found to be in good condition since there are no point sources of pollutants in the park. However, some surface-water locations periodically showed high nutrient concentrations. Certain ground-water sites also exhibited high levels of nutrients, likely the result of leaking septic systems.

Padre Island National Seashore (Texas) Physical changes to the coastal environment dramatically altered salinity patterns and affected seagrass composition, and low dissolved oxygen levels require further investigation. Although no exotic species have been documented in inland ponds and wetlands, it was recommended that the park monitor for water lettuce (*Pistia stratiodes*) and water hyacinth (*Eichhornia crassipes*) to prevent invasions.

Gulf Islands National Seashore (Florida and Mississippi) Water resources were found to be in a "stressed" condition. Water

Copies of completed coastal watershed condition assessments may be found at: http://www.nature.nps.gov/water/watershed_reports/WSCondRpts.htm.

segments adjacent to the park have been classified as impaired due to nutrients, toxic compounds, biological oxygen demand, dissolved oxygen, fecal coliforms and metals. However, additional sampling for specific parameters and adding new locations are necessary to more fully evaluate the condition of park resources.

Timucuan Ecological and Historic Preserve (Florida) Water samples were collected and analyzed for metals as part of the County of Jacksonville's monitoring program. Several stations adjacent to the park exceeded Florida surface-water criteria for several parameters, including Hg, Cu, Pb, and Fe. These data indicate that metals pose a potential threat to water quality within and adjacent to the park.

Cumberland Island National Seashore (Georgia) Dissolved oxygen concentrations were sampled at 20 locations over a period of four years by Georgia DNR-Coastal Resources Division. Concentrations below the Georgia Environmental Protection Division standards (4 mg L) occurred in 16% of the sample and exceedences of state criteria were most common in the summer months. The low dissolved oxygen values could be the result of increased inputs of nutrients into Georgia coastal waters. The observation of low dissolved oxygen has already resulted in increased attention by the State of Georgia concerning the potential for hypoxia in the area.

Timucuan Ecological and Historic Preserve (NPS)

Gulf Islands National Seashore (NPS)

Water Resources Foundation Report: Supporting the GMP Process for Golden Gate National Recreation Area

Don P. Weeks, Hydrologist
Planning and Evaluation Branch

Each park is encouraged to prepare a *Foundation for Park Planning* and *Management Report* (Foundation Report) that supports development of the park's General Management Plan (GMP). As defined in the 2004 NPS Park Planning Program Standards, the Foundation Report describes the park's purpose, significance, primary interpretive themes, and special mandates, along with identifying those resources and values determined to warrant primary consideration (Fundamental Resources and Values) in park planning and management.

In response to a technical assistance request from Golden Gate National Recreation Area (GOGA), WRD, working with GOGA and the NPS Denver Service Center planning staff, prepared a *Water Resource Foundation for Planning and Management Report* (Water Resources Foundation Report). This was the first Water Resources Foundation Report prepared for a park, incorporating the new NPS planning elements. The report was designed to support development of GOGA's Foundation Report and extend as a reference on water resources for the GMP.

The primary objectives of the Water Resources Foundation Report are to: 1) provide background for water resources and 2) build from the park's purpose and significant statements, identifying and describing the fundamental water resources at GOGA, along with the identification of stakeholders and laws and policies that apply to these fundamental water resources. Issues and management concerns known to impact these fundamental resources are also included in the report.

Golden Gate Bridge, looking north towards the Marin Headlands of Golden Gate National Recreation Area (Don Weeks).

In preparing the Water Resources Foundation Report, WRD participated in the first planning workshops where GOGA's Purpose Statement, which describes the specific reason(s) for establishing the park and Significant Statements, which define what is most important about the park's resources and values, were generated.

One of the GOGA Significant Statements pertaining to water resources is, "Protects an undeveloped remnant coastal corridor of marine, estuarine, and terrestrial ecosystems that support exceptional native biodiversity and provides a refuge of one of the largest concentrations of rare, threatened, and endangered species in the national park system." Building from the Significant Statements, water was easily defined as a fundamental resource at GOGA. The park's fundamental water resources were grouped into the following four categories, realizing some overlap between categories (i.e., wetlands and coastal water resources):

1. Freshwater streams and ponds
2. Ground-water aquifer and springs
3. Wetlands
4. Coastal and marine water resource

Bird Island Overlook, Golden Gate National Recreation Area (Don Weeks)

Some of the threats to water resources at GOGA captured in the Water Resources Foundation report include:

- Water quality degradation affected by past, current, and future activities, such as: bacteria and nutrient loading from wastewater disposal (septic systems); pollutants from landfills and dredging operations; chemicals from agricultural practices; non-point runoff pollution, including heavy metals from roads, parking lots, and stormwater outfalls; radioactive wastes dumped in the Gulf of the Farallones National Sanctuary; sedimentation and bacteria impacts from cattle grazing and equestrian services; and saltwater intrusion from overpumping of some shallow aquifers.

- Water quantity alteration, including seasonal timing of flows, continue to be affected by past, current, and future activities, such as: streams dammed to impound surface water, roads and trails concentrating surface runoff, and alteration of stream channels from channelization and bank stabilization efforts.

- Historic and current alterations to wetlands have occurred at GOGA, leading to a decrease in functions and species abundance and diversity within.

Identifying the fundamental water resources at GOGA, along with the supporting legislation and policy, will assist with development of *desired conditions* for water resources in the park's GMP. This will then set the stage for the next park planning element after the GMP, the Resource Stewardship Plan, where strategies will be presented that work towards maintaining and achieving the *desired conditions*, addressing the pressing issues influencing fundamental resources at the park.

Water resource planning reports for parks, including this report, are posted on WRD's website at: www.nature.nps.gov/water/planning.htm.

Restoring Montane Wetlands at the Former Glacier Creek Livery Site, Rocky Mountain National Park

Joel Wagner, Wetland Program Leader, Planning and Evaluation Branch
Michael Margo, Supervisory Biological Technician, Rocky Mountain National Park
Karl Cordova, Biologist, Rocky Mountain National Park

Prior to the park's establishment in 1915, the landscape was dotted with homesteads, commercial buildings, and lodges. Among these were guest facilities built by legendary homesteader Abner Sprague at what is now called Glacier Basin. Historical information indicates that Sprague cleared a willow/alder wetland along Glacier Creek to construct a horse barn in 1910. By 1958, the barn had been demolished and replaced by a new barn and corrals for a horseback riding concession. In the early 1990's, a park study indicated significant water quality problems in Glacier Creek immediately below the livery site (elevated ammonia and fecal coliforms). The facilities were subsequently demolished in 2002 and rebuilt about a half mile away, clearing the way for removing contaminated fill and restoring historic wetlands.

Upper corral at the former Glacier Creek Livery (Rocky Mountain National Park, 2002).

Park and WRD staff began collaborating on a wetland restoration design in 2002. Because site clearing and filling occurred very early in the 20th century, we did not have pre-disturbance aerial photography to clarify the boundaries and characteristics of historic wetlands. Also, corral excavations failed to expose an obvious buried soil layer, indicating that the wetland surface was likely removed and backfilled with sand and gravel to stabilize and dry the site. Without such important clues, we had to rely exclusively on evaluating nearby "reference wetland" characteristics and a thorough understanding of site hydrology to create a restoration design.

Volunteers and park staff install thousands of native wetland plants as specified in the restoration plan (note willow stakes leafing out in the right foreground) (Joel Wagner).

A park crew excavates fill material to achieve elevations called for in the restoration design. (Joel Wagner)

The reference wetland concept, where a nearby, undisturbed wetland system provides a model for the restoration design, is critical to successful wetland restorations of this type. The keys to choosing appropriate reference sites are: 1) they must have the types of plant communities and landscape features that likely existed at the "target" (restoration) site and 2) they must have the same hydrologic regime as the restoration site (e.g., water sources and seasonal water level fluctuations).

We monitored hydrology at the target and reference sites during 2002-2004, but for slightly different purposes. At the corrals, we installed wells to evaluate hydrology across the entire site. At the reference wetland, we installed wells to confirm that the hydrologic regime is comparable to the target site and also to evaluate how slight differences in ground surface elevations relative to the water table support a range of wetland, transitional, and upland habitats. For this latter purpose, we placed wells along a transect that began in an upland forest and descended through a willow/alder thicket and two emergent wetland communities. From this information, we developed a model describing what ground surface elevations needed to be achieved in the target area, relative to the local water table, to restore the desired wetland communities.

In late summer of 2004, with the reference model and knowledge of target site hydrology in hand, we were ready to create the restoration design. We determined the desired ground surface elevations for each well location in the corral area and, with the help of the park engineering technician, created a contour map of the final design elevations in AutoCAD. The design included a mix of herbaceous and willow/alder wetlands modeled after the reference area.

Construction began in fall of 2004. We were fortunate to have the services of park maintenance staff with the earthmoving skills necessary to remove several thousand cubic yards of fill and achieve the tight tolerances called for in the design (+/- 0.1 feet at staked contours). We left buried boulders in place and used fallen logs to distribute sheetflow, create habitat variability, and provide a source of organic material for the new wetland ecosystem.

In April 2005, over 500 willow stakes obtained from nearby wetlands were installed on slightly elevated "islands" and other transitional areas throughout the site. In late June, 60 members of Wildlands Restoration Volunteers, a non-profit organization based in Colorado, helped plant the nearly 20,000 native sedges, rushes, grasses, and alders specified in the revegetation plan. These extremely hard-working volunteers contributed over 870 hours of labor to the planting effort.

Later that summer, park staff installed five permanent monitoring transects to evaluate revegetation success, exotics, and herbivory. After noting that elk herbivory was very high on the willow stakes and herbaceous plantings, the park erected an eight foot tall buck-n-rail fence to exclude elk until vegetation becomes sufficiently established to accommodate herbivory.

Invasive Lake Trout Pose Threat to Native Fish Conservation in Glacier National Park

James T. Tilmant, Fisheries Program Leader, Planning and Evaluation Branch
William Michels, Biologist, Glacier National Park

Dramatic declines have occurred in native bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhyncus clarki lewisi*) in Glacier National Park's four largest western lakes due to the invasion of non-native lake trout (*S. namaycush*). Both bull trout (a federally listed threatened species) and cutthroat trout (a state species of special concern) are now close to extirpation from Lake McDonald, the largest and most prominent lake in the park.

Tracking tagged lake trout in Lake McDonald, Glacier National Park (University of Montana).

Lake trout, native on the east side of Glacier National Park but not to waters west of the continental divide, were introduced into Flathead Lake (110 kilometers downstream of the park and west of the divide) in 1905. Since then, they have slowly but consistently spread up the Flathead River system and into the park's western most rivers and lakes. Lake trout were first reported in the park at Lake McDonald in 1959. By 1969, gill net surveys revealed lake trout comprised approximately 20% of all trout captured from Lake McDonald. In 1977, that portion had increased to 45% and to over 77% by 2000. Due to a lack of funding and knowledge of how to address this issue, lake trout continued to spread further into the Flathead River drainage during the 1980's and 90's. By 2000, they had also invaded Logging, Bowman and Kintla Lakes. Over the past four years, the invasion of Harrison, Lower Quartz, and Upper Quartz Lakes has been verified by NPS and FWS researchers.

Andy Dux, Montana State University graduate student, measuring netted lake trout (University of Montana).

To address this issue, WRD has been working with park staff, FWS, and the Montana State University Fish and Wildlife Coop Unit to fund studies aimed at increasing knowledge of lake trout within the Flathead River system and to identify potential suppression measures. These studies have included a project to locate spawning sites, document population characteristics, and determine the spatial and temporal distribution of lake trout in Lake McDonald. Results will allow suppression efforts to target specific habitats at times that will maximize lake trout catch. A second study has involved the evaluation of fish populations in 15 park lakes, where adfluvial populations of bull trout reside, and

the identification of potential barriers to lake trout invasion of these lakes.

While these studies have been in progress, the park constructed an artificial barrier to lake trout movement on Quartz Creek between Lower and Upper Quartz lakes. This was in response to a recent discovery of lake trout in lower Quartz Lake and the desire to preserve the upper lake and drainage basin from invasion. The upper basin represented one of the last pristine aquatic ecosystems within the Flathead drainage. It contained pure wild populations of bull and westslope cutthroat trout. The barrier, constructed of rock gabions placed across the streambed, was put in place in September 2004. Unfortunately, the placement of this structure appears to have happened too late as during the Summer of 2005 lake trout were discovered to have already invaded Upper Quartz Lake.

At this time, the preservation of native fish assemblages within the Flathead drainages of Glacier National Park will depend on the implementation of costly suppression efforts for lake trout and other non-native species. The park is seeking funding to initiate a broad-scale lake trout reduction program with the hopes that populations can be reduced to a periodic maintenance removal level. Utilizing knowledge gained in the Lake McDonald lake trout study, the park initiated a limited lake trout netting effort in Fall 2005 with park base funding. This small effort was highly successful in verifying spawning sites and removing approximately 100 spawning lake trout. However, much larger efforts will be needed if the impacts of non-native lake trout are to be reduced or eliminated in the park's western waters.

The control and removal of lake trout populations is an issue at several large western park units, including Yellowstone and Grand Teton National Parks, and a more permanent solution for lake trout control is needed servicewide. WRD is encouraging research to address this issue and looking for partnerships to help develop a method by which lake trout could be eliminated from large lacustrine and riverine systems.

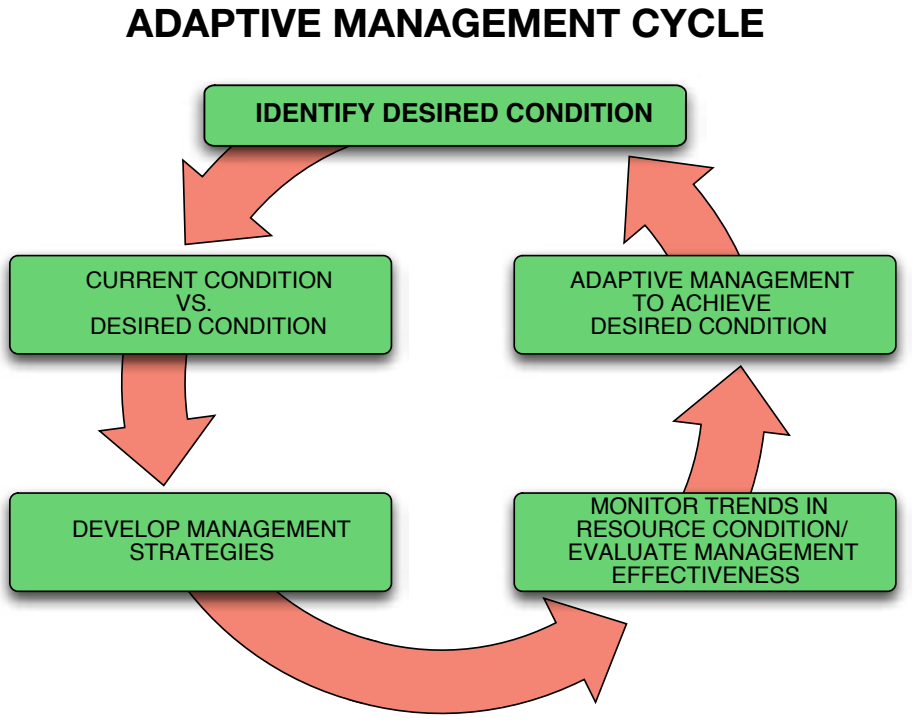
Glacier National Park staff installing fish passage barrier on Quartz Creek (University of Montana).

Early Insights into the Development of a Water Resources Stewardship Report for Point Reyes National Seashore

David Vana-Miller, Hydrologist
Planning and Evaluation Branch

Point Reyes National Seashore (PORE) competed successfully in 2004 for WRD funding to develop a Water Resource Management Plan (WRMP). The initiation of this project was coincident with two major developments in NPS planning – new Park Planning Program Standards and a draft of DO 2.1 (Resource Stewardship Planning). Because of these developments, WRD was in the midst of revising its planning program and moving away from issue-driven, project-based water resource management plans towards resource stewardship planning via the adaptive management cycle. The park and WRD agreed that it would be prudent to develop one of WRD's new planning products, a Water Resources Stewardship Report (WRSR) that supports the Resource Stewardship Plan (as proposed by DO 2.1), instead of a WRMP. However, with DO 2.1 still in draft and implementation guidance not yet developed, PORE would be a "guinea pig" in the resource stewardship planning process as it relates to water resources.

At an August 2005 scoping workshop for the WRSR, attendees' preconceived notions about certain aspects of the adaptive management cycle were evident. For example, the (at that time) current draft version of PORE's General Management Plan (GMP) had the requisite management zones and their attendant desired conditions. However, because these desired conditions were broadly based (and necessarily so) the tendency was for attendees to develop new desired conditions–a step wholly unnecessary and inconsistent with the intent of DO 2.1, as currently drafted. Additionally, the desired conditions in the GMP differed little across management zones such that the group wanted to distill all desired



conditions into one desired condition for water resources. While it may be difficult to see differences in the text-based desired conditions, it is important to remember that desired conditions should be quantified via an indicator/target value approach, and it is the target value (which equates to the desired condition) that may be different across zones. We developed a hierarchical system to better track the thought process in the quantification of desired conditions. That system uses the "desired condition → goal → subgoal → indicator/target value" approach such that if the measured indicator meets the target value, then the subgoal is met and, by definition, the goal, and ultimately, the desired condition are met. As an example:

DESIRED CONDITION = Natural resources and processes would be maintained to support terrestrial and aquatic native species and habitats to the greatest extent possible.

> **GOAL =** Facilitate natural hydrologic, fluvial, and ecological processes to maintain or enhance ecological integrity.
>
> > **SUBGOALS =**
> > 1. Maintain and enhance wetland and riparian functions.
> > 2. Maintain, preserve, or improve water quality conditions.
> > 3. Preserve or improve resident aquatic special status species.

Much discussion centered on how the Department's Government Performance and Results Act (GPRA) Land Health Goals and the resource stewardship planning process intersect. Park staff was adamant that they must, but GPRA should not direct the resource stewardship planning process. We developed an example of that intersection for PORE that should prove illustrative. Working with Subgoal 1, above, PORE already has a quantified indicator approach for assessing wetland function (a modification of the California Rapid Assessment Method). If a wetland is assessed as properly functioning then the subgoal is met and hence the desired condition; however, that is just one wetland. The GPRA land health goal is the number of wetland acres meeting the desired condition. For this exercise, we assumed PORE had assessed 700 wetland acres; but more need to be assessed. The first strategy is simply to assess the remainder of the wetland acres in order to understand which ones are properly functioning and which ones are not. We assumed that the result of that strategy is that 900 out of a total of 1400 wetland acres are properly functioning. We now have a target value of 1400 wetland acres that represent the desired condition and an indicator to assess whether a particular strategy, such as restoration, improved the functioning of a wetland. Structuring the indicator/target value to assess acreage allows the results to be easily applied to the GPRA land health goal for wetlands.

Scientific Partnerships Yield Results at Coral Reef Parks

Cliff McCreedy, Marine Management Specialist, Planning & Evaluation Branch

Interagency partnerships and coastal assessments took center stage in 2005 as WRD sharpened the scientific focus on coral reefs, working through the Natural Resource Challenge. More than 276,000 acres of coral reefs are located in ten units of the National Park System, spanning the states of Florida and Hawai'i and the territories of the US Virgin Islands, Guam, and American Samoa. Virgin Islands Coral Reef National Monument, adjacent to Virgin Islands National Park on St. John Island, is the most recent coral reef park to be created (2001). Buck Island Reef National Monument on St. Croix was greatly expanded the same year to 19,015 acres. Implemented as fully protected marine reserves, the new monuments were established to restore and maintain these coral reef ecosystems in light of impacts from overfishing and anchoring.

Coral reefs are the most biologically diverse marine ecosystems on the planet. On a healthy coral reef, several thousand species interact in complex, interdependent relationships that maintain the ecological balance between fish, invertebrates, and marine plants. Overfishing, anchor damage, pollution, and rising sea surface temperatures disrupt that delicate balance. The National Park Service must manage coral reefs in the face of these multiple stressors.

Assessing and monitoring the parks is no easy task because of the ecological complexity of coral reefs and the variability of species that rely on them for survival. However, scientific partnerships and interagency collaborations are providing rigorous evaluations of the extent and condition of coral reefs and island watersheds. In 2004, WRD, Pacific Island Inventory and Monitoring Network and Coral Reef Program, and park staffs began working with the University of Hawai'i on assessments of coastal water resources and watershed conditions in seven Pacific Island parks with marine resources. The first report completed for Kaloko-Honokōhau National Historical Park found the park's groundwater and coastal resources to be relatively healthy but highlighted additional studies needed to clarify potential threats to water quality, habitat integrity, and ecosystem health.

New housing and roads adjacent to Virgin Islands National Park are sources of sediment runoff onto coral reefs (Cliff McCreedy).

In 2005, a multi-disciplinary team of investigators from the University of Puerto Rico at Mayaguez, including a coral reef ecologist, fisheries biologist, hydrologist, coastal geologist, and a resource management specialist, is assessing the Virgin Island parks. These scientists will review and synthesize existing information to determine the status of the Virgin Island parks' resources, including water quality, habitat condition, invasive and feral species, extractive uses, physical impacts from resource use and coastal development, and other issues affecting resource health. Geographic Information Systems databases and maps will convey the extent and condition of upland watersheds and wetland resources.

The watershed condition assessment report will summarize marine mapping, monitoring, and assessments already underway. WRD is working with Buck Island Reef National Monument as coordinator for a Natural Resources Preservation Program project to support the park's collaboration with the NOAA National Center for Coastal Ocean Science Biogeography Program. NOAA has provided the Virgin Island parks with shallow and deepwater coral reef habitat maps obtained by satellite imagery, aerial photography, underwater video cameras, and sidescan SONAR. These maps are being enhanced by detailed topographic imagery provided by the USGS Coastal and Marine Geology Program, obtained by aircraft scanning the bottom with a laser altimeter. The end results will be detailed seabottom maps that enable resource managers to identify the extent and variation of different types of coral habitats.

But these advanced technological tools provide only part of the picture. In order to identify marine species utilizing these reefs, scientists are making visual observations using technology that has been around since World War II, SCUBA (Self-Contained Underwater Breathing Apparatus). NOAA divers are joined by NPS science divers from the parks and the South Florida / Caribbean Inventory and Monitoring Network to make detailed surveys of fish and shellfish and measurements of coral reef habitats. The network and the Virgin Islands parks also have been conducting coral monitoring at both Virgin Islands National Park and Buck Island Reef National Monument, tracking coral disease, bleaching and mortality, and long-term coral health.

Watershed health is a key determinant of coral reef health because watersheds affect marine water quality, sediment runoff, and salinity. The watershed condition assessment reports in the Pacific Island and Virgin Island parks will provide a "ridge to reef" evaluation with a comprehensive overview of upland, wetland, and coastal/marine resource condition.

Understanding Coaster Brook Trout Ecology at Pictured Rocks National Lakeshore

John Wullschleger, Fisheries Biologist, Planning and Evaluation Branch
Jay Glase, Fishery Biologist, Midwest Region
Sean Stimmell, Graduate Student, Biological Sciences, Northern Michigan University
Jill Leonard, Associate Professor of, Northern Michigan University
Lora Loope, Aquatic Ecologist, Pictured Rocks National Lakeshore

"Coaster," the regional name for the native brook trout (*Salvelinus fontinalis*) of Lake Superior, is known for its large size, vulnerability to angling, and migratory life-history. A typical life history pattern involves the hatching of eggs and rearing of young fish in tributaries, movement of juveniles downstream to the lake, maturation in the nearshore waters of the lake, and return of adults to natal streams to spawn. Migratory strategies of this fish may have been more diverse but were not well documented before it was extirpated from most its historic range. The near-elimination of coaster brook trout from Lake Superior has been attributed to over-harvest by anglers in the 1800's and degradation of stream habitat by logging. Coaster brook trout had disappeared from over 100 Lake Superior tributaries by the mid-1900's, leaving a few isolated, viable populations.

The Great Lakes Fishery Commission has established the goal of restoring self-sustaining populations of coaster brook trout throughout the original range. To date, agency efforts have shown limited success. Recapture rates for introduced fish have been low, and as of 2003, no self-sustaining populations had been reestablished, although spawning has been documented at Grand Portage National Monument in Minnesota. Achieving successful restoration in the future depends upon identifying the reasons for past failures and developing a better understanding of coaster life history requirements and habitat variables that may be limiting reproduction and recruitment.

Pictured Rocks National Lakeshore has been contributing to coaster brook trout restoration in Lake Superior by supporting applied research in stream systems within

Coaster brook trout (Salvelinus fontinalis), once abundant throughout Lake Superior, were extirpated by over-harvest and degradation of stream habitat (Jay Glase).

its boundaries. Tobin Harbor strain brook trout (from Isle Royale National Park) have been stocked in Pictured Rocks streams since 1996. In 2003, NPS BRMD competitive funds supported a Northern Michigan University (NMU) study of brook trout migration in three Lake Superior tributaries within Picture Rocks. The study employed Passive Integrated Transponder Technology (PIT), which is widely used by fisheries scientists to uniquely mark and subsequently identify fish. PIT tags are implanted subcutaneously and contain an electronically coded identification number, which can be read by a portable or fixed-position antenna. Because the tag is powered by the antenna, not an internal battery, it is extremely small, allowing use in smaller fish than self-powered transmitters.

Texas Instruments Radio Frequency ID station near the mouth of the Mosquito River, Pictured Rocks National Lakeshore. Reader, logger, and batteries are enclosed in a wooden box on the right (river left). The upper cable of the loop antenna is visible, suspended below the footbridge and above the stream; the lower cable is anchored on the stream bottom (John Wullschleger).

Wild and stocked Tobin Harbor brook trout in Hurricane River, Seven Mile Creek, and Mosquito River were implanted with PIT Tags in 2003 and 2004. Wild fish were captured by electrofishing; Tobin Harbor fish were tagged prior to stocking or after recapture by electrofishing. Wild brook trout in Pictured Rocks streams may include strains introduced from outside the Lake Superior basin. Texas Instruments Radio Frequency ID (TIRFID) systems were deployed at the mouths of the study streams. Fish exiting or entering each stream passed through a loop antenna attached to a reader and data logger. In addition to providing information on the timing of migration, logged identification numbers allowed researchers to examine relationships between migration and variables such as length and weight at time of release, calculated condition indices (Wr and K), and origin (stocked vs. wild).

During 2003 and 2004, TIRFID stations detected both wild and Tobin Harbor strain hatchery fish migrating between the study streams and Lake Superior, suggesting that wild populations may include alleles from native coaster brook trout. In addition, TIRFID stations detected movement of PIT-tagged brook trout between the three study streams, and electrofishing surveys recaptured tagged fish that had moved out of the study streams and into several nearby tributaries. Movement, between the lake and study streams occurred during all months that the systems were in place but was highest in Spring and Fall. Correlations between movement and length, condition, precipitation, and temperature were identified but were not consistent across streams, strains, and years. Photoperiod was correlated with the movement of stocked Tobin Harbor strain fish but not with the movement of wild fish.

Detailed results and analyses will be reported in a Master of Science thesis from NMU. To date, the study has contributed to coaster brook trout restoration by documenting migratory behavior in Pictured Rocks streams and by developing a tool that can be used in future investigations of migratory behavior. Additional work is underway using systems that employ a second antenna, allowing researchers to determine direction of movement for migrating fish.

WATER OPERATIONS BRANCH HIGHLIGHTS

Gary Rosenlieb, Acting Chief

The highlights of 2005 for the Water Operations Branch (WOB) were 1) achieving goals on programs and projects for which the branch staff has devoted significant time and effort over that last decade and 2) a productive foray into international water resources management issues. The branch also continued to provide high quality, issue specific technical assistance to individual parks.

As described in the article by Pete Penoyer, the Department of Energy in July 2005 released its EIS on the disposition of the Moab uranium mill tailings and selected an alternative that would relocate about 12 million tons of radioactive uranium mill tailings from the banks of the Colorado River to a repository near Crescent Junction, Utah. The announcement by the Secretary of Energy was very good news for Arches and Canyonlands National Parks, which manage sections of the Colorado River. In addition, as documented in an upcoming article in the Natural Resources Year in review, the first 12 Vital Signs networks have completed and submitted their monitoring protocols to WOB for review. Overall, the documents have been very impressive and will serve as excellent models for the remaining 20 networks as they complete their plans and protocols. In addition, we also were able to select pilot parks and networks for field implementation of the Watershed Assessment Program. Based on input on the design and implementation of the Program provided by park, region, and Inventory and Monitoring Network personnel during a July meeting in Fort Collins, WRD has selected 13 parks in 5 regions to begin conducting watershed condition assessments. Scopes of work will be developed in early 2006 in anticipation that field work will begin late in the year. Finally, Mike Martin provides a very interesting article on the assistance he provided for the management of stormwater runoff that threatens to deteriorate the structural integrity of an ancient temple located in the Angkor Archeological Park, Northwestern Cambodia. We trust that a successful solution to the problem has been designed and forwarded to the Cambodian Government.

The branch continued to provide technical assistance on a myriad of hydrology and water quality issues. A complete listing of the assistance is provided in an appendix to this report. Some of the higher profile efforts included:

Numerous requests for assistance on floodplain statement of findings and floodplain mapping were addressed by the Branch's Hydrology Group at Cape Lookout National Seashore; North Cascades National Park; Assateague Island National Seashore; Stones River National Battlefield; Bandelier National Park; Chesapeake and Ohio Canal National Historical Park; Padre Island National Seashore; Fire Island National Seashore; Channel Islands National Park; Capitol Reef National Park; and National Capital Parks.

Numerous ground-water management and supply issues were addressed, including those at Aztec Ruins National Monument where the branch assisted with the evaluation of the source of moisture affecting the ruins, Yosemite National Park, Shenandoah National Park, Fossil Butte National Monument, and Cape Hatteras National Seashore.

WOB staff provided assistance with contaminant cleanup efforts at Yellowstone National Park where the branch worked with the State of Montana to install ground-water monitoring wells at the proposed site of a State of Montana repository for the McLaren tailings. The branch also provided assistance with a contaminants and water quality assessment for oil and gas contamination and CERCLA site investigations at Big Thicket National Preserve, Indiana Dunes National Seashore, and Lake Roosevelt National Recreation Area.

In support of a Natural Resource Damage Assessment at Rocky Mountain National Park, WOB obtained funds for a watershed assessment that will provide data needed to design and implement emergency restoration for damaged wetlands and stream channels within the park. The branch also provided assistance to the Missouri National Recreation River to recreate the spring rise on the Missouri River in order to enhance a designated wild and scenic river.

The following articles provide additional insights into the WOB's highlighted accomplishments as well as other projects.

Update on the Watershed Condition Assessment Program

Jeff Albright, Watershed Condition Assessment Program Coordinator
Water Operations Branch

WRD's Water Condition Assessment (WCA) Program was initiated in FY03 through the Natural Resource Challenge to assess and report on natural resource conditions within national park units (parks). During FY05, the WCA Program conducted an outreach effort to obtain input from NPS program managers and resource discipline specialists on the type of assessment projects the program should be conducting within parks. In general, NPS staff at park, region, and national level science-support offices recommended that WCA Program assessments should:

- Complement and coordinate with–not duplicate–other NPS natural resource data collection, analysis, and reporting efforts;
- Rely on currently available and readily usable natural resource data and information (i.e., not fund the collection of new data or the extensive processing of raw data to get it into a usable form);
- Provide a multi-disciplinary (integrative) synthesis of what all of that resource data and information, taken together, tells us about significance, functional status, and issues/challenges associated with NPS managed watershed resources and habitats;
- Be park-wide in terms of the geographic area that is assessed; and
- Develop information products that, among other uses, help parks conduct resource stewardship planning and allow them to initiate reporting to the natural resource "Land Health" goals in

the Department of Interior's Strategic Plan.

Consequently, the WCA Program will initiate a new series of natural resource condition assessments in parks, beginning in FY06, consistent with the above recommendations. In FY06, prototype projects for this new series will occur on a limited basis, involving assessments in five NPS regions and at least thirteen parks. Program funding will then increase in FY07 and again in FY08 (reaching full program roll-out of approximately $2M/year, sufficient for funding 30-35 park assessments/year). By FY14, the WCA Program objective is to complete a park-wide natural resource condition assessment for each of the 270 plus parks that are served by the NPS Vital Signs Inventory & Monitoring Program.

Point Reyes National Seashore (Marie Denn)

Missouri River Spring Rise

Richard Inglis, Hydrologist
Water Operations Branch

The NPS collaborated with many other agencies to recreate, through dam operation, the spring rise (peak flow or pulse in water levels) on the Missouri River in order to enhance outstanding remarkable values of a designated wild and scenic river and to protect endangered species. WRD, Midwest Region, and Missouri National Recreation River staff actively participated in Missouri River Plenary Group organized by the Army Corps of Engineers (COE) and the US Fish and Wildlife Service (FWS). The interdisciplinary team from the NPS included fishery biologist, hydrologists, historian, and social scientist.

Using input from the work done this spring and summer by the Missouri River Plenary Group of 50 regional stakeholders, including Tribal representatives and special interest groups, the COE and FWS have closely coordinated on planning the proposed pulses during the spring of 2006. The COE's 2005-2006 Annual Operating Plan for the Missouri River provides interaction with the public on the water release schedules that impact river use. The plan also describes the overall management plan for dams and reservoirs.

The plan proposes two "spring pulses" to satisfy requirements of the Endangered Species Act, provided there is sufficient water in the main stem reservoirs. The Amended 2003 Biological Opinion published by the FWS identified pulses in the spring from Gavins Point as part of the Reasonable and Prudent Alternative to avoid jeopardizing the continued existence of the pallid sturgeon. Releases from Gavins Point, just upstream from MNRR, may be operated such that during May the least terns and piping plovers (also protected by the ESA) will be

encouraged to nest high on the sandbars, reducing mortality from flooded nests. The pulses from the reservoir system in the spring are intended to mimic the historic ebb and flow of the river to benefit the spawning of the endangered pallid sturgeon. While smaller than the spring rises that this ancient fish adapted to over the millennia, the pulses are considered essential to the successful reproduction of the fish.

The ability to provide such conditions depends on the volume, time, and distribution of the runoff from melting snow on the plains and in the mountains of Montana and Wyoming.

The Master Water Control Manual, which includes the annual operating plan, will be supplemented to include provisions for spring pulses in subsequent years along with flexibility to allow some modifications based on the results of monitoring and evaluation studies. This 2-stage approach was developed to address needs of the endangered pallid sturgeon population in the river below Gavins Point Dam.

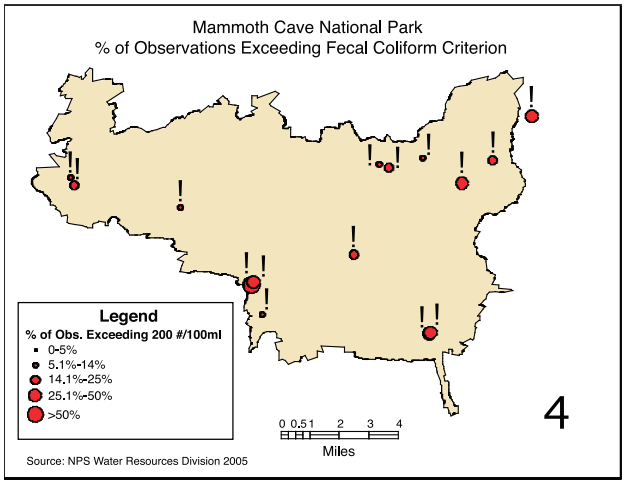
The duration of the pulses and the maintaining of the existing flood control constraints will result in minimal impact to navigation or water supply interests or increased risk for farmers downstream.

Information sign posted by the COE in the Missouri National Recreational River (NPS).

NPSTORET Gets Analytical

Dean Tucker, Natural Resource Specialist
Paula Galloway, Research Associate
Water Operations Branch

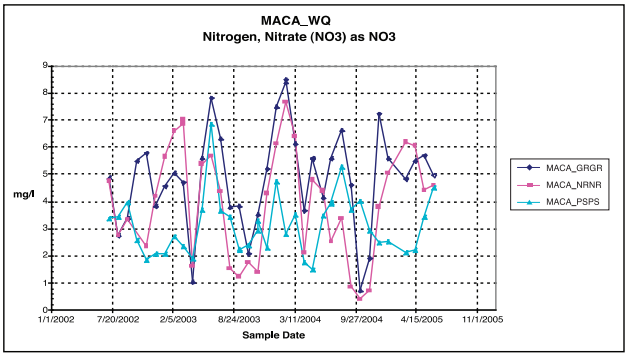
A drawback of the two largest national water quality databases, the Environmental Protection Agency's STORET database (http://www.epa.gov/storet/dbtop.html) and the U.S. Geological Survey's National Water Information System (http://waterdata.usgs.gov/nwis), is the absence of any built-in tools that enable users to screen, analyze, graph, or otherwise evaluate the archived data. NPSTORET, the National Park Service's decentralized, Microsoft Access-based database designed to facilitate funneling Vital Signs Network and park based monitoring program data into STORET, doesn't share this shortcoming. NPSTORET includes a number of screening, analytical, and graphical tools that networks and parks can employ to make their monitoring data (or any subset of their data) more meaningful.



Perhaps the quickest way to determine whether there are any obvious water quality problems apparent in a dataset is to screen the data against relevant national water quality criteria. NPSTORET's Water Quality Criteria Analysis compares data against fresh, marine, drinking, and other national water quality criteria. Result values

exceeding the criteria can be reported seasonally, annually, or for the entire period-of-record by characteristic (parameter) across an entire organization, a particular project, or station-by-station. Criteria exceedances can be summarized graphically in a GIS by importing the station-by-station characteristic exceedance file. Censored (detection limit) observations can be included or excluded in the criteria analysis. A quick examination of the NPSTORET Water Quality Criteria Analysis for the Cumberland Plateau Network reveals result values exceeding criteria for fecal-indicator bacteria, pH, turbidity, dissolved oxygen, and some other characteristics.

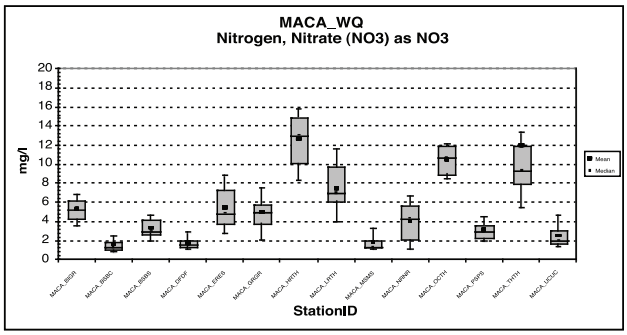
Another quick analysis in NPSTORET is to generate basic descriptive summary statistics for any specified portion of the data. Summary statistics include: mean, median, maximum, minimum, standard deviation, and percentiles. Users can specify whether percentiles should be calculated as in Microsoft Excel or as per the National Institute of Standards and Technology. Geometric means are automatically generated as appropriate. As with water quality criteria exceedances, descriptive statistics can be calculated seasonally, annually, or for the entire period-of-record by characteristic across an entire organization, a particular project, or station-by-station. Censored data can be included using substitution or Kaplan-Meier rules or simply excluded. Station-by-station descriptive statistics can be exported to a file for import and display in a GIS.



For visually inspecting time trends, NPSTORET can generate time series plots for any portion of the data. Data are plotted by characteristic for a station. Multiple stations can be included on a single plot by selecting to plot by organization or project. Single station characteristic plots can be generated by selecting to plot by station. Censored data can be handled by substitution or exclusion. Because NPSTORET uses Microsoft Excel to produce the selected time series plots, the user has complete access to all the data and graphics to customize as desired for publication.

To examine the distribution of result values for a characteristic at a station, NPSTORET can generate monthly, annual, seasonal, and period-of-record box and whiskers plots. There are numerous options for box and whisker plots, but the basic plot typically allows graphical comparison of the 10th, 25th, 50th (median), 75th, and 90th percentiles, as well as the mean. The box and whiskers plots can compare the distributions of data across stations over the same time period or across time periods for the same station. Outlier results can be optionally plotted. Censored data can be handled by substitution or exclusion. Because NPSTORET uses Microsoft Excel to produce the selected time series plots, the user has complete access to all the data and graphics to customize as desired for publication.

Enhancement of NPSTORET is ongoing. New features, including more sophisticated analyses and graphics, will be added to NPSTORET upon user request. To obtain more information or download the latest version, visit: http://www.nature.nps.gov/water/infoanddata/index.htm.



Breakthrough Step-By-Step to Determine Monitoring Detection Probabilities Consistent with Managing for Desired Conditions

Roy J. Irwin, PhD, Contaminants Specialist Water Operations Branch

Recently available Internet calculators and breakthroughs in statistical understanding (detailed in recent WRD water quality guidance for NPS Vital Signs monitoring networks) should help networks more easily determine required sample sizes to determine that changes of a magnitude of concern can be detected with planned monitoring designs. The process involves the following steps:

1. Refine (provide more time and space detail) objectives and questions.
2. Identify desired conditions qualitatively.
3. Identify resource-collapse or other thresholds (such as water quality standards or no-effect levels).
4. Identify existing conditions.
5. Choose a safety margin between existing conditions and threshold magnitude.
6. Refine target population details.
7. Document variability in time and space.
8. Choose the size of difference or change monitoring needs to be able to detect.
9. Choose initial statistics to be used.
10. Choose desired detection probability/ statistical power (1-beta).
11. Choose statistical significance level (alpha).
12. Use simple calculators to make initial estimates of required sample sizes.
13. Throw out measures or strata where excess variability will prevent detecting a trend or a difference of concern within budget.
14. Optimize monitoring plan details for affordability and logic.
15. Draft initial sample sizes and optimized monitoring design.

16. Finalize sample sizes and design with an applied environmental statistician.
17. Estimate the % of samples that will fail (for example 10%).
18. Increase the planned sample sizes accordingly.
19. Put completeness goals in a table in the QA/QC SOP.

By following WRD guidance, all except #15 can now be done by NPS staff with help from NPS quantitative ecologists.

As Vital Signs networks develop the fine details of the monitoring design, sample sizes, and statistics (in the protocol and SOP development stage), several of these inter-related issues have to be reconsidered in a more thorough and quantitative way to make sure they all line up and make sense when considered together.

When faced with a 19 step process, why not just go to a professional statistician to start with (or maybe consult with a statistician starting about step 4)? Great idea, if the network can afford it. However, even if the networks went to a statistician very early, many of the steps are simply decisions to be made by the park or network, not the statistician, and would, in fact, be input to bring to the statistician. All of the steps before 16, except perhaps 9 and 12, should be done by NPS staff, often with the help of the new network quantitative ecologists.

Fully informed quantitative ecologists can help park management refine the steps above in an adaptive management way. For example, after step 15 (above), it may become clear to all that initial decisions made for steps 1, 5, 6, 8, and 11 have to be adjusted for the design to make sense and be within budget.

It is appropriate to consult an applied statistician (step 16) before finalizing monitoring designs. However, understanding the WRD Part b lite guidance and the new Internet resources on the above step-by-step will help NPS quantitative ecologists be able to complete many of the steps that formerly may have seemed too complex to do in-house. Statistics is the language of results, and building quantitative expertise in-house is another side benefit.

Determining required sample sizes to ensure detect-ability of a change magnitude of concern admittedly takes a bit of effort, but failing to do so has all too frequently resulted in aquatic monitoring that produced indefensible data that has never been used for management decisions or anything else of value. Too often, water quality data collected has been data-rich but information-poor. Our goal is to help produce monitoring data of known and acceptable data quality--data with sufficient information content to be useful for management discussions. For more details, see WRD Part b lite guidance for developing water quality monitoring protocols and standard operating procedures (SOPs) at http://www.nature.nps.gov/water/Vital%20Signs%20Guidance/Guidance%20Documents/part%20b%20lite%2005_2005.pdf.

Progress of Studies on the Occurrence of Hydrocarbon Constituents in Lakes Powell, Mead, and Mohave

Barry Long, Hydrologist
Water Operations Branch

In 2003, the USGS assisted the NPS in the development of a monitoring plan containing a sampling and analysis approach that will provide the NPS with representative data on the occurrence of hydrocarbon compounds in waters of Lake Powell within Glen Canyon National Recreation Area and Lakes Mead and Mohave within Lake Mead National Recreation Area. The monitoring plan identifies potential sampling locations, sampling media, and target compounds and provides a template for future monitoring studies. The plan, funded by the Natural Resource Challenge, was initiated to fulfill the requirements of the preferred alternative contained in the personnel watercraft (PWC) environmental statements prepared by each park as per the settlement agreement with the Bluewater Network.

Previous investigations associated with PWC and other combustion powered watercraft impacts have documented measurable levels of volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) in waters and bottom sediments at both parks. Carburated, two-stoke engines can degrade water quality by releasing relatively large amounts of uncombusted fuel and oil to surrounding waters. In general, BTEX compounds (benzene, toluene, ethylbenzene, and xylenes) and MTBE (methyl tert-butyl ether) were present at most sampling sites in all three lakes. However, BTEX levels were below the EPA's recommended maximum contaminant levels for drinking water. No health standards exist for PAHs in sediments, and no drinking water standards exist for PAHs–although the EPA has established water quality criteria for human health consumption of toxic pollutants for some PAHs.

In 2004, two hydrocarbon project proposals were selected for funding by the NPS-USGS Water Quality Partnership Program. One project was designed to assess hydrocarbon contamination at sentinel sampling sites in Lake Powell. Fuel related contaminants including VOCs and semivolatile organic compounds (SVOCs), which include PAHs, were the primary constituents sampled in water and sediments. These compounds are of particular concern to NPS because they can pose potential health risks to both humans and aquatic life. Samples were collected from approximately 20 sites to establish baseline data. A poster about this project with results from earlier work was presented at the annual Arizona Hydrological Society's symposium in September 2005. The second project was designed to assess hydrocarbon contamination, primarily SVOCs, using passive semipermeable membrane devices in Lake Mead and Lake Mohave. It is also planned to test the toxicity of these compounds to surrogate bacteria that may simulate a similar response to exposure of higher organisms. Toxicity analyses will be conducted using the Microtox toxicity test system. Work continued on both projects in 2005, and the Lake Powell project will receive partnership funding for a third year in 2006. At the completion of both projects, all project data will be made available to NPS and professional reports will be produced by USGS. Hopefully, these two studies will not only provide critical data and information to these parks but also stimulate a greater effort to develop a long-term monitoring program that will support management rulemaking in all the Colorado River park units affected by the settlement agreement. Also, managers will be in a better position to respond to fuel related accidents and spills with a monitoring program like this already in place.

Water profiling in Glen Canyon National Recreation Area (Barry Long).

Water sample from Glen Canyon National Recreation Area (Barry Long).

Processing water samples from Glen Canyon National Recreation Area (Barry Long).

WRD Participates in of Preservation of Tenth-Century Khmer Temple in Southeast Asia

Mike Martin, Hydrologist
Water Operations Branch

Located in Northwestern Cambodia, the Angkor Archeological Park, a UNESCO World Heritage Site since 1992, is one of the most important archeological sites in Southeast Asia. It covers over 400 sq. km and contains numerous temples (including the famous Angkor Wat), walls, moats and other structures that served the Khmer Empire from the 9th to the 15th Centuries. One of these temples, Phnom Bakheng, has been selected by the U.S. Department of State (DOS) to receive a $500,000 grant for preservation and presentation allocated over the next three years. This grant was entrusted to the World Monuments Fund (WMF), which agreed to manage this project on behalf of the DOS, Embassy of the United States, Cambodia. The National Park Service became involved at the request of the U.S. Ambassador to Cambodia, The Honorable Mr. Charles Ray. During initial reconnaissance, the technical team recognized stormwater runoff as one of the primary causes of deterioration of the structure. Consequently, a WRD hydrologist was selected to 1) assess the degree that stormwater runoff contributes to structural degradation of the temple complex, 2) develop (with the help of the team) reasonable alternatives to manage runoff, and 3) prescribe specific remedies to mitigate water related degradation.

The Phnom Bakheng Temple is constructed of free standing, sandstone walls with dry masonry joints on the top of a bedrock plateau. Large sandstone blocks were stacked around a central bedrock core that was hewn into four terrace levels supporting two upper platform levels. The overall form of the

temple is a four-sided pyramid.

While the individual stones that make up the temple are quite impermeable, the temple as a whole has a very high bulk permeability due to broken, missing, or displaced paving stones. When the structure was completed in the 10th Century, the upper platforms and the four terrace surfaces were probably very impermeable due to the exquisite fitting of the paving stones. Many of the joints are still very tight and reject water completely. However, centuries of non-occupation and neglect in this tropical climate has compromised most of the paved surfaces. Particularly detrimental to the original paving was the nearly complete encroachment of woody vegetation by the early 20th century.

Incident rainfall (about 1.5 meters/year) infiltrates directly into the temple complex through cracked and missing paving stones, permeable joints between pavers, and other holes in the paving. Upon reaching the impermeable bedrock, the subsurface water is forced outward to the side walls and corners of the structure. Long duration storms have the potential to surcharge the space between the free-standing walls and the bedrock, creating substantial hydraulic pressure on the lower tiers of the structure. Consequently, the corners and some of the walls of the temple complex have suffered structural instability.

Continual failure of the free standing walls is greatly exacerbated, if not completely caused, by the inflow of stormwater. The most direct way to truly alleviate this problem is to exclude all infiltration, i.e., make the temple essentially impermeable. Conceptually, rendering the temple complex impermeable is simple; however, actually accomplishing this task while retaining the cultural integrity of the structure is a far more difficult matter. Several possible alternatives were reviewed in detail before we focused on simply sealing all of the joints, cracks, and gaps with an impermeable material.

View of the temple looking northwest from the plateau level. Note the failed walls and exposed bedrock on the three lowest tiers (Michael Ellis, WMF).

Introduction of any type of foreign material into historic structures is risky due to potential chemical and physical reactions. Consequently, all synthetic sealing compounds whose long-term effects and stability are unknown were rejected in favor of a relatively inert substance like bentonitic clay. As luck would have it, the WMF has been procuring locally-derived clay for brick reconstruction for some time, and that material was selected for further testing. Preliminary field application and subsequent laboratory tests indicate that the physical and chemical qualities of this local clay are favorable for the proposed application. The next step is to conduct comprehensive field application experiments to evaluate effectiveness of the treatment and develop an overall cost estimate.

Air photograph (c. 1915) of Phnom Bakheng taken by French archeologists soon after complete clearing of the vegetation. View is looking towards the northwest. The four terrace levels and the two upper platforms are identifiable. The plateau level is also identifiable with a scattering of trees (reproduction courtesy of Ecole Francaise D'Extreme – Orient (EFEO) Archive).

Ponded water on the upper platform after a short-duration, intense storm. Within several hours, all depression storage had infiltrated or evaporated (Mike Martin).

Photograph (c. 1915) of the temple from the plateau level taken by French Archeologists prior to clearing of any vegetation (reproduction courtesy of EFEO Archive).

Stormwater leaking through wall joints in the bottom tier after a prolonged rainfall (photo courtesy of the Authority for the Protection and Management of Angkor and the Region of Siem Reap).

Photograph (c. 1915) of the eastern face of the temple taken by French Archeologists after partial clearing of the vegetation (reproduction courtesy of EFEO Archive).

Department of Energy Decision to Move Moab Tailings Pile Proves Highly Positive for NPS

Pete Penoyer, Hydrogeologist
Water Operations Branch

On September 14, 2005, U.S. Secretary of Energy Samuel W. Bodman announced that "offsite disposal using predominately rail transport to the Crescent Junction, Utah, site and active ground-water remediation" would be approved as the accepted alternative for remediation of the Moab uranium mill tailings under the Record of Decision (ROD). This preferred alternative was selected by the Department of Energy in its final EIS document "*Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties Final Environmental Impact Statement (FEIS)*" released in late July 2005.

The acceptance and approval of this as the final remediation alternative in the ROD clears the way for the removal of 11.9 million tons of radioactive uranium mill tailings from the banks of the Colorado River. This decision is a very positive outcome for Arches National Park (which adjoins the Moab site on the north), Canyonlands National Park, and more distant, downstream parks on the Colorado River. Offsite disposal of the tailings 30 miles northwest of the Moab site to a newly designed and constructed waste repository at a site near Crescent Junction will effectively eliminate this waste from posing any further threat to park resources.

NPS WASO and park staff have served as active federal stakeholders and participants in formulating the site characterization and ground-water cleanup strategy over several years and have worked closely with DOE and other stakeholders toward the favorable outcome this ROD reflects. Several other less desirable alternatives considered by DOE included on site cap-in-place on the Colorado River floodplain, where uncertainties over the long term related to subsidence and catastrophic failure of the pile from flooding by the Colorado River or Moab Wash could not be eliminated. Other DOE offsite alternatives included placement of a radioactive waste repository up wind and visible from Arches National Park.

Moab Site aerial photo showing tailings pile (foreground), Colorado River, Spanish Valley, and La Sal Mountains (DOE).

Now that a ROD is approved incorporating Crescent Junction as the disposal site, the focus becomes the many engineering and design challenges that must be addressed in effectively and efficiently executing the alternative, necessitating the removal, transport, and disposal of the largest low level radioactive waste pile that DOE has yet to deal with. Removal of the 11.9 million tons of radioactive tailings from the Moab site and vicinity properties must be accomplished with the least public impact and at a reasonable cost to taxpayers. Progress toward achieving this goal has begun as DOE gears up to move the pile and vicinity waste by 1) requesting temporary withdrawal of approximately 2,300 acres of public domain lands near Crescent Junction for construction of the disposal cell and surrounding buffer zone, as well as areas needed for construction support purposes, 2) the hosting of two public meetings in October 2005 to allow local residents to stay abreast of DOE plans, the status of Moab Project site operations activities, and preparations for the remediation of the former ore-processing site and contaminated ground water, and 3) the conducting of more in-depth engineering assessments, economic evaluations and cost-benefit analyses of various options associated with the selected alternative.

Technical Assistance Provided to Delaware Water Gap National Recreation Area Following the Large Flood of April 2005

Gary M. Smillie, Hydrologist
Water Operations Branch

The Delaware Water Gap National Recreation Area (DEWA) experienced two major flood events within an eight month period between September 2004 and April 2005. Impacts to DEWA operations and infrastructure were substantial in both instances. WRD was requested to review flood damage at the park and provide recommendations for potential action to be taken to mitigate damage to park lands and infrastructure. Following the request, a study team was assembled, consisting of staff members of the Geologic Resources Division, North Atlantic Regional Office, and WRD. The team visited the park during the week of April 11, 2005, and provided a brief summary of recommendations to park staff. These recommendations assisted park staff in developing a request for emergency funding to address the most critical issues. A formal report, which provided more substance to the recommendations, followed later in the year.

The flood events were driven by prolonged rainfall and wet antecedent conditions. According to a DEWA newsletter, *Spanning the Gap* (Vol. 26, No.2, Winter 2004), the September 2004 Hurricane Ivan event included 5-7 inches of rain across the watershed over a 12 hour period. For the April event, the USGS released provisional data indicating up to 5 inches of rainfall on mountain snowpack combined with 2 inches of rain a week earlier, causing flood levels equivalent to 80- to 100-year events as estimated for the Delaware River. The April and September events were the third and fifth highest peak flows, respectively, estimated for the USGS Delaware River stream gage site at Montague, NJ, (#01438500) since 1904. The April flood rose from a stage height of approximately 14 feet on April 2, 2005, to over 31 feet on April 3, 2005, and back to approximately 12 feet on April 7, 2005 (estimated at Montague, NJ).

A total of thirteen sites in New Jersey and Pennsylvania were evaluated by the NPS team. The issues of greatest concern involved potential infrastructure and cultural resource damage. Potential hydrologic changes to a wetland harboring species of concern were also discussed. While some of the resource damage occurred along the Delaware River itself, many of the impacts associated with the floods occurred along tributaries. For example, several bridge crossings over tributaries to the Delaware River performed poorly in the high flow events, causing erosion and/or deposition of sediments that resulted in compromised conditions.

Recommendations provided by the team generally reflect a desire to allow fluvial systems to function naturally, to the extent possible. For example, log jams were recommend to be left in place if they do not create an undesirable hazard due to their habitat and nutrient benefits. Only when absolutely necessary to protect infrastructure was log removal or streambank hardening recommended. The recommendations are presented with the understanding that the park staff will need to balance management considerations to protect infrastructure with ecological requirements. Therefore, in some cases a series of options were presented.

In general, it is human influence on the landscape that creates situations requiring action. It is important to understand that flood events will continue to erode banks, overwhelm structures located in the floodplain, and threaten human welfare. Large storm events are necessary in stream and river systems to perpetuate their ecological and physical processes. Human intervention in these processes is only recommended when damage to infrastructure is deemed unacceptable or health and safety are at risk.

An example of resource damage along the banks of the Delaware River following the flood of April 2005 (NPS).

WATER RIGHTS BRANCH HIGHLIGHTS

Chuck Pettee, Chief

The Water Rights Branch (WRB) has continued to participate in hearings in state administrative proceedings, settle issues via stipulated agreements, collect and analyze hydrologic and water related resource data, and assist parks by being indirectly involved in non-NPS National Environmental Policy Act (NEPA) assessment proceedings.

In Nevada, the Southern Nevada Water Authority (SNWA) is proceeding on multiple projects to secure ground-water right permits and construct pipelines and related infrastructure that will enable them to import water to the Las Vegas area. The flow systems from which SNWA is seeking water also support water related resources at three park units in Nevada. Because these pipelines will cross public lands administered by the Bureau of Land Management (BLM), they are conducting NEPA environmental assessments to secure BLM right-of-way permits. During 2005, this NEPA review process was further complicated when the Vidler Water Company also filed for a pipeline right-of-way across public lands in a corridor common to one of the SNWA corridors. Additionally, the Bureau of Reclamation is preparing an Environmental Impact Statement on the operation of the Aspinall Unit dams just upstream from the Black Canyon of the Gunnison National Park. The NPS is a cooperator agency in these environmental processes, and WRB staff will provide technical support.

The WRB has continued to collect scientific information to support claims for water rights under state and federal law. Examples are 1) information collected for a claim previously filed on Rincon Creek in Saguaro National Park, 2) information collected in preparation for the adjudication of water rights at

Montezuma Castle National Monument, and 3) information collected where a claim has been filed, pursuant to the Great Sand Dunes Protection Act, for the in-place use of ground water at Great Sand Dunes National Park.

The WRB also continued to work with partners to collection and analyze hydrologic data in several areas that will improve the science available to decision-makers so park water related resources can be protected. This information was used to resolve issues through settlement agreements in two instances, one in Nevada involving Death Valley National Park and one in Oklahoma involving Chickasaw National Recreation Area. Both Las Vegas and Oklahoma City are proposing to withdraw large amounts of water from ground-water aquifer systems that are tributary to these park units. Their respective state water administrators have decided that additional technical data is required to determine if the aquifers can support water exports while maintaining the needs of local citizens and the ecosystem, including park water related resources. The settlement agreements provide for collection and management of the data necessary to meet this requirement.

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.

Ground-Water Discharge from the Navajo Sandstone to the Streamflow of the Virgin River in the Zion National Park Area

Paul K. Christensen, Jeffrey C. Hughes, and William R. Hansen, Hydrologists
Water Rights Branch

Water related resources in Zion National Park depend on ground-water discharge to maintain low flow in streams. The North and East Forks of the Virgin River are the two major streams flowing through the park. Quantification of ground-water discharge was necessary to support water-right claims of the National Park Service and to preserve and protect streamflow and associated biologic and aesthetic attributes for visitor enjoyment (Christensen, et. al., 2005).

The Navajo Sandstone, of Jurassic age, is the most aerially extensive and thickest sandstone unit in the park area. The sandstone has a thickness of approximately 2,000 feet and discharges water into the two forks.

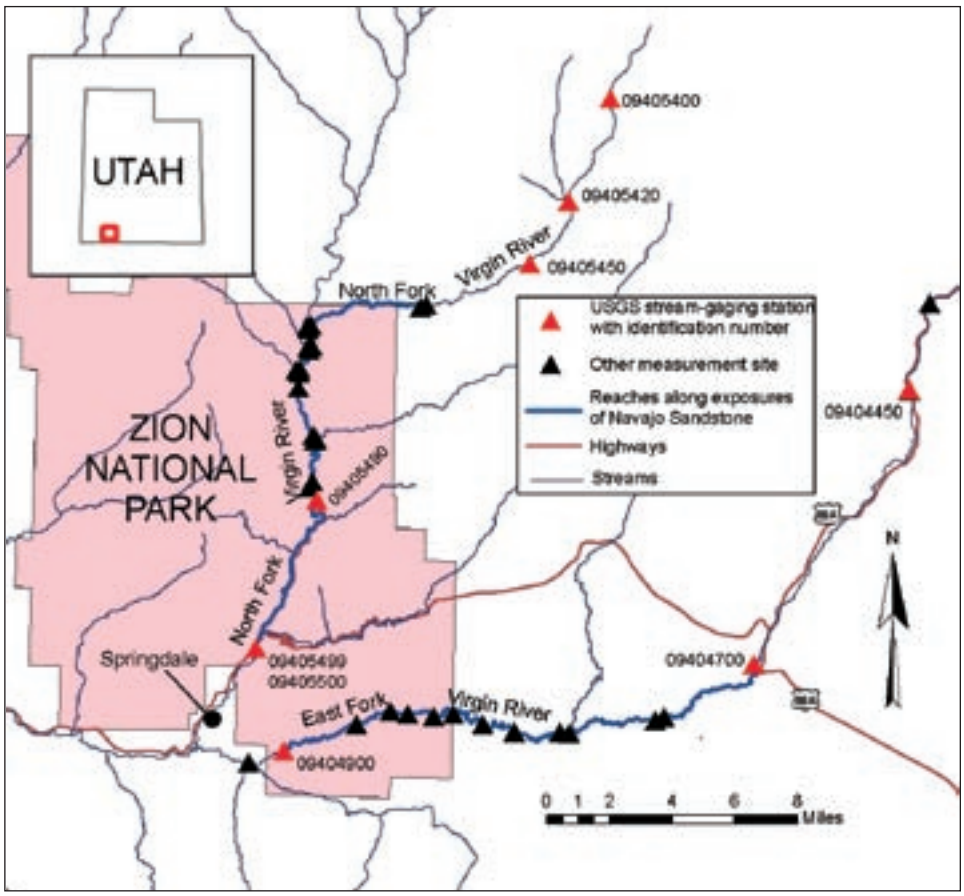
For the East Fork of the Virgin River near Springdale, UT, (Station 09404900) the maximum daily mean value streamflow is about 450 ft^3/s, the median mean is about 49 ft^3/s, and the minimum is about 26 ft3/s. For the North Fork of the Virgin River near Springdale, UT, (Stations 09405499 and 09405500) the maximum daily mean streamflow is about 3,000 ft^3/s, the median mean is about 65 ft^3/s, and the minimum is about 24 ft^3/s.

High flows occur during snowmelt in early spring, and low flows occur in late summer. The drainage areas of the two streams are nearly equal. More water, however, flows down the North Fork, because a larger part of the North Fork's drainage area is located in higher elevations, where precipitation and snow pack are larger.

To quantify discharge from the sandstone to the forks, instantaneous streamflow measurements were taken at selected locations along each fork. The measurements were taken during low flow conditions to reduce the effects of larger flows caused by snowmelt and convective storm events (thunderstorms) on streamflow and, thus, better represent ground-water discharge to the streams. From these measurements, sets of synoptic streamflow measurements were selected to determine increases or decreases in streamflow. These sets and daily mean streamflow records from several gaging stations operated by the USGS and the NPS were used to estimate discharge from the sandstone to the two forks. The sets of synoptic streamflow measurements indicate that flow of the two streams increases three- to six-fold during low-flow periods where the streams lie within the area where the Navajo Sandstone is exposed at the surface.

Streamflow data from USGS gaging stations on the East Fork (Stations 09404700 and 09404900) indicate streamflow increases ranging from 26 to 36 ft^3/s along the reach within the exposure of the Navajo Sandstone. The sets of synoptic streamflow measurements for the East Fork indicate streamflow increases ranging from 30 to 36 ft^3/s. Ground-water discharge from the Navajo Sandstone to the streamflow of the East Fork likely ranges from 26 to 36 ft^3/s. This range comprises as much as 100 percent of the minimum streamflow (26 ft^3/s) and 73 percent of the median streamflow (49 ft^3/s) of the East Fork.

Streamflow data from USGS gaging stations on the North Fork (Stations 09405450, 09405499, and 09405500) indicate a



Stream-discharge measurement sites and reaches along the Navajo Sandstone, East and North Forks, Virgin River, Zion National Park area (Christensen, et. al., 2005).

streamflow increase ranging from 24 to 47 ft^3/s along the exposure of the Navajo Sandstone. For the North Fork, the sets of synoptic streamflow measurements indicate streamflow increases of 35 to 81 ft^3/s. It is likely that the larger increases (above 55 ft^3/s) in streamflow, determined using the sets of synoptic streamflow measurements, include water from sources other than the Navajo Sandstone.

Ground-water discharge from the Navajo Sandstone to the streamflow of the North Fork likely ranges from 24 to 55 ft^3/s (minimum to median), a range much wider than that of the East Fork. This range comprises as much as 100 percent of the minimum (24 ft^3/s) and 85 percent of the median streamflow (65 ft^3/s).

In total, about 50 to 91 ft^3/s of water likely discharge from the Navajo Sandstone to the two streams, making the sandstone the dominant source of water in the two streams during low-flow periods.

Reference

Christensen, P.K., Hughes, J.C., and W.R. Hansen. 2005. Ground-Water Discharge from the Navajo Sandstone to the Streamflow of the Virgin River in the Zion National Park Area. National Park Service Technical Report NPS/NRWRD/NRTR-2005/343, 51 p.

Wild and Scenic River Task Force Paddling Up-Stream

William R. Hansen, Hydrologist, Water Rights Branch
Chris Brown, Acting Assistant Director, Recreation and Conservation
Sue Jennings, Wild and Scenic Rivers Specialist, Midwest Region

The National Park Service (NPS) is one of four federal agencies responsible for administering the Wild and Scenic Rivers Act of 1968 (Act) and managing designated rivers in the wild and scenic rivers system. The NPS currently manages 36 rivers flowing over 2,000 miles in 21 park units and has statutory responsibilities on 18 federally designated segments administered by state agencies. The NPS is also responsible for the rivers listed on the Nationwide Rivers Inventory (3,500 segments) and for providing technical assistance to federal and state partners.

The Act has complex provisions influencing the management and protection of outstandingly remarkable resources, including water quantity and quality, scenic, geologic, historic, cultural, fish and wildlife, and recreation values. Management is further compounded by the diversity of involved jurisdictions and ownerships, including varying responsibility for program direction within the NPS. The NPS has a good stewardship record with its wild and scenic rivers, but the dispersal of responsibilities, lack of sufficient expertise, and inconsistency in the application of the various provisions of the Act have led to resource damage, strained relations with partners and the public, and vulnerability to lawsuits. Because of these issues, it is critical that the NPS develop a strategic, prescriptive response.

To address these concerns and prepare for the 40th anniversary of the Act, a Wild

and Scenic Rivers Task Force was created in the Summer of 2004. The Task Force is composed of 15 members from field, region, and division offices and 5 ex officio members from NPS management. The purposes of the Task Force are 1) to analyze the responsibilities of the NPS under the Act and examine our strengths and weaknesses and 2) to make recommendations to the National Leadership Council (NLC) on how the NPS can fully satisfy statutory requirements, attain a consistent and sustainable management program, and realize the full potential of the Act. The Task Force has received the support of the NLC and expects to present recommendations to them in the Summer of 2006.

Channel Change and Flow History along the Little Missouri River in Theodore Roosevelt National Park, North Dakota

Jennifer Miller and Jeff Hughes, Hydrologists, Water Rights Branch

The National Park Service, Water Resources Division, Water Rights Branch initiated a collaborative study with the USGS to determine the important components of the Little Missouri River flow regime affecting riparian resources of Theodore Roosevelt National Park (THRO) in North Dakota (Miller 2005). The study was prompted by an upstream water right application filed in 2001.

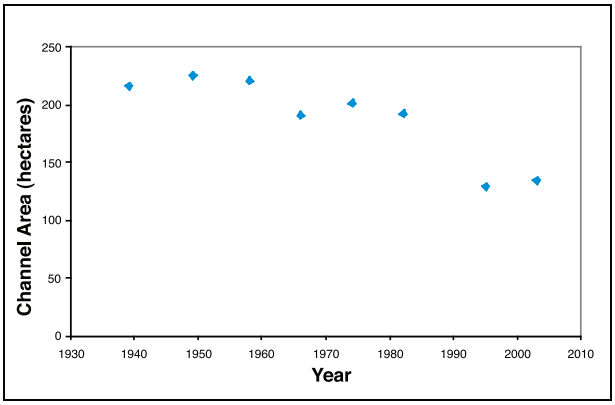
The study determined historic variations in the rate of channel and floodplain change along the Little Missouri River and related these changes to flow and sediment transport. The goal of this study was to provide the NPS with information about the characteristics of the river flow regime most critical to conserving riparian plains cottonwood (*Populus deltoides ssp. monilifera*) habitat. Plains cottonwood seedlings recruit on bare, sandy point bars or newly formed floodplain areas. Floodplains in this environment are continuously renewed by high flow events that remove vegetation from existing floodplains and erode channel banks. Sediments are deposited on the floodplain as high flows recede. During such high flow events, the channel may shift position and migrate across the valley floor.

The study was achieved by:

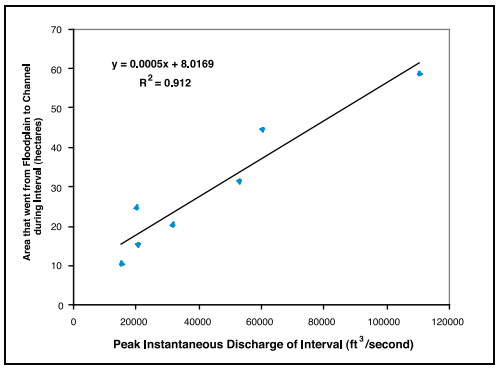
1) Obtaining and rectifying historical aerial photography of the study area,
2) Delineating historical channel and floodplain areas on each set of rectified photographs,
3) Analyzing discharge data and defining geomorphically important flow events,

4) Analyzing suspended sediment data and calculating its relationship to river discharge,
5) Correlating historical channel and floodplain changes to geomorphically significant flows and sediment discharge using linear regression analyses, and
6) Summarizing the most important factors of discharge and sediment transport regimes that produce the most channel change.

The study reach showed a decrease in the active channel area and an increase in floodplain area over time. Quantified bottomland transition areas were related to flow duration and magnitude metrics for the photo intervals using linear regression analyses to determine the flows responsible for the most geomorphic bottomland change. Floodplain erosion (floodplain to channel transition areas) was found to be strongly associated (R2 = 0.91) with the peak instantaneous discharge of the highest flows in a photo interval and with the total mass of sand transported during each interval, R2 = 0.7484. The new channel area created by the high flow events will eventually became floodplain habitat for cottonwood seedling development as its elevation rises from subsequent flood deposits and the channel migrates away over time.



Little Missouri River channel area over time, Theodore Roosevelt National Park North Unit (NPS).



Area that went from floodplain to channel during photo interval vs. peak instantaneous discharge of interval.

Cottonwood may be utilized as an indicator of channel history because it is the principal pioneer species along the Little Missouri River and in other similar western riparian environments (Everitt 1968, Scott et al. 1997, Friedman and Lee 2002). Everitt showed the value of cottonwood as an indicator of former channel areas and, therefore, floodplain age and former channel migration (Everitt 1968). Because cottonwood regeneration is dependent upon channel change, high flows are critical to the continuation of the cottonwood forest legacy along the Little Missouri River floodplain. The highest peak instantaneous discharges were found to create the most floodplain turnover, which in turn creates new habitat for cottonwood seedling recruitment. The even-aged bands of cottonwoods indicate that each stand became established at the same time and grew at similar rates as the river migrated away from the stand.

Plains cottonwood (Populus deltoides ssp. monilifera) forest along Little Missouri River, Theodore Roosevelt National Park North Unit (NPS).

The study found the magnitude and frequency of peak flows to be the most important hydrologic regime characteristics in the creation of new floodplain, which provides habitat for continued cottonwood recruitment. The NPS plans to use the information gained from this study in discussions with the office of the North Dakota State Engineer to aid in its evaluation of the impact of current and future water rights claims.

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Protecting the Mancos River in Mesa Verde National Park

Mark Wondzell and Gwen Gerber, Hydrologists; Water Rights Branch

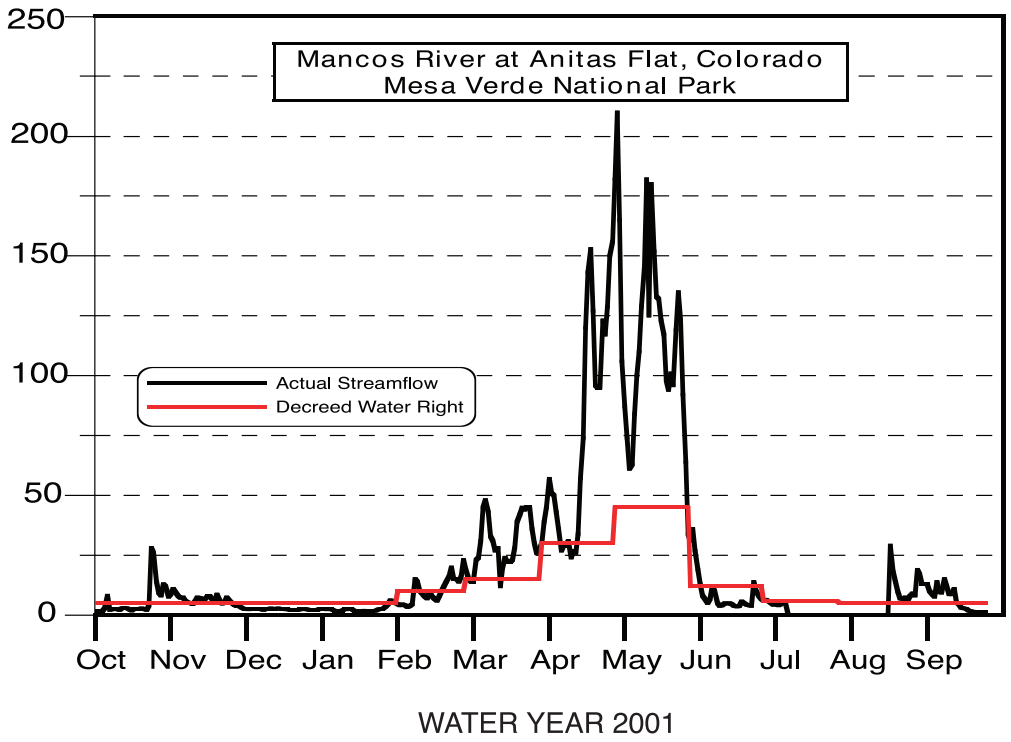
On July 31, 1997, the Colorado Water Court, Water Division 7, decreed the United States a Federal reserved water right to instream flows in the Mancos River through Mesa Verde National Park (Mesa Verde). This decree also granted the United States water rights for 119 springs as well as for other surface and ground waters throughout the park. The court recognized that continued flow of these springs and the Mancos River is necessary for "interpretation of the life of the prehistoric and primitive inhabitants" of Mesa Verde and for the "preservation of all timber, natural curiosities and wonderful objects within the park, including protection of the animals and birds in the park."

The final decree incorporated the results of years of negotiation between the United States, the State of Colorado, and local water user groups. In Colorado, as in many western states, water and water rights are prioritized in the order in which they were historically first put to use. This "first in time - first in right" approach is intended to legally establish order of use during times of water shortage, with the earliest users ("seniors") having priority over late-comers ("juniors"). Rather than pursue the most senior priority date (June 29, 1906, when Mesa Verde became a national park) and potentially risk lengthy litigation over quantifying minimum flows for the Mancos River, the United States agreed to a priority date of January 1, 1995. This date provided adequate protection for park resources, while allowing existing upstream users on the Mancos River to continue their historic water use. Water users after January 1, 1995, are required to demonstrate that their proposed use will not reduce minimum flows through the park.

As a condition of the negotiated settlement, hence the decree, the United States was required to install and maintain a streamflow measurement and recording device on the Mancos River and to submit annual water use reports to the Colorado State Engineer. The decree explicitly states that absent this stream gage, the United States would not be entitled to curtailment of other water rights or water users even if Mesa Verde were not receiving its decreed minimum flows in the Mancos River. As a result, Mesa Verde staff, with assistance from WRD, installed (and has continuously operated) a streamflow gage on the Mancos River near the upstream boundary of Mesa Verde since 2001. This gage, Mancos River at Anitas Flats, transmits data to the USGS Wyoming Water Science Center for 1) storage in the USGS National Water Information System, 2) display on the USGS real-time web page, and 3) publishing in the USGS Annual Data Report.

Working closely with the State Engineer, the National Park Service monitors the Mancos River flow daily and notifies the local water commissioner when streamflow at the gage drops below the decreed amount. If the insufficient flow at the gage is a result of upstream "juniors" taking water out-of-priority, those users may be forced to curtail their water use until flow in the Mancos River satisfies the decreed amount. There will be times, however, when low flow at the Mancos River gage is simply the result of proper administration of more senior rights during dry periods or even drought. Water year 2001 was one of those times (see below). Much of the year proved to be extremely dry, and only the most senior water users with the earliest priority dates received water.

Mesa Verde National Park recognizes the importance and value of maintaining this streamflow monitoring program to ensure the park receives the water to which it is entitled under Colorado water law. Beginning Fiscal Year 2006, primary responsibility for funding, maintaining, and operating the gage will fall to the park. WRD will continue to provide technical assistance and maintain communication with the State Engineers Office to help monitor existing use, respond to shortages, and evaluate new water right applications that may potentially harm the Mancos River and its many unique water related resources.



NATURAL RESOURCE CHALLENGE AQUATIC RESOURCE FIELD PROFESSIONALS HIGHLIGHTS

Investigation of White Growth at Sugarloaf Spring, Lake Mead National Recreation Area

Tom Culhane, Hydrologist, Pacific West Region
Gary Rosenlieb, Water Quality Program Leader, Water Operations Branch

In February 2005 a biologist observed an unusual phenomenon at Sugarloaf Spring, located less than one mile below Hoover Dam. The spring was observed to contain an abundant, white, slimy, filamentous substance with an associated sulfur smell. This spring had been visited many times in the past with the substance never observed. Consequently, the change constituted reason for concern.

During the first site visit the white substance was found extending down the first 15 meters from the spring source, beyond which there were smaller, occasional pockets. These pockets extended a distance of about 30 meters below the source and always had an associated sulfur smell. Every place where the white substance was present, there was also a sheen on the water. When the site was visited in April 2005, very little of the white substance was observed. When the site was visited in September 2005, no white substance was observed. A water sample collected in September was sent out for laboratory analyses.

At this point there is insufficient information to definitively state what the white substance is. Based on the visual appearance, associated sulfur odor, and high sulfate concentration, it appears this substance may be the result of a sulfur oxidizing bacteria. Specifically, it appears that anaerobic decomposition or dissimilation of nitrogen and sulfate may have occurred and that the fluctuation in sulfur bacteria may have resulted from the sulfur and nitrogen cycles. The very shallow water (i.e., proximity to air) found at the site is consistent with this speculation. The interesting question has to do with speculations as to potential sources of sulfur feeding this process.

Many species of sulfur oxidizing bacteria are mesophilic to thermophilic and are frequently found at geothermal springs that provide mineral forms of sulfur. Furthermore, there are a number of geothermal springs in the area, including one spring as close as 1,500 feet that produces 55 degrees C water. During the field investigation, Sugarloaf Spring was observed to produce 30 degrees C water, which for the area is warm enough to suggest at least some contribution of deep-circulating geothermal waters.

Alternatively to a natural explanation, however, the apparent bloom could also be a product of the dissimilation of sulfur-containing amino acids. An active sewage disposal pond is located approximately one half mile up-gradient of the spring. This pond is used for the evaporation of bio-solids produced by a small waste water treatment plant. Each day approximately 500 to 1,000 gallons of sludge is piped to the pond, where it is ultimately evaporated. In addition to the issue of potential leakage from the pond, the previous year a contractor ruptured the pipeline feeding the pond then subsequently repaired it. Some of the evidence suggesting bio-solids as a potential source includes the following:

- the white substance was never noted at Sugarloaf Spring prior to Spring 2005,
- if the sulfur was related to mineralization it is suspicious that

Sugarloaf appears to be the only spring in the vicinity that has produced the white substance,
- there was a release of sludge/water slurry associated with a sewage pipeline break sometime in 2004, shortly prior to the observance of the white substance at the spring,
- laboratory results indicate that the reduced form of nitrogen is present in the water, which suggests that some anaerobic reduction may be occurring, and
- geologic mapping suggests the presence of a high angle fault, that may create a fracture permeability conduit through which contaminants could travel.

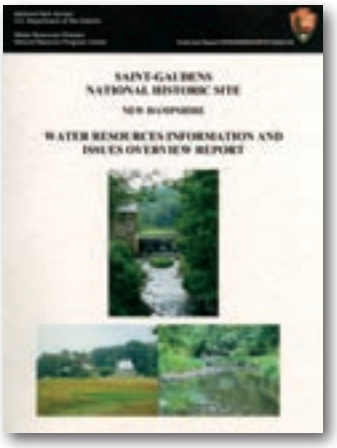
White substance observed at Sugarloaf Spring in February 2005 at Lake Mead National Recreation Area (NPS).

It is also possible that a mineral sulfur source has been present for some time and that recent sewage pond related leakage was sufficient to cross a threshold that allowed for sulfur oxidizing bacteria to grow at this point in time. For now, the big question is whether or not the white substance will return again. Given this unknown and all the unanswered questions regarding what this white substance is and what caused it, the options regarding how to proceed range from active additional hydrogeological testing to monitoring the spring conditions to see if the white substance returns again.

Water Resources Information and Issues Overview Report Saint-Gaudens National Historic Site, New Hampshire

Alan C. Ellsworth
Northeast Regional Hydrologist

Saint-Gaudens National Historic Site (SAGA) was established in 1964 to preserve, interpret, and exhibit historically significant properties associated with the life and cultural achievements of Augustus Saint-Gaudens. Saint-Gaudens is noted for helping to shape the American perception of sculpture as an art form via large public statues, bas-reliefs for the social elite, and establishment of an artist colony in Cornish, New Hampshire. The natural setting, including riparian, wetland, and open water areas, that is preserved at the Historic Site helped inspire the artists living in this community during the Guilded Age of the late 19th and early 20th centuries.



Water Resources Information and Issues Overview Reports (WRIIOR) are designed to provide park managers with water resource background, identify and discuss water related management issues, and provide park management with considerations for future actions to address those issues. WRD received a technical assistance request for a report to identify water resource issues,

propose management strategies, and support efforts to maintain an open water historical pond at SAGA. A WRIIOR was completed in 2005 after it was identified by the WRD Planning and Evaluation Branch as a newly developed tool that would address SAGA's needs.

Staff at the Historic Site were interviewed to establish known water issues, gain an understanding of the water resource infrastructure, and identify management needs. Due to SAGA's size (60 ha [150 ac]), it was possible to visually inspect the surface-based hydrologic components of the entire system. Literature reviews provided supporting information on local hydrography, aquatic ecology, water quality, and hydrogeology. Discussions with various agencies, including the Town of Cornish, NH Department of Environmental Services, the Federal Emergency Management Agency, the US Geological Survey, the Wildlife Conservation Society, and intra-agency personnel produced fundamental contacts and guidance.

Important water resources at SAGA include: Blow-Me-Down Pond, which is located behind a dam at an historic mill; Blow-Me-Down and Blow-Me-Up Brooks, the latter having an impounded historic swimming hole; and the adjacent Connecticut River that receives these waters. A well-designed trail system provides interpretive opportunities for both naturalists and those interested in gaining insight into the setting that inspired the artist colony inhabitants. Water quality monitoring along the brooks and pond includes an educational outreach component and has been conducted routinely by Steve Walasewicz (SAGA Natural Resource Manager) since 1997. Monitoring has established the presence of healthy biota and relatively pristine water throughout the site.

The final WRIIOR product serves as a single source description of water resources, notable issues, pertinent contacts, and reference literature for individuals interested in hydrologic science and management at SAGA. Recommendations are provided related to water quality monitoring, creation of a sedimentation monitoring plan for historic ponds, wetlands assessment, atmospheric deposition monitoring, effects of adjacent land development, and water supply management. Saint-Gaudens Historic Site personnel were integral in formulating issues and solutions, preparing interpretive components, and reviewing the document, which can be viewed at http://www.nature.nps.gov/water/planning/Issuesoverview_reports/overview_reports.htm.

Boardwalk overlooking Blow-Me-Down Pond (Alan Ellsworth).

Assessing the Condition of Wetlands in Smaller Pacific West Region National Parks

Marie Denn, Natural Resource Challenge Aquatic Ecologist Pacific West Region

During the next two years aquatic resources specialists at WRD and within the Pacific West Region (PWR) will assist a set of smaller parks with inventorying and assessing wetland resources. This work will be funded with a grant from WRD.

Wetlands are keystone ecosystems; according to the FWS, an estimated 46% of US endangered and threatened species and 50% of all bird species require wetland habitat. Some ecologists call wetlands "biological supermarkets" because they support complex food webs. Wetlands are also called "the kidneys of the land" because they regulate the quantity and quality of water moving through a landscape. Because of the high value of these habitats, directives calling for protection of wetland resources are found in the *National Environmental Protection Act*, the *Clean Water Act*, *Executive Order 11990,* and NPS *Director's Order 77-1*. Species protection laws, such as the federal Endangered Species Act, often compel the NPS to prevent degradation of wetland habitat.

Furthermore, the Department of Interior is implementing a Strategic Plan for management of natural resources. The Strategic Plan performance measure for "Land Health: Wetlands" is "Percent of acres of wetlands achieving desired conditions." To meet this objective, park managers will need to report "total acres of wetlands," "acreage of wetlands that meet desired conditions," and "acres of wetlands that do not meet desired conditions (i.e., are degraded)" and will need to establish annual goals for restoring degraded wetlands. This information will then be aggregated at the national level by WRD. Smaller parks, however, often have difficulty complying with mandates to obtain and report information about park wetlands. Resource managers may recognize the deficiencies in their knowledge base but lack the resources to acquire information about the extent, distribution, and condition of the wetlands in their care. Consequently, numerous managers seek funding for individual park specific wetlands assessments. This park by park approach presents problems for several reasons, including:

- Dissimilar wetland inventory and assessment efforts conducted at local scales cannot always be aggregated up to regional and national scales and
- When projects are funded one at a time, staff training and protocol development for each park results in duplication of effort.

Although these are problems for large park efforts also, conducting multiple dissimilar wetlands assessments in parks with small land areas exacerbates these issues.

During FY06 and 07, WRD and the PWR will assist smaller parks in addressing wetlands information needs. The WRD funded program will be coordinated by Natural Resource Challenge Aquatic Ecologist Marie Denn, WRD Wetland Program Lead Joel Wagner, Point Reyes National Seashore GIS Biologist Dave Schirokauer, and PWR Water Resources Program Lead Mietek Kolipinski. The objective of the project is to pool wetland mapping efforts for several smaller parks within the region, which have agreed to participate in this pilot program, in order to further knowledge of park wetland resources.

The work will draw heavily from a pilot wetlands assessment program from the Point Reyes Rapid Assessment Methodology (PRRAM). PRRAM is an office and field based procedure designed to systematically inventory and assess park wetlands. It is based on

standard federal guidance for inventorying wetlands, such as the 1987 COE Manual for Wetland Delineation and the 1979 FWS Cowardin Classification System, as well as more recently developed methods for describing wetland function and condition–such as the 2004 California Rapid Assessment Method for Wetlands.

For each target park the project will:

- Compile all documentation of park wetlands. Sources may include aerial photographs, National Wetlands Inventory (NWI) maps, vegetation maps, soils maps, park management documents, and previous studies.
- Conduct on the ground accuracy assessments of existing wetlands data, particularly NWI maps. Accuracy assessments will include correcting boundaries and classifications of previously mapped wetlands and mapping wetlands that the NWI maps omitted.
- Adapt PRRAM protocols to each park–which may include creating procedures for systematically gathering supplemental park specific data regarding impacts to wetlands. Then, with the resulting Rapid Assessment Method, conduct assessments of wetlands in high-priority areas, such as areas with populations of wetland dependent special status species or areas with threats from human activity.
- Train park staff regarding proven methods to increase knowledge of wetland resources. Provide staff with tools and techniques to continue with wetlands mapping and assessment.
- Recommend future actions to the park to meet obligations under *Director's Order 77-1* and other mandates, such as the upcoming *Department of Interior Strategic Plan*.

Together with park managers, WRD and PWR staff will increase the knowledge of wetlands in Pacific West Region National Parks in order to better manage valuable wetland resources.

Wetland condition assessment at Point Reyes National Seashore (Marie Denn).

NPS Becomes a Signatory to "Three Species Conservation Agreement" for Native Fishes

Melissa Trammell, Fishery Biologist
Intermountain Region

"That's 542 gram," intones Dr Kirby, followed by a gentle splash as he returns the native flannelmouth sucker to the Fremont River. Drs. John Kirby and James McAllister, volunteer researchers, arrive in Capitol Reef National Park every summer in the desert heat of August to test the waters of the river and record trends in the fish community. The Fremont River is one of several rivers in the Colorado River Basin that is home to the flannelmouth sucker and other little known desert fish. These fishes can be found from large turbid rivers to tiny desert trickles; they tolerate extremes in temperature and flow and feed omnivorously on insects, algae, detritus, and small fishes. Yet even these extremely adaptable creatures are succumbing to the pressures of human impacts on the environment. A great deal of attention has been paid to four endangered "big river fishes" of the Colorado River Basin–Colorado pikeminnow, bonytail, razorback sucker, and humpback chub. However, the flannelmouth sucker and several other native species, while not listed, are in decline and suffer the same threats as the listed species, namely, habitat alteration–mostly diminished flow, along with predation, competition and hybridization from nonnative species, regulatory inadequacy, and other factors.

The Utah Division of Wildlife Resources (UDWR) is spearheading a process to conserve and protect three of these native fish species. Roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), and flannelmouth sucker (*Catostomus latipinnis*) are primarily distributed within the Colorado River drainage, with parts of their ranges occurring in Wyoming, Utah, Colorado, Arizona, New Mexico, and Nevada. Each is listed as a species of concern or endangered species in one or more of the states where they occur. None is listed under the Endangered Species Act of 1973 (ESA), although the roundtail chub has been proposed for listing under the ESA as a distinct population segment in Arizona.

The Colorado River Fish and Wildlife Council members, a cooperative effort of the state wildlife agencies within the Colorado River drainage, have entered into a Conservation Agreement for the three species. While the state agencies are actively working to conserve the three species, they recognize that federal and tribal agencies and groups have management authority over areas where the fish occur and that working cooperatively with these agencies and groups would be beneficial to all. The Intermountain Region was the first federal agency to become a signatory to the Conservation Agreement. One or more of the three species occur in several Intermountain Region park units, including Dinosaur National Monument, Canyonlands National Park, Capitol Reef National Park, Glen Canyon National Recreation Area, Grand Canyon National Park, Black Canyon National Park, and Mesa Verde National Park. The flannelmouth sucker also occurs in Lake Mead National Recreation Area in the Pacific West Region.

I have participated in discussions with representatives of UDWR and other states in the development and review of the Conservation Agreement and the Range-wide Conservation Strategy being developed by the states. The states are also developing individual conservation strategies that outline specific actions to be taken and prioritize actions by stream reach, based on feasibility, local support, severity of threats, and other criteria. The NPS will continue to work with the states to refine their annual strategy workplans to include NPS sites. We

should conduct or facilitate surveys of park waters to locate and assess extant native fish populations. The states and NPS will share data on surveys and seek funding for park-specific projects to restore or enhance habitats. We can remove or reduce threats when identified, such as removing nonnative fish and removing or installing fish barriers.

Native flannelmouth sucker captured in the Fremont River, Capitol Reef National Park (NPS).

In Capitol Reef National Park the ongoing surveys have shown a nearly intact native fish fauna, including strong populations of flannelmouth and bluehead sucker; however, roundtail chub have been extirpated. Under the Conservation Agreement, the State of Utah could assist us in transplanting roundtail chub from the nearest source. Unfortunately a new threat, the nonnative white sucker (which can hybridize readily with the native suckers), is lurking below an artificial barrier proposed for removal in the park. We will assist the UDWR in their efforts to determine if white sucker occur above the waterfall barrier.

This Conservation Agreement is a wonderful opportunity for the NPS to work cooperatively with the states to maintain or restore native fishes in park waters. The states have already shown a great commitment to this agreement by restoring flows to some waters, stocking fish where they have been extirpated, and removing nonnative fishes. Much work remains to be done, including surveys to find unknown populations, assessing the levels of threat to existing populations, and restoring and protecting fish habitat.

Dr. John Kirby of Mansfield University, PA, weighs a flannelmouth sucker on the banks of the Fremont River before returning the native fish to the water (NPS).

Dr. Kirby and Melissa Trammell prepare to measure the flow in the Fremont River (NPS).

APPENDIX A

TECHNICAL ASSISTANCE

TECHNICAL ASSISTANCE SERVICEWIDE

Strategic Planning

Supported the implementation of Servicewide Goal 1a4 of NPS's Strategic Plan by developing new technical guidance for reporting to Goal 1a4A, 1a4B, and 1a4C and providing input to the DOI task force working to develop a water quality goal for the Department's Strategic Plan.

Supported the implementation of Servicewide Goal 1a4A and 1a4B of NPS's Strategic Plan by the completion of the Impairments element of the Designated Use and Impairments database. The system was made available servicewide on the Intranet.

Supported the implementation of Servicewide Land Health Goals 1a1C (Wetlands), 1a1D (Riparian and Stream Areas), 1a1E (Upland Areas), and 1a1F (Marine and Coastal Areas) by finalizing servicewide technical guidance for field staff reporting, assisting regional and park staff in interpreting the guidance for reporting, and certifying the national database.

Assisted regional and park GPRA goal contacts with the use and interpretation of the new DOI Strategic Plan water quantity goal (1a4C).

Created prototype Office of Management and Budget scorecard for servicewide water quality management.

Served as a member of the Natural Resource Program Center GPRA/Scorecard Task Group.

Water Resources Planning

Continued to develop the context of the new paradigm for water resources planning within WRD including the development of a "fact sheet" outlining the purpose and scope of revised planning products including the Water Resources Information and Issues overview, Water Resources Foundation Report, and Water Resources Stewardship Report.

Established liaison with Denver Service Center Planning Teams for the identification of "pilot" candidates in the development of prototype Water Resources Foundation for Planning and Management Reports.

Maintained liaison with Resource Stewardship Planning (draft DO 2.1) author in order to identify "pilot" candidates for the development of prototype Water Resources Stewardship Reports in support of Resource Management Planning activities.

Provided policy and technical review of the draft *DO-2 Planning Sourcebook*.

Identified and implemented strategies for developing water related "Desired Future Conditions" in response to GPRA and planning-related requirements.

Provided initial WRD review and triage for more than 350 external environmental documents which could potentially affect the operations of the NPS. Arranged for in-house WRD review of those documents with greatest relevance to NPS water resources management and consolidated review comments, as appropriate.

Watershed Condition Assessment

Hosted a Watershed Condition Assessment Program planning meeting to get input on a program implementation model and project funding priorities. Participants included NPS staff from parks, Vital Signs monitoring networks, and regional and national level science support offices.

Developed and refined procedures for reporting the current condition of NPS-managed coastal resources through a "scorecard" approach.

Water Quality Management

Coordinated the NPS-USGS Water Quality Assessment and Monitoring (WQAM) Partnership Program as part of the Clean Water Action Plan funded by Congress by serving as co-chair of the interagency work group for the NPS-USGS Partnership Program. With USGS personnel, maintained the partnership web site.

Represented the National Park Service as a member of the National Water Quality Monitoring Council, attending the council meeting in Pensacola, FL.

Continued to participate on the State Of Wyoming's Total Maximum Daily Load Implementation Advisory Board and the Federal Family Coordination Committee.

Provided programmatic oversight for an investigation entitled "Use of Semipermeable Membrane Devices to assess the Presence and Potential Impacts of Polycyclic Aromatic Hydrocarbons Resulting from Recreational Snowmobile Use in National Parks" being conducted by the Columbia Environmental Research Center.

Wetlands Protection

Provided servicewide program guidance and coordinated NPS activities undertaken in response to *Executive Order 11990: Wetlands Protection*.

Coordinated NPS activities with the FWS pertaining to the production of National Wetland Inventory maps and digital data. Developed a proposal titled *Acquiring Baseline Digital Wetland Maps for High Priority NPS Units: A Critical Need*. This proposal to conduct National Wetland Inventory mapping on NPS lands will be submitted to eligible funding sources.

Served as the primary NPS representative for the Wetlands Subcommittee of the Federal Geographic Data Committee and coordinated servicewide responses to interagency wetland data and information calls.

Prepared NPS's portion of the *Interagency Wetlands Performance Report* for the Office of Management and Budget.

Advised Land and Water Conservation Fund Grants Program staff regarding applicability of *Director's Order #77-1: Wetland Protection* to proposals that would have adverse impacts on wetlands.

Provided NPS review for a proposed COE rule change regarding the *Clean Water Act* Section 404 nationwide permit program.

Served as a panel member during the Standardization of Environmental Compliance Nationwide session at the 2005 NPS/FHWA Environmental Streamlining Collaboration Workshop.

Fisheries Management

Coordinated with other federal, state, and tribal fisheries management and regulatory agencies, and the national conservation / sportfishing organizations regarding NPS fisheries management programs, issues, needs, and initiatives.

Provided technical assistance to the National Fish Habitat Initiative being coordinated by the FWS and the National Sportfish and Boating Partnership Council.

Represented the NPS at a meeting of the Federal Caucus for the FWS sponsored National Fish Habitat Initiative in Arlington, VA.

Represented the NPS on the Executive

Committee of the Western Regional Panel of the Aquatic Nuisance Species Task Force.

Represented the WRD at the Interagency River Manager's and River Management Society's sponsored workshop in Salt Lake City, UT, and presented a paper concerning parks as potential refuges for native fish sustainability.

Completed a draft of the Fisheries Catch and Release brochure and submitted it to the Office of Education and Outreach for final development and publication.

Marine Resources Management

Coordinated NPS activities in support of the *U.S. Ocean Action Plan and the Ocean Park Stewardship Action Plan and Seamless Network of Ocean Parks, Wildlife Refuges, Marine Sanctuaries & Estuarine Reserves.*

Participated on the NPS Ocean Park Task Force and four subcommittees of this task force.

Coordinated NPS activities in support of *Executive Order 13158: Marine Protected Areas.*

Drafted NPS accomplishments report for DOI-NOAA report to White House on Marine Protected Area's *Executive Order 13158* implementation.

Coordinated joint ocean programs with NOAA National Marine Sanctuaries Program, National Estuarine Research Reserves, and the National Wildlife Refuge System.

Coordinated interagency approval on *Memorandum of Agreement for Cooperative Enforcement between National Parks, National Wildlife Refuges, and NOAA National Marine Sanctuaries and Fisheries.* This agreement enables sharing of resources between NOAA and DOI sites for enhanced visitor safety and resource protection.

Coordinated NPS activities in support of *Executive Order 13089: Coral Reef Protection.*

Briefed Assistant Secretary in preparation for House Ocean and Fisheries Subcommittee hearing on *Coral Reef Conservation Act.*

Developed background paper and draft legislative language for reauthorization of the *Coral Reef Conservation Act.*

Supported DOI Assistant Secretary/Fish, Wildlife & Parks in planning the FY05 Coral Reef Task Force meetings in Miami, FL, and Washington, DC.

Participated on a coral reef research review panel established by the USGS to review staff proposed studies of coral reef ecosystems.

Provided technical peer review for three funding proposals to NOAA's International Coral Grant Program.

Information and Data Management

Coordinated the joint NPS-USGS effort to acquire the high-resolution National Hydrography Dataset for watersheds containing national park units, including acquiring and quality assuring NPS data incorporated into NHD.

Maintained NPS Water Right Dockets filing system. Distributed docket files in CD-ROM format to parks, regions, and the Office of the Solicitor on an as-requested basis.

Provided programmatic oversight for the redevelopment of the software procedures employed to produce Baseline Water Quality Data Inventory and Analysis Reports for parks.

Continued development of NPSTORET - a series of Microsoft Access templates/forms for entering and documenting the results

of water quality monitoring projects in accordance with the National Water Quality Monitoring Council's guidelines.

Enhanced WRD's STORET infrastructure by debugging issues associated with Oracle and STORET installation in order to bring Legacy STORET, National STORET, STORET Data Warehouse, and the NPS WRD's STORET on-line.

Provided numerous corrections and additions to EPA regarding characteristics and other aspects of the STORET database.

Updated metadata for 35 parks created by North Carolina State University for the small-scale GIS databases that were produced from the Baseline Water Quality Data Inventory and Analysis Report effort to correct the horizontal reference information.

Wild and Scenic Rivers

Participated on the Wild and Scenic River Task Force established to review wild and scenic river policies and vulnerabilities and to provide recommendations to the National Leadership Council.

Chaired the Eastern Rivers Summit Planning Team convened to develop and plan the Eastern Rivers Summit to be held in Sheperdstown, WV, on February 27 – March 1, 2007.

Contributed review and comments on the Wild and Scenic River Sec. 7a determination on the Little Miami River (a State of Ohio managed river outside of the National Park Service).
Outlined a procedure for determining which NPS Wild & Scenic River segments are impacted by water impoundments for the NPS Rivers, Trails, and Conservation Assistance Program.

International Activities

Conducted initial evaluation and developed feasible strategies for managing stormwater runoff in and around a 10th century Hindu Temple in the Angkor Archeological Park, Cambodia.

Miscellaneous

Reviewed and evaluated the 2005 Development Advisory Board list of construction project submissions for inconsistencies between proposed tasks and proposed costs and for any inconsistencies regarding water related impacts or conditions at the various project locations.

Provided review and comment on Congressional Oversight hearing testimony on invasive species that was to be given by the Associate Director of Natural Resource Stewardship and Science at a hearing in Hawaii.

Reviewed and commented on the draft *NPS Reference Manual #40: Dams and Appurtenant Works Maintenance, Operation, and Dam Safety.*

Provided technical review on the draft NPS Native Plant Revegetation Framework.

Provided technical review of the Marine Resources Monitoring chapter of the new Geological Resources Monitoring Manual being developed by the Geological Resources Division.

Responded to public water resource inquiries generated by NPS Internet Web Site.

Maintained WRD's Resource Room Collection of water resource related publications for use by NPS aquatic professionals.

Continued updating and distributing handouts for parks on subjects such as deicers, dust suppressants, detection probabilities, and chlorophyll.

Participated in the WASO Hydrology/Dams Committee.

TECHNICAL ASSISTANCE VITAL SIGNS MONITORING NETWORKS

I & M PROGRAMWIDE SUPPORT

Provided technical and programmatic guidance support to the Vital Signs Program through response to queries from network staff regarding water quality monitoring, protocol development, core parameter monitoring, compliance with detailed monitoring plan requirements (checklist), network monitoring plan and protocol reviews, and water quality data management.

Provided reviews of Annual Administrative Report and Work Plans for the Arctic, Central Alaska, Mediterranean Coast, Northeast Temperate, Northern Colorado Plateau, Rocky Mountain, Southwest Alaska, and Upper Columbia Basin Networks.

Established the WRD Vital Signs web page to host WRD generated guidance documents and other key information that could be useful to network aquatic resource monitoring staff in their plan and protocol development.

Maintained *Part E. Draft Guidance on Data Reporting and Archiving in STORET* of the overall *Guidance on Water Quality, Contaminants, and Aquatic Biology Vital Signs Monitoring under the Natural Resource Challenge* posted on the Servicewide I & M Program website.

Provided quality assured and edited NPSSTORET back-end support to the Appalachian Highlands, Cumberland – Piedmont, and Greater Yellowstone Networks.

Monitored ongoing revisions to continuous monitoring protocols being implemented by the USGS to determine what procedures and

methodologies may best be adopted by the Vital Signs Program.

Participated in the 4th Annual I & M Meeting of the Networks. WRD provided a presentation on "Vital Signs Data Management and Archiving."

Participated in the Vital Signs Monitoring Plan "Review-a-thon."

Appalachian Highlands Network

Reviewed Phase 3 Vital Signs monitoring plan and water quality protocols / Standard Operating Procedures (SOPs) and other documents.

Provided advice on the selection of STORET characteristics.

Arctic Network

Initiated a task agreement for the completion of coastal water resources / coastal watershed condition assessments for Cape Krusenstern National Monument and Bering Land Bridge National Preserve.

Chihuahuan Desert Network

Provided a water quality station summary for Carlsbad Caverns National Park.

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Reports in PDF format for parks in the Chihuahuan Desert.

Cumberland / Piedmont Network

Reviewed Phase 3 Vital Signs monitoring plan and commented on network water quality SOPs and protocol narratives.

Eastern Rivers and Mountains Network

Participated in the Eastern Rivers and Mountains Network Vital Signs workshop held at Penn State University.

Provided Level 1 inventory water quality data inventory file format documentation.

Great Lakes Network

Reviewed draft documents and provided technical input to assist in the detailed planning for Vital Signs monitoring.

Provided background information on determining park study areas and which water quality stations are located within park boundaries.

Assisted in the final review and publication of a technical report entitled *Aquatic Studies in National Parks of the Upper Great Lake States: Past and Future Efforts* by Brenda Moraska LaFrancois and Jay Glase (Technical Report NPS/NRWRD/NRTR-2005/334).

Initiated task agreements for the completion of coastal water resources / coastal watershed condition assessments for Indiana Dunes National Lakeshore, Apostle Islands National Lakeshore and Pictured Rocks National Lakeshore.

Greater Yellowstone Network

Participated in the network water quality workshop and provided training to network staff on use of multi-parameter water quality monitoring instruments.

Completed review and provided comments to network staff on water quality protocol narratives and SOPs.

Gulf Coast Network

Completed coastal water resources/coastal watershed condition assessment reports for Padre Island National Seashore and Gulf Islands National Seashore.

Met with network staff to discuss progress on analyzing past data and other Phase 1 and Phase 2 tasks.

Heartland Network

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Report, data files, metadata, and other information to

the Central Plains Center for BioAssessment.

Provided information on importing stations and results into NPSTORET.

Reviewed draft documents and provided advice on developing optimal survey designs.

Klamath Network

Provided technical review and comment on the proposed Klamath Network Inventory and Monitoring Program project to inventory wetland conditions.

Provided assistance for the initiation of a Level 1 water quality inventory and reviewed water quality portions of draft Phase 2 monitoring report.

Mediterranean Coast Network

Initiated a task agreement for the completion of coastal water resources / coastal watershed condition assessments for Cabrillo National Monument and Channel Islands National Park.

Provided technical assistance on alternative approaches to monitoring.

Mid-Atlantic Network

Provided Clean Water Act 303(d) designated use and impairment information and GIS coverages.

Provided copies of the Baseline Water Quality Data Inventory and Analysis (Horizon) Report datasets, including complete disk replacements.

Mojave Desert Network

Provided oversight on WRD funded project "Assessment of Ground-water Resources in the Mojave Network: Hydrogeological Framework."

Provided advice and assisted in prioritization of water resource monitoring needs.

Provided copies of the Baseline Water Quality Data Inventory and Analysis (Horizon) Report datasets for Death Valley National Park.

North Coast and Cascades Network

Provided programmatic oversight for a WRD funded, multi-park project entitled "Assess Impairment of Water Quality and Biological Integrity through the Use of Invertebrates."

Provided network staff with comments on Abundance/Biomass Comparison (ABC) indicator and methods and diel variation in nutrients, chlorophyll, TDS, and flow.

Finalized a modification to task agreement to include a GIS component in the coastal resources / coastal watershed condition assessment projects for Olympic National Park, Lewis and Clark National Historical Park, Ebey's Landing National Historical Reserve, and San Juan Island National Historical Park.

Northeast Coastal and Barrier Network

Provided network staff with updated information on nutrients, remote sensing, survey designs, minimum sample sizes, and minimum detectable differences.

Northern Colorado Plateau Network

Provided review and comment on network water quality data flow and coordination with the State of Utah Department of Environmental Quality.

Northern Great Plains Network

Provided guidance on the acquisition of Clean Water Act impairment and Outstanding National Resource Waters information.

Pacific Island Network

Continued to work with University of Hawaii cooperator in the completion of coastal resources / coastal watershed assessment reports for Kalaupapa National Historical Park, Kaloko-Honokōhau National Historical Park, Pu'uhonua o Hōnaunau National Historical Park, and Pu'ukoholā Heiau National Historic Site.

Provided digital GIS data files for each park in the network containing the locations of water quality monitoring stations.

Reviewed water quality technical documents related to analyses of past data, advised park on staffing alternatives, and provided input into monitoring design options.

Rocky Mountain Network

Attended the network Vital Signs workshop held in Rocky Mountain National Park and participated in the aquatic resource breakout vital signs identification and prioritization process.

Provided network with information on stream level/order in the National Hydrography Dataset.

San Francisco Bay Area Network

Reviewed draft protocol and SOPs for water quality monitoring and suggested approaches for improvements in detection limits for nutrients, bacteria provisions, sample size requirements, representativeness, and data comparability.

Participated in scoping discussions with the California Sea Grant cooperators during the early phases of the development of coastal resources / coastal watershed condition assessment projects for Point Reyes National Seashore and Golden Gate National Recreation Area.

Provided network staff information on Level 1 data transmittal from USGS and importing into STORET and NPSTORET.

Provided network staff with the final Baseline Water Quality Data Inventory and Analysis (Horizon) Report.

Sonoran Desert Network

Provided network staff with recent WRD guidance on power analyses and Minimum Detectable Differences vs. sample designs.

South Florida / Caribbean Network

Initiated a task agreement for the completion of coastal water resources / coastal watershed condition assessments for Virgin Islands Coral Reef National Monument, Virgin Islands National Park, Buck Island Reef National Monument, and Salt River Bay National Historical Park.

Southeast Alaska Network

Continued to provide programmatic oversight for coastal water resources/coastal watershed condition assessments for Glacier Bay National Park and Preserve, Klondike Gold Rush National Historical Park, and Sitka National Historical Park.

Southeast Coast Network

Continued to provide programmatic oversight for coastal water resources / coastal watershed condition assessments for Cape Hatteras National Seashore, Cape Lookout National Seashore, Cumberland Island National Seashore, Fort Pulaski National Monument, Canaveral National Seashore, and Timucuan Ecological and Historic Preserve.

Participated in Water Quality Scoping Meeting to assist the network in developing a water quality monitoring plan.

Provided *Clean Water Act* 303(d) designated use and impairment information and GIS coverages.

Southern Colorado Plateau Network

Provided network staff with state STORET contact information.

Southern Plains Network

Participated in the network's Aquatic and Landscape Conceptual Model Workshop which identified management issues that affect the quality of the aquatic resources and the candidate indicator vital signs for network parks.

Southwest Alaska Network

Initiated a task agreement for the completion of coastal water resources / coastal watershed condition assessments for Aniakchak National Monument and Preserve, Katmai National Park and Preserve, Kenai Fjords National Park, and Lake Clark National Park and Preserve.

Imported modern STORET Data Warehouse data into NPSTORET.

Upper Columbia Basin Network

Provided digital water quality and station location databases from the Baseline Water Quality Data Inventory and Analysis (Horizon) Reports.

TECHNICAL ASSISTANCE REGIONS AND PARKS

ALASKA REGION

Advised regional office staff regarding requirements of in-holders for compliance with *DO #77-1: Wetland Protection* on rights-of-way.

Denali National Park and Preserve

Provided programmatic oversight, technical review, and publication support in the completion of the Denali *National Park and Preserve Water Resources Issues and Information Overview Report* (Technical Report NPS/NRWRD/NRTR-2005/341).

Provided programmatic oversight for a project to assess the hydrology along a state-proposed road corridor through a remote portion of the park.

Advised regional staff regarding NPS wetland compliance requirements for construction of the proposed Savage Camp Rest Stop.

Obtained, entered, reformatted, and quality assured and edited a variety of water quality data for upload to new STORET.

Glacier Bay National Park and Preserve

Provided technical guidance to in developing new projects aimed at understanding changes occurring in the East Alsek River hydrology and geomorphology and their effects on sockeye salmon productivity.

Katmai National Park and Preserve

Provided programmatic oversight and technical review/comment for the draft *Katmai National Park and Preserve's Water Resources Management Plan*.

Kenai Fjords National Park

Conducted flood hazard assessments and developed strategies for mitigation for several developed sites within Kenai Fjords National Park.

Klondike Gold Rush National Historical Park

Reviewed and approved the final completion report for the restoration of Nelson Slough in the Taiya River estuary.

Lake Clark National Park and Preserve

Provided technical review/comment on final report for a BRMD funded project addressing the abundance and distribution of spawning sockeye salmon.

Assisted in the technical review of the *Baseline Environmental Study Plan for the Pebble Mine Project*.

Provided programmatic oversight and technical support for a WRD funded project entitled "Characterization of Water Quality, Hydrology and Aquatic Biology in the Kijik River Basin."

Sitka National Historical Park

Provided technical review/comment on the draft *Sitka National Historical Park Seashore Coastal Resource / Coastal Watershed Condition Assessment*.

Wrangell-St. Elias National Park and Preserve

Provided technical review of the final accomplishment report for a project entitled "Investigate Limnological Conditions in Tanada Lake affecting Sockeye Salmon Production."

Provided technical review of the draft *Coastal Resources / Coastal Watershed Condition Assessment at Wrangell-St. Elias National Park and Preserve*.

Provided policy and technical review of the draft *Wetland Statement of Findings for the Twin Lakes Campground Rehabilitation and Expansion, Wrangell-St. Elias National Park and Preserve*.

Provided programmatic oversight and technical review for a study addressing stream stability issues for National Creek as it flows through the Kennicott Historic District.

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

Yukon-Charley Rivers National Preserve

Obtained, entered, reformatted, and quality assured and edited a variety of water quality data for upload to new STORET.

INTERMOUNTAIN REGION

Represented the NPS in the cooperating agencies group for the *Flaming Gorge Dam Operations EI.S.*

Provided support to the Department of Justice regarding the *Montana Reserved Water Rights Compact*.

Assisted the Office of the Solicitor and Department of Justice in preparing a motion for formatting hydrographic survey reports for NPS units in the Gila River General Adjudication.

Provided input to the Intermountain Region regarding the Yampa Basin Management Plan, in particular non-native fish control and plans to enlarge Elkhead Reservoir for the purpose of enhancing base flows for endangered fishes.

Served as members of the Colorado River Technical Group and Steering Committee. Followed EIS process of DOE on Moab uranium mill tailings site and their decision to recommend preferred alternatives for active

pump and treat ground-water remediation and off-site repository placement at Crescent Junction, UT.

Continued to review and coordinate with park representatives the monitoring of DOE ground-water remediation activities and technical work products/reports developed for the Moab uranium mill tailings site.

Amistad National Recreation Area

Reviewed and commented on the draft *Amistad National Recreation Area General Management Plan*.

Arches National Park

Reviewed and responded to comments from the Utah School and Institutional Trust Lands Administration to the Core Provisions for settlement of reserved water rights.

Provided oversight and funding for spring flow measurements in Sevenmile Canyon and Courthouse Wash in support of water right negotiations.

Developed plan to determine age and origin of water in the Moab Member and Navajo Sandstone Aquifers.

Aztec Ruins National Monument

Assisted in preparation of a project proposal, a study plan, and implementation of a monitoring program to investigate the source of moisture in soils adjacent to ruins which threatens the stability and preservation of the ruins for future generations.

Bandelier National Monument

Reviewed floodplain statements of findings for utilities improvement project in Frijoles Canyon.

Bent's Old Fort National Historic Site

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

Reviewed and evaluated a proposal to reduce mosquito breeding habitat within the floodplain of the Arkansas River and evaluated the condition of an eroding irrigation channel.

Conducted channel stabilization reconnaissance and reviewed engineering diagrams.

Big Bend National Park

Advised park regarding wetland compliance requirements for 1) proposed culvert replacements and related activities in dry washes and 2) proposed reconstruction and maintenance of siltation ponds at Rio Grande Village.

Provided assistance to identify alternative water sources, hydrogeologic conditions, and test well drilling at Rio Grande Village and Panther Junction.

Big Hole National Battlefield

Provided technical oversight and management of data for the North Fork Big Hole River stream gage to protect decreed water rights.

Submitted annual water use report as required by the *NPS-Montana Water Rights Compact*.

Big Thicket National Preserve

Provided technical and policy review of Union Gas Operating Company's proposed BP Rafferty A-45 directional well drilling project. Provided comment on impacts to wetlands resulting from stormwater runoff into park wetlands and from potential spills.

Provided technical and policy review of Union Gas Operating Company's proposed Bertrand-Nelson directional well drilling project. Evaluated potential impacts to wetlands in the park and recommended additional studies.

Provided technical and policy review of *Sanchez Oil and Gas Corporation Plan of Operations to Drill and Produce the WM Rice #1 Well*

proposal inside the Turkey Creek Unit.

Provided technical and policy review of the Davis Brothers Application for an Exemption for its *Salisbury#1 Well in Jack Gore Baygall Unit*. Comments were used to revise wetland mitigation measures and reduce wetland impacts.

Assessed wetland damage assessment for Evadale train derailment.

Reviewed Texas law concerning instream uses based upon riparian rights.

Provided recommendations to the environmental contractor conducting the investigation of Site 80 to determine if residual soil and ground-water contamination remained from past oil and gas operations.

Bighorn Canyon National Recreation Area

Submitted annual water use report for park as required by the *NPS-Montana Water Rights Compact*.

Provided information to the Department of Justice concerning park water rights in the Bighorn Basin Phase II decree.

Provided hydrogeologic analysis and recommendations for well construction at Lovell maintenance shop.

Black Canyon of the Gunnison National Park

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

Provided technical input to the park and region pertaining to flow recommendations for endangered fish and the *Aspinall Project EIS*.

Conducted hydrogeologic assessment of both the North and South Rim areas and provided reports identifying potential well locations.

Identified several issues related to surplus irrigation draining into the park through Red Rock Canyon.

Canyon de Chelly National Monument

Provided programmatic oversight for a project to develop servicewide concepts for riparian habitat & stream restoration within Canyon de Chelly National Monument.

Reviewed and commented on draft wetland and riparian area "desired conditions" being prepared for the draft *Canyon de Chelly National Monument General Management Plan*.

Capitol Reef National Park

Continued project work related to quantification of state prior appropriation and federal reserved water rights.

Filed water right claim for a state appropriative right for the Pleasant Creek well at Sleeping Rainbow Ranch.

Filed protest to Wayne County change of point of diversion application.

Filed PROOF for Fremont River water well.

Completed field review and provide input to park staff on potential approaches to reconnecting and restoring an abandoned oxbow on the Fremont River.

Reviewed *Floodplain Statements of Findings for the Highway 24 Project*.

Carlsbad Caverns National Park

Prepared study plan to protect the water and water related resources of Lechuguilla Cave.

Provided recommendations for monitoring spring discharge and restoring natural flow at Rattlesnake Springs.

Continued oversight for stage gages in Sulphur Springs and Lake of the White Roses in Lechuguilla Cave.

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

Chaco Culture National Historical Park

Compiled history of ground-water exploration and hydrogeologic conditions and provided recommendations for long-term monitoring to identify potential threats to ground-water resources.

Conducted a repeat survey of cross sections of Chaco Wash using permanent endpoints.

Chickasaw National Recreation Area

Provided oversight for the operation of, and managed the data obtained from, two monitoring wells constructed in the Arbuckle-Simpson Aquifer.

Participated in technical advisory discussion on the Arbuckle-Simpson Aquifer study being conducted by the State of Oklahoma and the USGS.

Assisted Office of the Solicitor in negotiating resolution of NPS's protest of ground-water applications by the Meridian Aggregates Company.

Colorado National Monument

Evaluated water rights applications in Water Division 5 to determine impact of diversions on park water rights.

Curecanti National Recreation Area

Provided input to the park, region, and WRB on flow recommendations for endangered fish and the *Aspinall Project EIS*.

Provided assistance regarding wetlands policy and regulatory compliance for the park's *Draft Resource Protection Plan and EIS*.

Compiled water well records and provided hydrogeologic assessment of several developed areas.

Provided programmatic oversight and technical support for a WRD / NRPP funded project entitled "Data Collection and Analysis of Required Water Quality Parameters; Outstanding Waters Designation."

Devils Tower National Monument

Evaluated adverse impacts to wetlands that might result from road reconstruction activities, determined wetland compliance requirements, and advised park staff on how to avoid and minimize adverse impacts.

Dinosaur National Monument

Evaluated water rights applications in Water Division 6 to determine impact of diversions on park water rights.

Reviewed flow recommendations for Colorado River fishes with respect to park resources and water rights.

Provided technical review and revisions to a project completion report entitled *Movement, Migration, and Habitat Use by Colorado Pikeminnow (Ptychocheillus lucius) in a Regulated River below Flaming Gorge Dam, Utah*.

Provided hydrogeological analysis of headquarters area in support of design planning for a new septic leachfield.

El Malpais National Monument

Assisted Office of the Solicitor and Department of Justice in responding to motions regarding the guiet title action and water right claim preparation for the Zuni River Adjudication.

El Morro National Monument

Assisted Office of the Solicitor and Department of Justice in responding to motions regarding the quiet title action and water right claim preparation for the Zuni River Adjudication.

Florissant Fossil Beds National Monument

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

Obtained a water rights decree for A-frame well change application.

Conducted briefing of Chief of Maintenance and Acting Superintendent on the adequacy of park water rights to serve the planned visitor center.

Fossil Butte National Monument

Provided technical analysis and recommendations for reconstruction of collection system at a spring.

Gila Cliff Dwellings National Monument

Provided hydrogeologic assessment and information on water well construction.

Glacier National Park

Evaluated water right applications to determine impacts on park water rights pursuant to the *NPS-Montana Water Rights Compact* and filed objections when needed.

Provided water rights advice on use of water from Kelly Creek for hydropower purposes.

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

Provide programmatic oversight and guidance on the NRPP funded Lake McDonald fish and limnological studies.

Finalized a task order to continue to provide support for studies of native, fluvial, bull trout populations.

Visited the park and provided advice regarding the Going-to-the-Sun Road and the Divide Creek bridge in the Saint Mary District.

Coordinated the effort to acquire, QA, and incorporate park GIS hydrographic edits in the National Hydrography Dataset.

Glen Canyon National Recreation Area

Completed a final implementation plan to monitor the water quality impacts of personal watercraft.

Provided onsite technical assistance for restoring East End Spring on Navajo Point, where livestock grazing has caused severe vegetation damage and accelerated soil erosion, and Cottonwood Springs.

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Grand Canyon National Park

Assisted park with a spring monitoring program on the South Rim.

Provided funding to USGS to map the geology of the Cameron Quadrangle.

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Provided wetland technical evaluation and *DO #77-1* policy review of the *Draft Environmental Impact Statement for the Grand Canyon National Park's Fire Management Plan*. Obtained, entered, reformatted, and quality assured and edited a variety of water quality data for upload to new STORET.

Grand Teton National Park

Provided assistance to park in the development of strategies to secure and protect instream flows in the Gros Ventre River.

Reviewed and approved WRD funded project implementation plan entitled *Baseline Water Quality of Four Western Tributary Streams in the Upper Snake River Basin*.

Reviewed Wyoming water law and provided

park with information regarding ditch access and maintenance limitations.

Grand Teton National Park (Bill Jackson)

Reviewed an application for change in point of diversion and means of conveyance for an inholding and advised the park regarding consent for the change.

Met with staff and representatives of a local surveying company to discuss survey needs in the Gros Ventre Campground.

Evaluated lease and deed documents between the park and the Teton Valley Ranch.

Grant-Kohrs Ranch National Historic Site

Assisted park managers understanding impacts to park resources associated with a FEMA flood improvement project in the town of Deer Lodge, MT.

Great Sand Dunes National Park and Preserve

Completed draft final report for September 2004 seepage run on Deadman, Sand, Big Spring, and Little Spring Creeks.

Installed shallow ground-water monitoring wells on Big Spring, Little Spring, and Medano Creeks.

Completed resurvey of Dr. David Cooper's (Colorado State University) vegetation / ground-water transects.

Filed protest to Beck water right application.

Completed quality control / quality assurance review of historic surface water and well data.

Guadalupe Mountains National Park

Provided a water related policy review of the draft *Guadalupe Mountains National Park General Management Plan/EIS*.

Advised on the potential for impacts to park resources from ground-water withdrawals in the Dell City area associated with a proposed reverse osmosis plant.

Hovenweep National Monument

Evaluated water rights applications in Water Division 7 to determine impact of diversions on park water rights.

Submitted 2004 water use report for reserved water rights at springs to the State of Colorado.

Hubbell Trading Post National Historic Site

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Provided technical assistance in evaluation of water supply from an existing well.

John D. Rockefeller, Jr., Memorial Parkway

Served as key official for the project "Monitoring the Success of Wetland Restoration: Snake River Gravel Pit, John D. Rockefeller, Jr., Memorial Parkway."

Provided technical assistance for revegetation work at the Snake River Gravel Mine reclamation site. Helped park staff address the inadvertent introduction of a non-native sedge species during revegetation.

Assisted in developing a proposal and securing funding for a project titled "Prepare Final Reclamation Design for the Pond 5 Area at the Snake River Gravel Mine."

Provided hydrogeologic assessment of the Flagg Ranch area and identified location for a new well.

Lake Meredith National Recreation Area

Provided technical and policy review and evaluation of the *Wetland Statement of Findings for F-1 Gas Gathering Pipeline Replacement Project, Lake Meredith National Recreation Area*. Made recommendations for defining wetland impact areas and for determining the need for wetland compensation.

Provided technical and policy review and evaluation of the *Lake Meredith National Recreation Area Wetland Report*.

Provided technical and policy review and evaluation of wetland impacts from the *Re-Entry of Existing Natural Gas Well and Drill Dual Horizontal Air Laterals: Proposed Drilling Activity* proposal from adjacent land.

Little Bighorn Battlefield National Monument

Advised Denver Service Center staff regarding wetland compliance requirements for a proposed road reconstruction project. Provided oversight of the operation and maintenance of the Little Bighorn River gage to monitor decreed flows.

Submitted water use report as required by the *NPS-Montana Water Rights Compact*.

Mesa Verde National Park

Assisted Department of Justice in the preparation of a protest of water right application on the Mancos River.

Assessed erosion potential on several cultural sites impacted by recent wildfires. Made recommendations for advanced preparation of site protection treatments to be incorporated into future Burned Area Emergency Restoration Reports.

Evaluated water rights applications in Water Division 7 to determine impact of diversions on park water rights.

Provided technical oversight and funding for park operation of a stream gage on the Mancos River.

Assisted park with preparation of annual water use reports for the District Water Commissioner.

Montezuma Castle National Monument

Continued investigation to determine vulnerability of park water resources to ground-water withdrawals in the region and continued review of monitoring program.

Continued geophysical investigation to determine source of water issuing from Montezuma Well.

Provided oversight for park operation of two stream gages at Montezuma Well and operation of a stream gage on Wet Beaver Creek and funded the operation of a USGS stream gage on Beaver Creek at the Castle Unit.

Completed report on hydrogeology of the monument.

Continued preparation of project plan to quantify federal reserved rights for the Verde River Adjudication.

Natural Bridges National Monument

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Reports in PDF format.

Padre Island National Seashore

A watershed condition assessment report entitled Assessment of *Coastal Water Resources and Watershed Conditions at Padre Island National Seashore* (Technical Report NPS/NRWRD/NRTR-2004/323) was completed and published through a cooperative effort among the Center for Coastal Studies (Texas

A&M University), Padre Island National Seashore, and WRD.

Evaluated the feasibility of reclaiming a six-acre portion of the Malaquite Visitor Center parking lot to wetland habitat.

Provided technical and policy review and evaluation of the *Environmental Assessment for the BNP Petroleum Corporation, Dunn-Peach #2, 3, 4, 5, and 6 Wells* proposal.

Provided technical and policy review and evaluation of the *Wetland Statement of Findings for the Bird Island Basin Recreational Use Plan*.

Palo Alto Battlefield National Historic Site

Served as key official and assisted in developing a revised study plan for the final year of the project "Restore Resaca Wetlands and Associated Habitats, Phase II: Restoration Design."

Pecos National Historical Park

Initiated project plan to protect water rights.

Petrified Forest National Park

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Pipe Spring National Monument

Provided a water related policy review and technical comment on the draft *Pipe Spring National Monument General Management Plan/EIS*.

Assisted ongoing studies of geology and hydrogeology and causes of springflow reduction.

Rocky Mountain National Park

Assisted in the evaluation of the breach in the Grand River Ditch and the Resource Damage Assessment claims from the resulting debris flow and sedimentation of downstream wetlands.

Identified the study area and coordinated delivery of products from a LiDAR (Light Detection and Ranging) survey and georeferenced color aerial photography of the upper Colorado River valley funded through WRD.

Assisted in developing final design specifications for a wetland restoration at the former Glacier Creek Livery.

Assisted in developing the detailed study plan for the WRD funded project "Ecological Restoration of a Willow Carr that was Destroyed in the 1982 Lawn Lake Flood."

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

Collaborated on an analysis of historic flows in the creek below Long Draw Reservoir for assistance in flow negotiations.

Reviewed and approved a supplementary plan and budget for a BRMD funded project to restore greenback cutthroat trout (*Oncorhynchus clarki stomias)* to Hidden Valley Creek.

Provided policy and technical review and comment on an Environmental Assessment of the restoration and management of greenback cutthroat trout (*Oncorhynchus clarki stomias*).

Completed a task order to continue a Colorado State University study of factors affecting reintroduction success of Colorado River cutthroat trout within high mountain streams.

Participated in a park sponsored workshop to identify existing and potential future threats from nonnative species and to begin to identify potential strategies for reducing those threats.

Provided recommendations for a new well at Moraine Park.

Coordinated the installation, data collection, and retrieval of datasondes at a telemetry beta test site on the Big Thompson River with park staff and water quality instrument vendors (Hach-Hydrolab and In-Situ).

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Reports in PDF format for Hovenweep and Natural Bridges National Monuments.

Reviewed proposed Watershed Assessment Project "Evaluation of Environmental Estrogen Exposure in Fishes from Rocky Mountain National Park."

Saguaro National Park

Continued preparing draft report describing water rights and use along Rincon Creek to support the instream-flow water right application.

Operated three stream gages on Rincon Creek to support the instream-flow water right application.

Continued oversight and funding for hydrologic and macroinvertebrate, riparian and emergent vegetation, and aquatic herpetofauna studies to support the instream flow water right application on Rincon Creek.

Provided technical review and comment on a proposal for habitat restoration and reestablishment of lowland leopard frogs.

Consulted with park staff regarding the need for a *Clean Water Ac*t Section 404 permit for road maintenance in arroyos.

Salinas Pueblo Missions National Monument

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Sand Creek Massacre National Historic Site

Provided onsite technical assistance for watershed and wetland restoration and management. Recommended a plan of action for restoring an artificial channel and maintaining wetland conditions while allowing public access.

Completed and published a technical report titled *A Preliminary Assessment of Wetland, Riparian, Geomorphology, and Floodplain Conditions at Sand Creek Massacre National Historic Site, Colorado* (Technical Report NPS/NRWRD/NRTR-2005/335).

Participated in the park's General Management Plan Development Workshop.

Conducted floodplain analysis for a proposed visitor center site.

Conducted analysis of potential for streamflow depletion from pumping ground water.

Sunset Crater Volcano National Monument

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Tumacocori National Historic Park

Provided technical and policy review and evaluation of wetland resources.

Walnut Canyon National Monument

Assisted with development of a Governmental Agreement and a Technical Advisory Charter to implement the water rights agreement between the U.S. and the City of Flagstaff.

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Washita Battlefield National Historic Site

Served as key official for the ongoing study by Oklahoma State University titled "Conduct a Riparian Corridor Restoration Study at Washita Battlefield NHS."

White Sands National Monument

Provided hydrogeologic analysis and assessment of potential impacts of ground-water pumping and desalinization plant at Alamogordo.

Wupatki National Monument

Participated in water right settlement discussions for the Lower Colorado River Adjudication.

Provided a compilation and analysis of water well construction information.

Yellowstone National Park

Evaluated water right applications to determine impacts on park water rights and filed objections when needed.

Submitted annual water use report to the State of Montana as required by the *NPS-Montana Water Rights Compact*.

Assisted USFS legal counsel with proposed water rights transfers from Royal Teton Ranch to the United States.

Briefed park management on USFS La Duke Hot Spring agreement and abandonment of the Royal Teton Ranch well.

Thermal pools in Yellowstone National Park (Bill Jackson).

Reviewed report by Yellowstone Controlled Ground-water Area Technical Oversight Committee on ground-water pumping in the Big Sky area.

Coordinated with park and USFS on water delivery issues under Reese Creek water rights settlement.

Provided water rights assistance to obtain a temporary water right associated with the East Entrance construction project.

Provided comments to the USFS on *Agency Review Draft of 2005/2006 Work Plan for the New World Mining Project Response and Restoration Project*.

With the State of Montana, installed monitoring wells at the proposed repository site for the McLaren tailings. Also, obtained an agreement from the state to install transducers that would provide continuous monitoring of ground-water levels in the coming year.

Reviewed and provided comments on several documents generated by park staff relating turbidity impacts to Mammoth Crystal Springs to quarry operations at Sylvan Pass.

Coordinated the effort to acquire, quality assure, and incorporate park GIS hydrographic edits in the National Hydrography Dataset and link SONYEW attributes to reach codes.

Conducted detailed floodplain survey at three sites.

Zion National Park

Evaluated water rights applications to determine consistency with the Zion Water Rights Agreement and to evaluate impacts of diversions on park water rights.

Reviewed progress report for WRD study "Develop Standards and Indicators for Aquatic Invertebrates" and provided technical advice on practical ways to control mea-

surement precision and determine needed sample sizes.

Zion National Park (Bill Van Liew)

MIDWEST REGION

Assisted regional staff with wetland compliance for a proposed bridge replacement on the Vermillion River (eligible for designation as a National Wild and Scenic River.)

Agate Fossil Beds National Monument

Prepared final report describing hydrogeology and water resources of the park.

Apostle Islands National Lakeshore

Participated in scoping and assessment meetings with Apostle Island National Lakeshore, Great Lakes Inventory & Monitoring Network, and University of Wisconsin (Stevens Point) cooperators in order to initiate the "Apostle Island National Seashore Coastal Water Resources and Watershed Condition Assessment Project."

Provided a review of the draft *Project Agreement for the Apostle Islands National Lakeshore General Management Plan/EIS*.

Buffalo National River

Provided programmatic oversight and technical review in support of freshwater mussel study on the Buffalo River.

Provided assistance to the park for their participation on the Technical Group for the Bear Creek Dam proposal.

Provided programmatic oversight and approved the implementation plan for the study entitled "An Assessment of Macroinvertebrate Communities at Buffalo National River Water Monitoring Stations."

Continued to serve as WRD project officer for "Characterization of Macroinvertebrate Community and Drift in a Tributary of Buffalo National River, Prior to Damming; provided input on how to determine adequate sample sizes for invertebrate and hellbender monitoring; and provided technical review of the final accomplishment report."

Provided a detail review and analysis of the State of Arkansas' storage of the park's water quality data in STORET.

Continued as WRD Project Coordinator for NRPC funded project entitled "Delineate and Characterize the Karst Ground-water Recharge Zone of Tomahawk Creek."

Cuyahoga Valley National Park

Advised resource management staff regarding NPS wetland policy and federal compliance requirements for a proposal to install drain tiles in an agricultural lease area.

Provided technical and policy review and evaluation of the draft *Combined Wetland and Floodplain Statement of Findings for the SUM-271-8.02 Bridge Replacement Project, Cuyahoga Valley National Park*.

Reviewed and provided recommendations on incorporating data from a long-term water quality monitoring program into NPSTORET and STORET.

Effigy Mounds National Monument

Provided a review of the draft *Project Agreement for the Effigy Mounds National Monument General Management Plan/EIS*.

Fort Union Trading Post National Historic Site

Provided consultation on issues related to the Missouri River, particularly on various proposals to stabilize river banks. Met with the Geologist in the Park and provided guidance on conducting geomorphic studies.

Provided analysis of existing water supply well and recommendations for construction of a new well.

Herbert Hoover National Historic Site

Provided comments to park staff on a stream restoration plan for Hoover Creek and the associated NEPA documents.

Indiana Dunes National Lakeshore

Reviewed and approved the detailed study plan for the completion of the "Derby Ditch Great Marsh Restoration Project," which will result in the restoration of 500 acres of wetlands.

Participated in scoping and assessment meetings with the park and Michigan State University cooperator in order to initiate the "Indiana Dunes National Lakeshore Coastal Water Resources and Watershed Condition Assessment Project."

Continued coordination with park in the review of EPA and Potentially Responsible Party's proposed Remedial Investigation/ Feasibility Study and resulting negotiated work plan for the Pines Superfund Alternative Site characterization.

Reviewed and submitted comments to park on the *Northern Indiana Public Service Company's Bailly Generating Plant RCRA Facility Investigation Workplan and Current Conditions Report*.

Isle Royale National Park

Provided technical assistance to park and FWS staff, who are working to complete the *Isle Royale Fishery Management Plan*.

Provided policy and technical review of the draft *Isle Royale National Park Water Resources Management Plan*.

Provided programmatic oversight on WRD funded project "Assess Hydrocarbon Threats to Park Waters."

Knife River Indian Village National Historic Site

Provided background information and guidance to a Geologist in the Park to conduct a geomorphic study of the Knife and Missouri Rivers adjacent to the historic site.

Lincoln Boyhood National Memorial

Provided a water related policy review of the draft *Lincoln Boyhood National Memorial General Management Plan/EIS*.

Mississippi National River and Recreation Area

Participated in a water resources issues workshop convened to identify the range of water related management issues affecting the park as an initial step in the development of a water resources information and issues overview report for the park.

Missouri National Recreational River

Co-authored and published the *Missouri National Recreational River Water Resources Information and Issues Overview Report* (Technical Report NPS/NRWRD/NRTR-2005/326). This report summarizes the existing hydrological, chemical, and aquatic biological resource information for the parks and identifies and analyzes the major water resource issues facing park management.

Provided technical assistance in identifying potential impacts of emergent sandbar construction on aquatic organisms, including the endangered pallid sturgeon (*Scaphirhynchus albus*) in support of a NPS Wild and Scenic Rivers Act Section 7 determination on the Missouri River.

Provided ongoing review and technical comments on the preparation of an EIS on the cumulative impacts of bank stabilization projects (Section 33 Program).

Attended the Spring Rise Process (a series of workshops in a seven state area with stakeholders involved with the Missouri River) of evaluating alternative flow patterns to comply with the Endangered Species Act Biologic Opinion for the pallid sturgeon.

Niobrara National Scenic River

Assisted park in the development of strategies to secure and protect flows in the Niobrara River.

Ozark National Scenic Riverways

Provided assistance regarding the local hydrogeology and potential impacts of lead mining in the park's watershed.

Provided review and comments on proposed amendments to the State of Missouri Water Quality Standards and Regulations.

Pictured Rocks National Lakeshore

Participated in scoping and assessment meetings with park and network staff and University of Wisconsin (Stevens Point) cooperators in order to initiate the "Pictured Rocks National Seashore Coastal Water Resources and Watershed Condition Assessment Project."

Pipestone National Monument

Coordinated a technical assistance request to analyze the affects of a new development outside of the park on the potential for increase of flooding in Pipestone Creek.

Saint Croix National Scenic Riverway

Reviewed and approved the detailed study plan for the completion of the "Saint Croix River Management Environmental Histories Project." This project will reconstruct the ecological history of the river as a baseline for use in making management decisions regarding wetland protection and restoration.

Provided technical and policy review and evaluation of the Arrowhead-Weston Transmission Line Right-of-Way Crossing, at Saint Croix National Scenic Riverway. Recommended changes to minimize wetland impacts.

Provided oversight on WRD funded project "Simulation of ground-water/surface-water interaction in the St. Croix River Basin, Wisconsin and Minnesota."

Provided programmatic oversight and technical assistance for a WRD funded project

entitled "Historical Trends in Phosphorus Loading to the St. Croix National Scenic Riverway from Permitted Point Source Discharges and Development of an Index for Mercury in Fish Tissues of St. Croix River Basin."

Sleeping Bear Dunes National Lakeshore

Provided technical hydrology and water rights assistance related to Glen Lake / Crystal River water management issues.

Theodore Roosevelt National Park

Surveyed established cross sections on the Little Missouri River to detect floodplain evolution and channel movement.

Completed assessment of North Dakota law regarding general recognition of instream flow and values associated with instream flows.

Provided funding for the operation of the Watford City gage.

Voyageurs National Park

Provided programmatic oversight, policy review, and publication support in the completion of the *Voyageurs National Park's Water Resources Management Plan*, which was completed by cooperators at the University of Minnesota.

Reviewed and approved the final completion report for the Large Lake Management project. The park monitored and evaluated the effects of managed lake water levels on the aquatic macrophyte communities.

Provided technical review of a Master of Science thesis resulting from the BRMD funded project entitled "The Protection of Muskellunge in Shoepack Lake."

Reviewed progress reports and technical documents as WRD project officer on two projects entitled "Document changes in reservoir management on mercury accumulation in fish and other components of the aquatic ecosystem of Voyageurs National Park" and "Impacts of forest fires on levels of mercury in lake and forest environments."

NATIONAL CAPITAL REGION

Reviewed and provided comment on the study implementation plan for assessing freshwater mussel habitat within selected park units of the National Capital Region.

Reviewed floodplain statements of findings for Anacostia Riverwalk project.

Provided programmatic oversight and technical support for a WRD funded project entitled "Assess condition and identify stressors of aquatic resources in the National Capital Region."

Reviewed final report and provided comments on improving quality assurance project plans for environmental monitoring and continuing study entitled "Baseline water resource inventory to support aquatic and watershed management activities in National Capital Region parks."

Catoctin Mountain Park

Observed effects of recent high water events and provided recommendations to park staff related to infrastructure concerns.

Chesapeake and Ohio Canal National Historical Park

Provided final review and comment on the COE's Solids Management EIS for the Washington Aqueduct.

George Washington Memorial Parkway

Provided water related policy review of a draft *General Management Plan/EIS for Great Falls Park (Virginia) Unit.*

Visited park and provided advice to park managers and the Denver Service Center about how to address flood hazard for pro-

posed new infrastructure.

Participated in a workshop for the NRPP funded project "Should We Restore Dyke Marsh? – A Management Dilemma Facing George Washington Memorial Parkway." The purpose was to review data and information prepared by the University of Maryland investigators, identify any critical data gaps, and discuss feasibility of preliminary restoration alternatives.

Assisted in developing a proposal and obtaining funding for a project titled "Evaluate Sediment Accretion and Subsidence for Dyke Marsh Restoration Planning Using Rod Surface Elevation Tables (SET)."

Reviewed and approved the final completion report for the Potomac Gorge Wetland Inventory project at George Washington Memorial Parkway.

Provided technical review and comment on an annual progress report for study of shortnose sturgeon (*Acipenser brevirostrum*) in the Potomac River at Great Falls.

Harpers Ferry National Historical Park

Advised regional staff regarding wetland compliance requirements for proposed modifications to the John Brown Fort foundation.

Monocacy National Battlefield

Provided policy and technical review and comments of the draft *Monocacy National Battlefield General Management Plan/ EIS*.

Rock Creek Park

Provided technical advice on wetland delineation issues and compliance requirements related to the proposed Rock Creek Park Beach Drive Road reconstruction project.

NORTHEAST REGION

Reviewed and provided comment on the study implementation plan for assessing freshwater mussel habitat within selected units of the Northeast Region.

Provided water related policy review of the "Niagara Heritage Special Resource Study."

Acadia National Park

Provided technical assistance to the park with fishery management issues and representation with the State of Maine Department of Inland Fish and Wildlife.

Provided programmatic oversight on WRD funded project entitled "Determining wetland susceptibility to hydrologic stresses in Acadia National Park."

Provided programmatic oversight for an NRPC funded project entitled "Assessment of Current and Historic Atmospheric Deposition of Toxic Contaminants at Acadia National Park, Maine."

Assateague Island National Seashore

Provided technical review and comment on the draft *Statement of Findings for Floodplains and Wetlands for Improvements to Island Facilities and Infrastructure at Assateague Island National Seashore*.

Provided programmatic oversight on a WRD funded project entitled "Conduct surveys to characterize direct ground-water discharge to the coastal bays."

Cape Cod National Seashore

Reviewed and approved the final completion report for the "Dune Slack Wetland Management Project" at Cape Cod National Seashore.

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

Provided review and recommendations on interfacing the Natural Resource Database Template with NPSTORET.

Incorporated suggested database improvements into NPSTORET.

Provided STORET EDD terminology list.

Colonial National Historical Park

Provided STORET database structures and field names for a project being conducted by the College of William & Mary.

Helped park staff review various contaminants reports dealing with Superfund Site 12, Ballard Creek, and for mercury.

Delaware Water Gap National Recreation Area

Participated in a multidisciplinary team tasked with developing recommendations for repair of infrastructure damaged during a large magnitude flood in April 2005.

Provided technical consultation and assistance on an instream flow study being conducted by the Delaware River Basin Commission and provided recommendations for habitat classification criteria within the study modeling programs.

Provided technical and policy review and evaluation of the *Wetland Statement of Findings for the Columbia Gas Transmission Corporation line 1278 Replacement Project at Delaware Water Gap National Recreation Area*.

Provided technical review for a study report on the ecological status and fish distribution within the Eight-Mile River, a tributary to the Delaware River.

Advised park staff regarding NPS policy and procedures related to acceptance of Clean Water Act Section 404 mitigation money.

Provided programmatic oversight and technical support for a WRD funded projects entitled "Regional Point Source Management to Support Special Protection Water Quality Regulations" and "Existing Water Quality for Development of Special Protection Waters Regulations."

Provided park staff with updated summary information on dust control and deicer compounds.

Eisenhower National Historic Site

Provided technical review on the revised draft final report for a WRD funded study entitled "The Effects of Municipal Water Supply System Operations on Aquatic Habitat In Marsh Creek, Gettysburg, Pennsylvania."

Erie Canalway National Heritage Corridor

Provided a water related policy review of the draft *Erie Canalway National Heritage Corridor Management Plan*.

Fire Island National Seashore

Provided review comments on a draft *Wetland Statement of Findings for the Fire Island National Seashore Sailor's Haven Marina and Ferry Dock Project*.

Provided technical and policy review and evaluation of an Environmental Assessment and a *Draft Statement of Findings for Wetlands and Floodplains for the Construction of the New West-end Entrance Station, Fire Island National Seashore*.

Provided technical and policy review and evaluation of the draft *Wetland Statement of Findings for the Fire Management Plan at Fire Island National Seashore*.

Provided programmatic oversight on an NRPP funded project "Simulation of the Shallow Ground-Water Flow System."

Fort McHenry National Monument and Historic Shrine

Provided technical review and comment on the *Draft Tiered Environmental Impact Statement for the Baltimore Harbor and Channels*

Dredged Material Management Plan Project for any potential adverse impacts.

Gateway National Recreation Area

Provided programmatic oversight and technical review for the "Big Egg Marsh Experimental Restoration Project."

Manassas National Battlefield Park

Provided a water related policy review of the draft *Manassas National Battlefield Park General Management Plan / EIS*.

Minute Man National Historic Park

Provided technical review and evaluation of the construction drawings for the fourteen-acre Battle Road wetland and stream restoration.

Morristown National Historical Park

Obtained, entered, reformatted, and quality assured and edited data from the park's ongoing water quality monitoring program and other historical projects for upload to new STORET.

New River Gorge National River

Provided programmatic oversight for an NRPC funded project entitled "Technical Evaluation of Water Quality Monitoring Program."

Participated in the NERI-hosted water quality program review and provided follow-up comments/recommendations to meeting organizers.

Saint-Gaudens National Historic Site

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Data set.

Shenandoah National Park

Provided hydrogeologic analysis and recommendations for repair/rehab of several water supply systems in the park.

Provided recommendations associated with erosion of Rapidan Creek near Herbert Hoover's cabin.

Provided programmatic oversight on an NRPP funded project entitled "Hydrology of Big Meadows, Shenandoah National Park, Virginia: Assessment of a Sensitive Wetland System in the Blue Ridge Mountains."

Valley Forge National Historical Park

Advised consultants to the park regarding wetland compliance requirements for a proposed dam removal project.

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Weir Farm National Historic Site

Provided technical review and comment on the need for, and type of, wetland compliance from the COE and NPS for the construction of a new maintenance and cultural facility on nine acres of the park.

PACIFIC WEST REGION

Provided briefings for the DOI liaison to the Southern Nevada Water Authority (SNWA) on water rights issues at Death Valley National Park, Lake Mead National Recreation Area, and Great Basin National Park.

Researched California water rights law and requirements to protect riparian rights and instream flows.

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

Notified California parks of the Office of the Solicitor's advice to not pay the fees assessed by the State of California for NPS licensed rights.

Cabrillo National Monument

Obtained, entered, reformatted, and quality

assured and edited additional water quality data for upload to new STORET in preparation for producing a Baseline Water Quality Data Inventory and Analysis Report.

Helped park and Navy staff with efforts to finish summarizing past data collected by the Navy near the park.

Channel Islands National Park

Co-authored a technical report titled *Riparian System Recovery after Removal of Livestock from Santa Rosa Island, Channel Islands National Park, California* (Technical Report NPS/NRWRD/NRTR- 2004/324). The report documents recovery of stream and floodplain morphology and riparian-wetland vegetation six years after cattle were removed and deer populations were reduced on the island.

Provided on-site technical assistance for the proposed Prisoners Harbor wetland restoration project. Assistance included establishing a wetland "reference area" as a model for restoration, sampling original (buried) soils for green-house seed germination testing, conducting soil pit investigations to determine depths and areal extent of fill, and topographic surveying for use in calculating fill removal quantities and for hydrologic modeling.

Provided technical review and comment on the proposed *Environmental Assessment for the Construction of Two Bridges on Santa Rosa Island and the Finding of No Significant Impact to Construct Two Bridges on Santa Rosa Island, Channel Islands National Park.*

Provided ongoing advice to park and Denver Service Center staff on flood hazard in the Prisoners Harbor and Scorpion Creek areas and reviewed the *Floodplain Statements of Findings for Scorpion Developed Area.*

Crater Lake National Park

Provided consultation to park fishery biologist for development of a presentation on fishery management in the NPS to be given to local universities.

Completed scope of work for construction of a water well in the South Yard.

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

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Death Valley National Park

Provided technical assistance to Death Valley National Park on matters related to protecting Devils Hole and the Devils Hole pupfish (*Cyprinodon diabolis*). Assistance included participation in habitat modification, larval monitoring studies, and evaluation of refuge populations.

Provided presentations on efforts to protect the Devils Hole pupfish at the annual meeting of the Desert Fishes Council in Tucson, AZ, and at the Devils Hole Workshop in Death Valley, CA.

Provided technical assistance for ground-water and wetland studies related to proposed reconstruction of the Furnace Creek water collection system. Provided technical/policy review and comments on the draft *Wetland and Floodplain Statement of Findings for Reconstruction of the Furnace Creek Water Collection System at Death Valley National Park.*

Provided oversight and guidance to NPS consultant on the evaluation of the effects of proposed pumping by Southern Nevada Water Authority (SNWA) on Devils Hole. Secured negotiated agreement with SNWA that protects park water rights and enabled NPS to withdraw protest to SNWA change applications.

Evaluated Nevada water right applications for potential impacts to park resources and water rights. Filed protests when needed.

Continued discussions with Nye County, NV, and DOI bureaus for collaboration and coordination on water rights issues in the Death Valley region.

Assisted in the quantification of flood magnitude and frequency of the August 2004 flood in Furnace Creek.

Coordinated the preparation of a journal article entitled *Analytical-Regression Analysis of Stage Fluctuations in Devils Hole, Death Valley National Park, Nevada* by NPS consultants.

Provided oversight to NPS contractor conducting study of crustal deformation in the Devils Hole area.

Prepared evaluation of potential monitoring well locations near Devils Hole and executed agreement with USGS to drill and complete three wells.

Provided oversight for operation of, and managed data obtained from, spring flow and water level monitoring gages at Devils Hole and Texas, Travertine, and Nevares Springs.

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Report and databases.

Ebey's Landing National Historical Reserve

Provided policy review and comment on the water resources-related sections of the draft *Ebey's Landing National Historical Reserve General Management Plan/EIS*.

Drafted, for the park, initial and follow-up responses to a COE request for public comment on a maintenance and dredging project that will impact wetland areas.

Evaluated the existing ecological and hydrological conditions of Crockett Lake, a major wetland feature.

Golden Gate National Recreation Area

Completed a draft report entitled *Golden Gate National Recreation Area Water Resources Foundation for Planning and Management Report*, which is currently under review by the park and the General Management Planning Team.

Prepared a report *Preliminary Evaluation of Hydrologic Data Collected at the South Parking Lot at Stinson Beach*. The hydrologic and soil stratigraphy data are being used to evaluate the feasibility of restoring wetlands at the former Willow Camp Lake area, which were filled in the mid to late 1950's.

Provided technical review and comment on the report *Golden Gate National Recreation Area 2002-2004 Wetlands Inventory: Rodeo Valley, Lower Redwood Creek Watershed, Mori Point, and Bolinas Lagoon Sites*.

Provided technical review and comment on the report *Wetland Processes and Restoration Opportunities in the Rodeo Lagoon Watershed, Golden Gate National Recreation Area, Marin County, California*.

Researched chain of title to park lands regarding the severance of water rights in support of wetland restoration project and continued assessment of alternatives for water rights exchange in support of wetlands rehabilitation.

Provided technical review and comment on the draft *Hydrologic Feasibility Assessment Report for the Tennessee Hollow Watershed Project* for the Presidio of San Francisco.

Worked with park staff and private consultants to design a relevant study of alternative

bridge designs for Redwood Creek in the Muir Beach area.

Reviewed and commented on draft report *Evaluation of Fish and Habitat Characteristics Upstream and Downstream of Well in Redwood Creek, Marin County.*

Provided technical assistance on numerous water resource issues. Recommended erosion control treatments on a small wildfire in an urban area. Surveyed wells for a wetland restoration at Stinson Beach. Examined numerous road and trail sites at Fort Cronkite needing erosion reduction.

Continued helping the park with technical assistance and document review related to pharmaceuticals and the active ingredients in personal care products in runoff from irrigation of Crissy field with treated sewage. Advised park on nutrient issues in Rodeo Lagoon.

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

Great Basin National Park

Provided technical oversight of USGS hydrologic and geophysical studies to determine susceptibility of park water resources to ground-water pumping adjacent to the park.

Presented overview of water right protection efforts and a written hydrogeologic analysis in response to a NEPA scoping request by USDA Rural Development, regarding application by Baker Water and Sewer General Improvement District (BGID) for a water supply well and NPS concerns about pumping effects on Lehman Caves.

Assisted park and region management in discussions with USDA and State of Nevada to resolve the NPS protest of BGID's water right application by trying to find consensus on water supply alternatives.

Presented to White Pine County Water Advisory Committee NPS's perspective on water issues which could affect park water resources, water resources that are potentially susceptible to the effects of pumping, and NPS activities to address concerns.

Provided programmatic oversight and a technical review of the completion report for the WRD funded project "Aquatic Survey and Condition Assessment of Great Basin National Park."

Participated in development of scoping comments regarding specific hydrologic concerns for the "Clark, Lincoln, and White Pine Counties Ground-Water Development (SNWA) Project."

Provided reference tables for Legacy STORET.

Hagerman Fossil Beds National Monument

Verified and responded to Preliminary Recommendations for water rights made by the Idaho Department of Water Resources.

Provided programmatic oversight on two WRD funded projects: "Large Scale Groundwater Tracer Test" and "Water Quality Impacts to the Snake River from Landslides."

Haleakalā National Park

Served as chairperson of review panel established to evaluate proposals for installation of flood hazard warning system in the Kipahulu area.

John Day Fossil Beds National Monument

Provided a review of the draft *Project Agreement for the John Day Fossil Beds National Monument General Management Plan/EIS.*

Provided hydrogeologic analysis and recommendations for well construction at Foree

and Painted Hills.

John Muir National Historic Site

Reviewed and commented on a draft watershed management plan which contained new geomorphic data of drainages in the park. Consulted with park staff on cross-section monitoring data evaluating the stability of John Muir's gravesite near Alhambra Creek.

Kaloko-Honokōhau National Historical Park

Provided policy and technical review of the draft *Assessment of Coastal Water Resources and Watershed Conditions at Kaloko-Honokōhau National Historical Park*.

Provided programmatic oversight on a WRD funded project entitled "Determining Subterranean Ground-water Nutrient Input to Kaloko-Honōkohau National Historical Park's Coastal Ocean Ecosystem."

Advised park on contaminants and eutrophication issues, including nutrient filtration, fish farming contaminants, and statistical power/sample sizes required for minimum detectable differences.

Assisted in preparing letter to the Hawaii Commission on Water Resources regarding concern for Well No. 4161-03.

Researched state water law regarding native Hawaiian water rights.

Lake Mead National Recreation Area

Provided recommendations for rewriting sections of the *Lake Mead Lake Management Plan and Environmental Impact Statement*.

Continued to advise park on the results of modeled predictions of the impacts of Las Vegas wastewater discharge alternatives into Lake Mead being developed by the Clean Water Coalition Systems Conveyance and Operations Program.

Reviewed draft of a professional publication that will highlight pharmaceuticals and personal care products in the waters of Lake Mead.

Provided briefings for senior NPS managers, Office of the Solicitor, and Assistant Secretary on status of negotiations between Moapa Band of Paiutes, southern Nevada water developers, and FWS concerning endangered species at Muddy River Springs.

Provided technical oversight of work by GeoTrans, Inc., to develop a numerical ground-water flow model of the Lower Colorado Flow System (LCFS).

Compiled water right summaries for selected hydrographic basins in the Colorado Ground-water Flow System of Nevada.

Continued implementation of monitoring and ground-water management provisions of negotiated settlements with the SNWA and with Vidler Water Company, Inc.

Participated in a meeting with the Nevada State Engineer to address concerns that pumping by Coyote Springs Investments be included in the SNWA aquifer-test plan.

Participated in a meeting with NPS consultants and representatives from Lincoln County and Vidler Water Company (LCVWC) to review plans by LCVWC for a monitoring well to detect effects of ground-water pumping in Tule Desert Basin pursuant to Nevada State Engineer Ruling 5181.

Coordinated with Virgin Valley Water District on the development of a hydrologic monitoring and management plan for the Virgin River (Nevada).

Secured agreement with BLM that provides funding of a three-year project to develop a numerical ground-water flow model of the LCFS to predict future effects of ground-

water pumping in the region on park water resources.

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

Conducted a field reconnaissance of the lower Virgin River to observe evapotranspiration data collection site and to re-locate the Virgin River gage site.

Provided technical oversight of USGS project to conduct surface geophysical surveys and geologic cross-sections of the LCFS area.

Provided technical oversight on USGS agreements to monitor spring and stream discharges at Rogers and Blue Point Springs at Virgin River near Overton.

Completed the USGS/NPS plan to monitor the water quality impacts of personal watercraft.

Advised park on findings on contaminants one would expect to find in sediments below marinas.

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Report and databases.

Lake Roosevelt National Recreation Area

Co-authored a WRD technical report titled *An Assessment of Riparian and Upland Conditions on Grazing Allotments at Lake Roosevelt National Recreation Area, Washington* (Technical Report NPS/NRWRD/NRTR-2005/329).

Assisted in technical review of a draft document entitled *Phase I Tissue Sampling and Rationale – Upper Columbia River Site CERCLA RI/FS*.

Provided park, EPA, and contractors with detailed advice on survey plans, protocols, and SOPs needed for proper monitoring of sediments and fish at a Superfund site.

Lassen Volcanic National Park

Participated in field work for a Klamath Network funded project entitled "A Functional Assessment of Wetland/Riparian Communities in Crater Lake National Park, Lassen Volcanic National Park, and Oregon Caves National Monument."

Provided technical review and evaluation of the *Implementation Plan for Summer 2005 Assessment of Wetlands in Lassen Volcanic National Park*.

Lewis and Clark National Historical Park

Worked with park staff and the University of Washington cooperators towards expanding to the scope of the coastal resources / coastal watershed condition assessment to include coastal resources brought into the park as park of a recent boundary expansion.

Manzanar National Historic Site

Conducted a preliminary topographic survey to establish the feasibility of construction a drainage canal to mitigate flood hazard.

Mojave National Preserve

Assisted park and region staff in consultation with contractors performing a flood hazard assessment for Hole-in-the-Wall Campground.

Continued to provide technical review and revisions for a report on the proceedings of the 2003 Mojave tui chub (*Salvelinus bicolor mohavensis*) workshop.

Mount Rainier National Park

Provided programmatic oversight for a WRD funded project entitled "Develop Reference Site Data for Monitoring Biological Integrity and Water Quality of Streams."

National Park of American Samoa

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

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Nez Perce National Historical Park

Advised park staff regarding wetland compliance requirements for a proposal to clear vegetation and place a liner in an irrigation canal that passes through the park.

Reviewed recommendations for water rights from the Idaho Department of Water Resources.

North Cascades National Park

Served as a member of the Technical Advisory Group for the *North Cascades Mountain Lakes Fishery Management Plan/EIS*.

Provided technical/policy review and final concurrence with the *Statement of Findings for Floodplains and Wetlands for the Coon Run Bridge*.

Reviewed Floodplain *Statements of Findings for Stehekin Road Project*.

Provided programmatic oversight for a WRD funded project entitled "Develop Reference Site Data for Monitoring Biological Integrity and Water Quality of Streams."

Facilitated the incorporation of edits made to the park's GIS hydrographic coverage into the National Hydrography Dataset.

Provided technical review of a draft WRD funded project report entitled "Development of Stream Benthic Macroinvertebrate Biomonitoring Protocols for North Cascades National Park Service Complex and Adjacent USFS Lands."

Olympic National Park

Provided continuing assistance related to the proposed removal of two dams on the Elwha River, including development of a monitoring plan and interpretation of results of a physical modeling study.

Participated in a field team review of the potential need and feasibility to undertake native fish restoration projects within the Elwa River watershed (prior to dam removal) and in other park river systems with introduced trout species.

Provided technical and policy review of the draft *Wetland Statement of Findings for the Elwha River Ecosystem Restoration: Removal of the Elwha and Glines Canyon Dams and Associated Mitigation at Olympic National Park*.

Provided hydrologic assistance to the park regarding Finley Creek and the development of alternatives for inclusion in the new general management plan.

Provided programmatic oversight and technical review of the final accomplishment report for an NRPP funded project entitled "Determination of the Migratory Pathways, Spawning Areas and Potential Sources of Threats to Bull Trout in Olympic National Park."

Fisheries biologists at Olympic National Park surgically implant radio transmitters into federally threatened bull trout to determine migratory patterns (Sam Brenkman).

Aerial telemetry flights at Olympic National Park relocate radio tagged bull trout (Sam Brenkman).

Provided programmatic oversight and approved the implementation plan for an NRPP funded Disturbed Lands Project entitled "Restoration of the Hydrologic Function, Fish, Wildlife and Native Vegetation on the Upper Hoh River."

Provided programmatic oversight for a WRD funded project entitled "Constructing a Sediment Source and Deposition History of Lake Ozette."

Provided NPSTORET, NPSCol2Row, and Baseline Water Quality Data Inventory and Analysis (Horizon) Report and data.

Pinnacles National Monument

Continued water rights assessment.

Point Reyes National Seashore

Provided programmatic oversight and approved of the study plan for a project to develop the Point Reyes National Seashore water resources stewardship report.

Provided technical and policy review and evaluation of the "Tomales Bay Wetlands Mapping and Assessment Project" and of the *Point Reyes National Seashore Wetlands Mapping and Assessment Protocol Report*.

Reviewed and approved the final completion report for the restoration of Horseshoe Pond. This project restored a 35-acre stock pond back to its original, coastal-lagoon hydrology and habitat conditions.

Provided technical review of a Master of Science thesis resulting from work undertaken as part of a WRD funded project entitled "Impacts of Commercial Oyster Farming on the Biota of Drakes Estero."

Collected site information in support of applications to convert consumptive use rights to instream flows.

Provided information on fingerprinting ground water to determine if salty water was from seawater or other sources.

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

Provided Baseline Water Quality Data Inventory and Analysis (Horizon) Report and databases to the Bay Institute.

Redwood National Park

Provided policy and technical review and comments regarding the draft *Redwood National Park Coastal Watershed Condition Assessment Report*.

Advised park staff regarding wetland compliance requirements for a proposed maintenance facility.

Sequoia and Kings Canyon National Parks

Co-authored and published the *Sequoia / Kings Canyon National Park Water Resources Information and Issues Overview Report* (Technical Report NPS/NRWRD/NRTR-2005/333). This report summarizes the existing hydrological, chemical, and aquatic biological resource information for the parks and identifies and analyzes the major water resource issues facing park management.

Provided technical assistance and obtained funding for a project titled "Evaluate Reference Meadows and Develop Restoration Concepts for Halstead Meadow."

Whiskeytown-Shasta-Trinity National Recreation Area

Provided information on MTBE in lakes and continued serving as WRD project officer on a water monitoring project for Willow Creek.

Yosemite National Park

Provided review and assistance in the development of a study recommending improvements to infrastructure in the Mariposa Grove developed area.

Provided a review of past well drilling and made a hydrogeologic analysis and recommendations for alternative water supplies for the Yosemite Institute in the Crane Flat area.

SOUTHEAST REGION

Provided a briefing for Southeast Region's Associate Regional Director for Natural Resources on the Coastal Watershed Assessment Program during his visit to WRD offices in Fort Collins, CO.

Provided a review of the draft *Project Agreement for the Virginia Key Beach Special Resource Study*.

Abraham Lincoln Birthplace National Historic Site

Provided a water resources-related policy review and technical comment on the draft *Abraham Lincoln Birthplace National Historic Site General Management Plan / EIS*.

Big Cypress National Preserve

Reviewed and approved the *Wetland Statement of Findings for Seminole Housing on Tamiami Trail, Big Cypress National Preserve*.

Provided technical and policy review of the *Collier Resource Company 3-D Seismic Oil and Gas Exploration Proposal at Big Cypress National Preserve*.

Big South Fork National River and Recreation Area

Provided support in communicating water quantity concerns to the Office of Surface Mining on a proposed permit.

Provided support in responding to an Aquatic Alteration Permit Application to build an impoundment upstream of the park.

Provided technical review and comment on a freshwater mussel study proposal.

Reviewed and provided comments on a mining proposal for areas outside of, but likely affecting, the park.

Biscayne National Park

Participated in inter-disciplinary team discussions and planning for coral reef and seagrass restoration projects involving vessel groundings and in the development of a programmatic EIS to respond to vessel grounding incidents.

Assisted the park in developing the draft *Biscayne National Park Fisheries Management Plan*.

Continued reviewing technical documents and issues related to the landfill and ammonia while providing WRD programmatic oversight for a project entitled "Development and Implementation of Water Flow Needs for Biscayne National Park Using Adjacent Coastal Wetland Indicators."

Provided comments and recommendations concerning a fund-raising fishing tournament proposal by local park supporters.

Prepared USGS Center for Coastal and Watershed Studies water quality ground-water data for upload to STORET.

Blue Ridge Parkway

Provided recommendations to the park for the resolution of issues regarding the Town of Blowing Rock water reservoir, proposed exchange lands, and the Moses T. Cone Estate and Trust.

Completed review and provided comments for proposed administrative solutions for the Blowing Rock Reservoir.

Continued to coordinate with the park on monitoring well site selection, well installation, permitting, and drilling activities to support a ground-water investigation on park lands by an adjacent landowner.

Cape Hatteras National Seashore

Evaluated the applicability of state and federal wetland regulations and NPS wetland policies to proposed use of an existing drainage system to lower the water table in a park wetland.

Provided comments for an Environmental Assessment for expansion of the Ocracoke water treatment plant.

Cape Lookout National Seashore

A watershed condition assessment report entitled *Assessment of Coastal Water Resources and Watershed Conditions at Cape Lookout National Seashore* (Technical Report NPS/NRWRD/NRTR-2005/322) was completed and published through a cooperative effort among the Center for Marine Science, University of North Carolina at Wilmington, Cape Lookout National Seashore, the Southeast Coast Inventory & Monitoring Network, and WRD.

Assisted park and Denver Service Center staff regarding NPS wetland compliance requirements for proposed rehabilitation of historic structures in marsh areas.

Reviewed *Floodplain Statements of Findings for South Core Banks Visitor Contact Center.*

Chattahoochee River National Recreation Area

Provided consultation and guidance to Chief of Resources Management concerning management of tributaries to the Chattahoochee River and native fish restoration and protection.

Assisted the Regional Fisheries Biologist in developing a study proposal evaluating the potential impacts of Morgan Falls Dam on native shoal bass populations.

Completed policy and technical review and comments regarding a FERC application and environmental compliance for the relicensing of the Morgan Falls Dam.

Provided technical assistance regarding in-stream flow studies and evaluation of flow needs for biological resources.

Provided technical review and comment on the *Draft Restoration Plan, Johnson Ferry Unit.*

Reviewed floodplain statements of findings for river access project.

Chickamauga and Chattanooga National Military Park

Provided programmatic oversight and technical support for an NRPC funded project entitled "Karst Ground-water Delineation at Russell Cave National Monument and Chickamauga and Chattanooga National Military Park of the Cumberland/Piedmont Network."

Congaree National Park

Provided programmatic oversight and technical review for a WRD funded project entitled "Assessing the Impact of Water Releases from the Saluda Dam During Peaking and Modified Run-of-River Operations on the Congaree National Park Floodplain."

Provided technical review and comment on a draft final report for the NRPP funded proj-

ect entitled "Species Diversity and Condition of the Fish Community during a Drought in Congaree National Park."

Cowpens National Battlefield

Provided technical review and comment on the draft report entitled *Inventory and Classification of Wetlands at Cowpens National Battlefield*.

Cumberland Island National Seashore

A watershed condition assessment report entitled *Assessment of Coastal Water Resources and Watershed Conditions at Cumberland Island National Seashore* (Technical Report NPS/NRWRD/NRTR-2005/332) was completed and published through a cooperative effort among the University of Georgia's Department Marine Sciences, the University of Georgia's Marine Extension Service, Cumberland Island National Seashore, and the WRD.

Dry Tortugas National Park

Participated in discussions with DOI and CEQ to expedite agreement with State of Florida on management of submerged lands.

Assisted DOI legal counsel and park staff with drafting and editing regulations to implement *Dry Tortugas National Park General Management Plan Amendment/Environmental Impact Statement*.

Reviewed and provided comment on draft special regulations for implementation of the non-take marine reserve (Research Natural Area) called for in the revised general management plan.

Everglades National Park

Participated in a multidisciplinary team tasked with developing reasonable strategies for repairing the geomorphic, water quality, and trespass issues associated with four canals dug in the early 1900's.

Reviewed and commented on the *Draft Revised General Reevaluation Report/Second Supplemental Environmental Impact Statement for the Tamiami Trail Modifications* and provided guidance to park staff regarding preparation of a wetland statement of findings for the project.

Conferred with the park and provided recommendations on the use of cast nets by recreational fishers.

Provided information and statistical advice related to EMAP analyses of Florida Bay.

Provided *Clean Water Act* 303(d) designated use and impairment information and GIS coverages.

Fort King National Historic Landmark

Provided a water related policy review and technical comment on the *Fort King Resource Study and EIS*.

Fort Pulaski National Monument

Provided policy and technical review and comments of the draft *Assessment of Coastal Water Resources and Watershed Conditions at Fort Pulaski National Monument*.

Great Smoky Mountains National Park

Provided a technical/policy review for the *Draft Environmental Impact Statement, North Shore Road, Great Smoky Mountains National Park*.

Provided technical and policy review and evaluation of proposed impacts to wetlands in the *Draft Environmental Impact Statement and General Management Plan Amendment, Elkmont Historic District*.

Assisted in the technical review and publication of a report entitled *Restoration of Sams Creek and an Assessment of Brook Trout Restoration Methods at Great Smoky Mountains National Park* (Technical Report NPS/NRWRD/NRTR-2005/342).

Reviewed proposed channel modifications for effects of flood elevations.

Gulf Islands National Seashore

A watershed condition assessment report entitled *Assessment of Coastal Water Resources and Watershed Conditions at Gulf Islands National Seashore* (Technical Report NPS/NRWRD/NRTR-2005/330) was completed and published through a cooperative effort among the University of Florida's Department of Environmental Engineering Sciences, Gulf Islands National Seashore, and WRD.

Participated in a teleconference with the park and region concerning the development of vessel grounding protocols.

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

Horseshoe Bend National Military Park

Reviewed and provided comment on a new fishing method (snorkeling/treble hook snagging of nesting catfish) being employed to catch catfish.

Jean Lafitte National Historical Park and Preserve

Reviewed and approved the final completion report for the "Barataria Wetland Inventory and Monitoring Project."

Reviewed and approved the detailed study plan for the completion of the "Submerged Aquatic Vegetation Inventory Project."

Reviewed proposed study of potential impacts of the Davis Pond Diversion on the Barataria Reserve fish populations and participated in teleconference discussions of this potential project.

Little River Canyon National Preserve

Provided a review of the draft *Project Agreement for the Little River Canyon National Preserve General Management Plan/EIS*.

Mammoth Cave National Park

Provided programmatic oversight for the development of the *Mammoth Cave National Park Water Resources Management Plan*.

Reviewed water quality data, QC reports, inter-laboratory round robin lab performance comparisons, and results from July 2005 phytoplankton DNA tests.

Moores Creek National Battlefield

Continued with contracting officer's technical representative duties and provided technical advice to park staff for a project to reintroduce native wetland grasses.

Russell Cave National Monument

Continued as WRD Project Coordinator for NRPC funded project entitled "Karst Ground-water Delineation at Russell Cave National Monument and Chickamauga and Chattanooga National Military Park of the Cumberland/Piedmont Network."

Obed Wild and Scenic River

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

Continued oversight of a USGS study of streamflow associated with geomorphologic processes and vegetation of alluvial surfaces and conducted a field review of study sites with the USGS investigator.

Assisted the Office of Natural Resource Information Systems in determining watershed areas for impoundments in the park watershed.

Shenandoah National Park

Assisted park staff with wetland compliance requirements for transferring a road right-of-way to a private party.

Shiloh National Military Park

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

Stones River National Battlefield

Reviewed floodplain statements of findings for improvements to self-guiding tour routes.

Timucuan Ecological and Historic Preserve

A watershed condition assessment report entitled *Assessment of Coastal Water Resources and Watershed Conditions at Timucuan Ecological and Historical Preserve* (Technical Report NPS/NRWRD/NRTR-2005/340) was completed and published through a cooperative effort among the University of Florida's Department of Environmental Engineering Sciences, Timucuan Ecological and Historical Preserve, the Southeast Coast Inventory & Monitoring Network, and WRD.

Reviewed and evaluated a research proposal from a Natural Resources Laureate from the Environmental Alliance for Senior Involvement.

Vicksburg National Military Park

Provided technical/policy review and comments on the *Environmental Assessment for Battlefield Rehabilitation: Railroad Redoubt, Vicksburg National Military Park*.

Advised consultants (Greenhorn and O'Mara, Inc.) regarding NPS protocols for wetland delineations and functional assessments in the park.

Provided technical and policy review and evaluation of the *Wetland Delineation and Functional Assessment Report for the Vicksburg National Military Park*.

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

TECHNICAL ASSISTANCE PROVIDED BY NATURAL RESOURCE CHALLENGE AQUATIC RESOURCE FIELD PROFESSIONALS

TECHNICAL ASSISTANCE SERVICEWIDE

Participated in a workshop in Fort Collins, CO, assisting WRD staff in the development of strategies/goals for the Watershed Condition Assessment Program.

Served on review board for national water quality project funding for USGS/NPS Water Quality Partnership Program. Reviewed, commented on, and ranked the 34 leading submissions for water quality assistance to National Parks.

Provide ongoing support for planning 2007 Eastern Rivers Summit to identify and coordinate common park issues associated with large rivers.

Served as liaison for NPS/USGS/multi-agency workshops on Ecological Response to Flow Alterations, Lotic Systems, and Appalachian Research Initiatives.

Participated in the I & M Vegetation Scoping meeting at the SERO, which focused on selecting long-term monitoring objectives for wetland vegetation, related to plant community structure, function, and composition.

Participated as an instructor at the Natural Resource Law and Policy Training held in Jacksonville, FL.

Provided data and guidance for Seamless Network of Parks initiative by BRMD.

TECHNICAL ASSISTANCE REGIONS, NETWORKS, PARKS

ALASKA REGION

Arctic Network

Participated on the Arctic Network's technical advisory committee attending scoping workshops and reviewing the Phase 1 monitoring plan.

Initiated a cooperative agreement with the University of Alaska, Fairbanks to compile all accessible fisheries and aquatic related data in network parks.

Continued development of a fisheries inventory to be from FY06-09.

Central Alaska Network

Refined protocols for monitoring shallow lakes and coordinated the completion of the shallow lake monitoring plan. Formed partnerships with University of Alaska, Fairbanks, faculty to investigate shallow lake dynamics in interior Alaska.

Attended USGS workshop to prioritize research activities in the Yukon River corridor.

Participated in Central Alaska Network technical committee meetings.

Oversaw the completion of the watershed delineation project.

Advised Yukon-Flats National Wildlife Refuge (YFNWR) on use and deployment of sondes for continuous water quality monitoring.

Advised YFNWR on water quality monitoring strategy for Beaver Creek.

Participated in an invasive plant survey along Beaver Creek, a national wild and scenic river in YFNWR.

Lake Clark National Park and Preserve

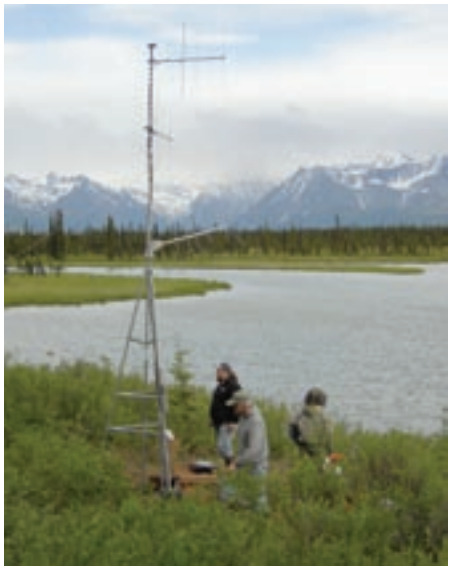
Participated on the NPS Pebble Mine Resource Management Team attending meetings, reviewing study plans, and commenting on fisheries resource issues concerning this potential mine.

Completed a final project report entitled *Distribution and Characteristics of Sockeye Salmon Spawning Habitats in the Lake Clark Watershed, Alaska*.

Designed and conducted a study investigating the escapement and population structure of Lake Clark sockeye salmon.

Designed and implemented a study, in collaboration with USGS, on the distribution and population structure of humpback whitefish within the Lake Clark drainage.

Assisted the Alaska Department of Fish and Game with sockeye salmon research in the Kuskokwim River drainage.



Sockeye salmon research in Kuskokwim River Drainage (Dan Young)

Southwest Alaska Network

Represented NPS at strategic planning meetings concerning federal management of subsistence fisheries in Southwest Alaska. Assisted Alaska Department of Fish and Game with fish collection from the Nushugak drainage in Southwest Alaska.

Attended workshops, reviewed project proposals and phase reports, and provided technical assistance with fish and water resources.

Assisted with the development of monitoring protocols for resident fish.

Presented results from NPS fish and aquatic resource studies at local and national meetings and conferences, including the 2005 American Fisheries Society National Meeting in Anchorage, AK.

Yukon-Charley Rivers National Preserve

Continued a pilot study of shallow lake monitoring.

INTERMOUNTAIN REGION

Worked with the Utah Division of Wildlife Resources and numerous affected parks to conserve, protect, and avoid listing three fish species through a multi-state and multi-agency "three-species agreement."

Provided technical support to numerous southwestern park units with equipment and data needs for well monitoring and spring discharges.

Provided technical assistance to several Colorado River Basin park units and off-park locations, including the San Juan River from Clay Hills down in Glen Canyon National Recreation Area, partnering with the Utah Division of Wildlife Resources in a fish survey.

Continued the endangered fish technical representation of the NPS on the Colorado River Recovery Program (a nationally recognized partnership), coordinating efforts with management and technical staff from the region and the WASO.

Developed informational handouts for the Colorado River Recovery Program, including a handout on suggestions for better communication on endangered fish stocking program.

Aztec Ruins National Monument

Helped develop proposal and cost estimate for a hydrology study.

Chickasaw National Recreation Area

Provided technical support for the installation of monitoring equipment, collection of critical hydrologic data, and efforts to protect spring and stream flows. Served as technical liaison to a state-sponsored aquifer study and worked with WRD and other watershed partners to support an evaluation of the potential impacts of a proposed large-scale ground-water development on basin water resources.

Chiricahua National Monument

Directed on-site effort to successfully replace potable water well.

Fort Bowie National Historic Site

Developed a scope of work and cost estimate for bid proposal for rehabilitation of a water supply well.

Fort Davis National Historic Site

Provided technical support for the development of a WRD flood evacuation plan with the aim of protecting park natural resources, infrastructure, and visitors.

Grand Teton National Park

Reviewed and evaluated options for re-directing park irrigation rights to restoring flows for habitat improvements on the Gros Ventre River.

Lyndon B. Johnson National Historical Park

Provided oversight for University of Texas at Austin cooperative projects to evaluate conditions on the Pedernales River.

Montezuma Castle National Monument

Worked with Water Rights Branch (WRD) on a seepage run at Wet Beaver Creek.

Northern Colorado Plateau Network

Assisted the network with completing fish databases for Arches National Park, Black Canyon of the Gunnison National Park, Bryce Canyon National Park, Canyonlands National Park, Capitol Reef National Park, Curecanti National Recreation Area, Dinosaur National Monument, and Zion National Park.

Southern Plains Network

Supported the development of the network by preparing conceptual models for stream, lake, and wetland ecosystems of 11 New Mexico, Colorado, Kansas, Oklahoma, and Texas NPS units.

MIDWEST REGION

Prepared or revised water resources-related project proposals for several Midwest Region parks, leading to approval of a 3-year U. S. Geological Survey project to develop a water quality protection program for rivers and world-class springs of Ozark National Scenic Riverways, Missouri.

Great Lakes Network

Completed a synthesis of aquatic research for network parks, published as part of the WRD technical report series.

Prepared and assisted with the preparation of project statements for the Servicewide Comprehensive Call, including two proposals related to aquatic nuisance species in network parks.

Assisted in the beginning stages of developing fisheries monitoring protocols for network parks. Coordinated a meeting of fisheries experts from around the region, including participants from state and federal agencies and academia.

Homestead National Monument of America

Provided technical support for a fluvial geomorphic assessment.

Hot Springs National Park

Provided technical review for USGS water resources investigation.

Isle Royale National Park

Began an inventory of shoreline rock pools as part of the park's interagency spill response planning efforts.

Assisted with logistics of preliminary zooplankton sampling for use in spiny water flea investigations.

Mississippi National River and Recreation Area

Analyzed 29 years of water quality data from two riverine lakes at Mississippi National River and Recreation Area and at Saint Croix National Scenic Riverway. Published a related manuscript in a special issue of the *Journal of Paleolimnology*.

Helped design and participated in a successful water resources scoping meeting. Results of the meeting will be used to develop a water resources information and issues overview report in the coming year.

Missouri National Recreational River

Provided comments on a draft water resources information and issues overview report.

Commented on an ecological assessment prepared by the COE.

Northern Great Plains Network

Participated in technical meetings and workshops for the network.

Ozark National Scenic Riverways

Participated in a multi-agency evaluation of the potential impacts of proposed lead-zinc mining on the park and other Ozark water resources.

Prepared water resources related GIS coverages.

Pictured Rocks National Lakeshore

Developed field and lab methods for analyzing spiny water flea remains in lake sediments.

Saint Croix National Scenic Riverway

Analyzed 29 years of water quality data from two riverine lakes at Mississippi National River and Recreation Area and at Saint Croix National Scenic Riverway. Published a related manuscript in a special issue of the *Journal of Paleolimnology*.

Southern Plains Network

Participated in technical meetings and workshops for the network.

NATIONAL CAPITAL REGION

Provided regional coordination for Wetlands, Riparian, Water Quality, and Water Quantity GPRA goals.

Continued the impervious surface (IS) project with the creation of Threatened Watersheds Maps for the years 1986, 1990, 1996, and 2000 for most parks in the region.

Assisted the region in determining sites for possible wetland restoration.

Served as expert opinion regarding the observation of sturgeon in the Potomac River.

Attended National Capital Region Network's Integrating Applications Network workshop for the development of conceptual diagrams. Installed approximately twenty water level loggers in streams.

Purchased two stormwater samplers for the Water Quality Equipment Loaner Program.

Catoctin Mountain Park

Continued trend analysis of water quality data.

Continued work on synthesis, analysis, and interpretation of water quality data for the water resources scoping report project to be completed in FY06.

Chesapeake & Ohio Canal National Historical Park

Advised park regarding the drawdown of water in Widewater Lake and the downstream canal.

Assisted in the writing of an interagency agreement for the USGS/NPS project for the installation of SETS rods in Dyke Marsh.

Consulted with park staff regarding the presence of beavers on Daingerfield Island.

Assisted with creation of a list of 303d listed streams and summary data.

George Washington Memorial Parkway

Provided recommendations to park staff regarding the restoration of Dyke Marsh.

Harpers Ferry National Historical Park

Provided recommendations to park staff regarding ground water inside the basement of a cultural resource site and on wetlands issues.

Manassas National Battlefield Park

Gave expert opinion regarding the interpretation of water quality data.

National Capital Region Network

Assisted in protocol development for surface-water discharge measurement, water quality sampling, sample site selection, and statistical analysis.

Prince William Forest Park

Continued trend analysis of water quality data. Advised on a stream photography project.

NORTHEAST REGION

Provided regional coordination for Wetlands, Riparian, Water Quality, and Water Quantity GPRA goals.

Gave expert opinion and review of the *Draft Review of Integrative Assessment of Biological and Physical Attributes of the Eightmile River Phase 1 Final Report*. Eightmile is a proposed National Wild and Scenic River.

Acadia National Park

Provided written comments on *Preliminary Evaluation of In-House Acadia National Park Lake Monitoring and Chemical Analysis Report*.

Alleghany Portage Railroad National Historic Site

Worked with USGS-PA to complete an acid mine drainage assessment report. The final product included analysis of flow, chemistry, treatment alternatives, and cost estimates for mitigation.

Bluestone National Scenic River

Provided written recommendations for water quality issues defined during a multi-agency river workshop.

Booker T. Washington National Monument

Reviewed PMIS projects, "Stabilize Creek Bank along Jack-O-Lantern Branch Trail (#62219)" and "Provide Environmentally Improved Watering Alternatives for Interpretive Farm Livestock (#83370)." Provided verbal and written streambank protection alternatives and best management practices.

Cape Cod National Seashore

Reviewed coastal resource issues with park staff.

Colonial National Historical Park

Provided a written review of the USGS-VA administrative report assessing the hydrologic features of the Green Spring Unit.

Provided a written review of the *Historic Jamestowne Stormwater Management Inventory and Baseline Report*.

Delaware Water Gap National Recreation Area

Assisted with water quality model data collection and project review.

Provided floodplain and floodway description for the proposed New Jersey Swimbeach. Worked with NPS, USGS-NJ, and State of New Jersey contacts to define, interpret, and quantify desired information.

Wrote report assessing damage from Hurricane Ivan and prescribing mitigative actions.

Edited and co-authored a flood analysis report with WRD and GRD geomorphologic professionals in response to an emergency request by the park superintendent and natural resource staff.

Flood debris, Delaware Water Gap National Recreation Area (Alan Ellsworth).

Continued representing NPS on the subcommittee for ecological flows on the Delaware River.

Eastern Rivers and Mountains Network

Served on Science Advisory Committee and assisted with vital signs workshop.

Provided written review of the Level 1 water quality inventories for Johnstown Flood National Memorial and Allegheny Portage Railroad National Historic Site.

Eleanor Roosevelt National Historic Site

Provided written review and consultation for the *Val-Kill Pond Restoration Environmental Assessment*.

Erie Canal National Heritage Corridor

Established connection between park superintendent and USGS-NY regarding current and potential hydrologic research.

Fire Island National Seashore

Represented NPS on COE technical committees for Fire Island to Montauk Point Reformulation Planning to develop storm damage reduction and protection for the southern shore of eastern Long Island.

Coordinated coastal research for characterizing submarine ground-water discharge from a barrier island as a component of managing estuarine eutrophication.

Surf-zone fish study at Fire Island National Seashore (Patti Rafferty).

Represented park on The Nature Conservancy's Blue Point Bottomlands Council to develop restoration and protection of the Great South Bay ecosystem.

Provided assistance on USGS-NY shallow ground-water study during field assessment with USGS Science Center Director and staff and NPS scientists and land managers.

Provided written opinion and WRD liaison assistance for minor wetland manipulation as a mosquito control technique for a project entitled "Restoration of Wilderness Area salt marshes: Assessment of mosquito ditches."

Flight 93 National Memorial

Provided site assessment and written overview of potential hydrologic concerns for creation of a new unit of the National Park System.

Settling ponds at Flight 93 National Memorial (Alan Ellsworth).

Gateway National Recreation Area

Represented NPS on COE team for development of marsh restoration in the Jamaica Bay Unit for a project entitled "Jamaica Bay Wildlife Refuge West Pond Restoration."

Conducted pre-construction nekton monitoring for the COE funded restoration of Elders Point Marsh, Jamaica Bay Unit.

Helped coordinate USGS-NY study proposal entitled *Assessment of Nutrient Loading to Jamaica Bay, Gateway National Recreation Area, New York*.

Marsh restoration at Gateway National Recreation Area (Patti Rafferty).

Gauley River National Recreation Area

Provided written recommendations for water quality issues defined during a multi-agency river workshop.

George Washington Birthplace National Monument

Provided written reviews of the scope of work proposals for Natural Resource Assessment for George Washington Birthplace National Monument and the Wetland Delineation and Wetland Functional Assessment for the George Washington Birthplace National Monument, Virginia.

Reviewed coastal-related resource management issues with park staff.

Johnstown Flood National Memorial

Coordinated GIS analysis of floodwater quantification for interpretive purposes.

Marsh-Billings-Rockefeller National Historical Park

Provided hydrologic expertise, written review, and comments for the park's forest management plan.

Provided site assessment and hydrologic opinion for an environmental assessment to support construction of a wood barn and conference facility.

Mid-Atlantic Network

Provided expert opinion as member of the Science Advisory Committee.

Provided written review of proposed ecosystem models.

Minute Man National Historical Park

Provided site review assistance for Northeast Temperate Network-USGS water quality monitoring plan with USGS-MA water professionals.

Provided written opinion of the *Sunnyside Lane Drainage…Preliminary Design Report*.

Morristown National Historical Park

Continued trend analysis of water quality data.

Provided water quality monitoring equipment.

New River Gorge National River

Provided written recommendations for water quality issues defined during a multi-agency river workshop.

Northeast Temperate Network

Provided water quality data coordination and consultation regarding Morristown National Historical Park to USGS-ME for the Northeast Temperate Network.

Provided a site survey for water quality sampling locations at Saratoga National Historical Park.

Acted as NPS professional contact for USGS-ME water quality vital signs initiative.

Richmond National Battlefield Park

Provided direction on stormwater drainage and state stream water quality listing issues, which led to WRD technical assistance requests.

Saint-Gaudens National Historic Site

Completed the water resources information and issues overview report.

Upper Delaware Scenic and Recreational River

Continued representing NPS on the subcommittee for ecological flows on the Delaware River.

Co-authored funded USGS/NPS water quality monitoring proposal to examine water quality in the Delaware River in support of source identification and special protection water standards.

Provided written comments on the Pennsylvania Power and Light Authority Lake Wallenpaupack Federal Energy Regulatory Commission relicensing plan.

Valley Forge National Historical Park

Reviewed a draft environmental assessment for Valley Creek streambank stabilization.

Produced a streambank stabilization report assessing proposed methods.

Provided consultation on Valley Creek to the Environmental Quality Division.

Highway undercutting at Valley Forge National Historical Park (Alan Ellsworth).

Produced a stream restoration guideline report to assist park with watershed improvement plans.

Provided oversight and status review of stream sediment project.

Procured funding to support installation of continuous sediment analyzer in cooperation

with USGS-PA and University of Maryland, Baltimore Campus.

Weir Farm National Historic Site

Provided site review and written recommendations for water quality monitoring.

Weir Pond outlet, Weir Farm National Historic Site (Alan Ellsworth).

PACIFIC WEST REGION

Collaborated with USGS-WQ staff to write a proposal entitled *Characterize temporal and spatial variability of core water quality parameters in three perennial water bodies of central and southern Arizona*.

Co-taught a BLM class entitled "Measuring and Monitoring Plant Populations." This class was presented to NPS, BLM, USFS, FWS, and local-government biologists in an effort to increase efficiency of government vegetation monitoring and restoration programs.

Channel Islands National Park

Helped WRD describe soils and install monitoring wells in association with a proposed Prisoner's Harbor wetland restoration project on Santa Cruz Island.

Collaborated on the design of an estuary restoration project.

Death Valley National Park

Acted as NPS hydrologic lead regarding two ongoing BLM managed EIS evaluations of Southern Nevada Water Authority projects: the Clark, Lincoln, and White Pine counties ground-water development project and the Virgin and Muddy River's surface-water development project.

Worked with park staff, FWS specialists, USGS scientists, and Nevada Department of Wildlife biologists to formulate an emergency management strategy to counter the continuing decline of the federally endangered Devils Hole Pupfish populations.

Eugene O'Neill National Historic Site

Assisted with determining restoration alternatives for an artificial cattle pond.

Golden Gate National Recreation Area

Collaborated on the design of an estuary restoration project.

Great Basin National Park

Acted as NPS hydrologic lead regarding two ongoing BLM-managed EIS evaluations of Southern Nevada Water Authority projects: the Clark, Lincoln, and White Pine counties ground-water development project and the Virgin and Muddy Rivers' surface-water development project.

Assisted with reestablishing extirpated non-game fish to park streams.

John Muir National Historic Site

Continued to work with the region and network to protect the integrity of John Muir's historic grave site from stream channel deepening associated with rapid watershed urbanization.

John Muir is buried in the Strenzel/Muir family graveyard on the bank of Alhambra Creek in Martinez, CA (Paul Kennard).

Joshua Tree National Park

Investigated the hydrogeologic considerations of how Stubbe Spring would be affected by the removal of a guzzler at the site.

Klamath Network

Assisted in defining a scope-of-work for inventorying and assessing wetlands in three network parks.

Lake Mead National Recreation Area

Acted as NPS hydrologic lead regarding two ongoing BLM-managed EIS evaluations of Southern Nevada Water Authority projects: the Clark, Lincoln, and White Pine counties ground-water development project and the Virgin and Muddy River's surface-water development project.

Provided technical hydrologic input in support of management actions regarding the Rhodes Home Development proposal that would develop privately held lands within park boundaries.

Acted as NPS principal contact with the USGS for work performed as part of two task orders funded by the NPS under a Southern Nevada Public Lands Management Act interagency agreement, to provide continuous monitoring of surface-water discharge at Rogers Spring, Blue Point Spring, and the Virgin River.

Investigated the occurrence of an unexplained white filamentous growth at Sugarloaf Spring and whether this was due to natural or man-made conditions.

Mojave Desert Network

Worked toward approval of several hydrologic proposals, including 1) a Southern Nevada Public Lands Management Act proposal that would include funding for an evaluation of the sources and vulnerability of springs in the Black Canyon of Lake Mead National Recreation Area, 2) an investigation of the ground-water sources at Tassi and Pakoon springs in the Grand Canyon-Parashant National Monument, and 3) the potential risks to water dependent resources in the Pinto Basin Wilderness in Joshua Tree National Park.

Helped in coordination of I & M workshop and in development of the network water quality monitoring plan.

Mount Rainier National Park

Initiated a program to survey the beds of the river channels and compare them to historic maps and to an in-river survey done in 1910. These data will help evaluate the rate of historic channel filling (inches per decade), which will be invaluable for future park planning.

Mount Rainier Geologist-in-the-Park, Holly Brunkal, determines exact location during stream survey. Note flooded old-growth trees in background (Paul Kennard).

Olympic National Park

Made several visits to the site where the Quinault River has shifted hundreds of feet in the last two years and threatens a historic chalet, a former hunting lodge now in wilderness that serves as a back country ranger station. Determined the cause was related to extreme storm-related sediment loading of the upper watershed and recruitment of copious amounts of large trees from eroded stream banks. Made recommendations to reduce risk to the chalet, while maintaining aquatic and wilderness values.

Historic chalet/ranger station at imminent peril of washout (OLYM).

"Stream gone bad." Extreme sediment loading and wood recruited from stream bank in Olympic National Park (Paul Kennard).

Pinnacles National Monument

Assisted with implementing a floodplain restoration project.

Point Reyes National Seashore

Assisted in the design of a rare plant monitoring program.

Collaborated on the design of an estuary restoration project.

San Francisco Bay Area Network

Organized and facilitated a workshop to determine priorities and techniques for long-term monitoring of amphibian and reptile species.

Yosemite National Park

Helped staff develop a proposal to investigate the hydrology of Mariposa Grove and how it has been affected by anthropomorphic changes.

SOUTHEAST REGION

Developed draft strategic planning to develop regional fisheries program by obtaining and summarizing data through NRMAP, NPSpecies, and T&E database.

Represented NPS at Gulf States Regional Panel for aquatic invasive species semi-annual meetings.

Attended Southeast Aquatic Resources Partnership semi-annual meetings as NPS representative.

Provided information for developing partnership opportunity with the Gulf of Mexico Alliance.

Guest lectured at the University of South Carolina on NPS policies and the conservation of aquatic resources.

Guest lectured at The Walker School on the role of NPS in conserving aquatic resources.

Presented role of the Southeast Aquatic Resources Partnership at regional bi-annual natural resources conference.

Continued to develop a volunteer fish sampling program with the North American Native Fish Association (NANFA) by conducting one sampling event with NANFA at Little River Canyon National Preserve and meeting with the TN and GA representatives regarding the development of a volunteer fish monitoring network.

Attended meeting of Southeastern Association of Fish and Wildlife Agencies. Presented and published paper on age and growth of young-of-year shoal bass.

Biscayne National Park

Aided in developing fisheries management plan by commenting on the draft environmental impact statement and attending the Regional Director's briefing.

Blue Ridge Parkway

Assisted in developing proposal for wetland inventory and monitoring project.

Carl Sandburg Home National Historic Site

Worked with park and partners (FWS and the South Carolina Department of Natural Resources) to sample fish to assess status of fish health.

Chattahoochee River National Recreation Area

Provided assistance and oversight for wetland and stream restoration plans provided through the "Corporate Wetlands Restoration Project at Johnson's Ferry Unit."

Obtained funding from WRD to investigate the role of dams on isolation and genetics of shoal bass (a rare fish species).

Obtained funding from Southeast Region Geographic Information Systems program to investigate the effect of backwater sedimentation on NPS lands due to the operation of the Morgan Falls Hydropower project.

Assisted with FERC re-licensing of Morgan Falls Hydropower Project.

Continued shoal bass restoration in partnership with Georgia Department of Natural Resources with aid from Georgia Power and Piedmont College by stocking approximately 70,000 young-of-year, sampling for young-of-year at three sites, and analyzing the efficacy of oxytetracycline for marking young-of-year.

Administered the conclusion of the Asian rice eel (an invasive species) project in cooperation with the University of Georgia and enlisted the aid of the Boy Scouts of America to survey for new invasions.

Conducted educational program for Youth Conservation Corps.

Youth Conservation Corps at Chattahoochee River National Recreation Area during a fisheries education program (NPS).

Chickamauga & Chattanooga National Military Park

Provided technical assistance regarding newly acquired lands at Moccasin Bend and the proposed river bank stabilization project.

Congaree National Park

Assisted with FERC re-licensing of Saluda Dam upstream of the park by reviewing hydrologic impact analysis conducted by the University of South Carolina and working with NPS Regional Hydropower Coordinator in the development of project proposals.

Cumberland Gap National Historical Park

Worked with park and partners (FWS and the Tennessee Technical University) to draft research needs statement and to prepare a research proposal for blackside dace habitat requirements.

Dry Tortugas National Park

Assisted in the development of research regulations for the natural area by commenting on draft special regulations.

Everglades National Park

Helped develop guidelines to regulate fishing tournaments occurring within and beyond park boundaries.

Guilford Courthouse National Military Park

Completed a fish inventory at the request of the Cumberland Piedmont Inventory & Monitoring Program.

Ocmulgee National Monument

Provided assistance in requesting and developing a Section 404 permit from the COE for the construction of a river trail through a large wetland area.

Southeast Coast Network

Participated in a water resources scoping meeting.

Stones River National Battlefield

Reviewed the proposed plan for "Tour Road Improvements Project" and provided input on selected alternatives which would lessen impacts to wetlands and floodplains.

Timucuan Ecological and Historic Preserve

Conducted a site visit and provided a wetland delineation and assessment of potential impacts to open water and marsh habitat from the proposed Cedar Point boat ramp project.

Tuskegee Airmen National Historic Site

Conducted a field site visit and provided the park with a wetland delineation in regard to proposed Development Concept Plan which could impact wetland sites.

Participated in meetings with a representative from the COE Wetland Regulatory Section and provided recommendations on alternatives which would lessen/avoid impacts to wetland habitat.

Vicksburg National Military Park

Assisted in drafting project proposal with the park and Mississippi State University to eliminate invasive fish species and restore native fish community in a park stream.

APPENDIX B

SUMMARY OF WATER RESOURCES DIVISION FUNDING

FY05 base funding for the Water Resources Division (WRD) was $12,436,000 (Figure 1). These funds are distributed among five principal categories: Water Resource Projects (Water Resource Protection; Competitive Projects; and Other); Water Quality Monitoring; Water Resource Protection – Aquatic Resource Professionals; Watershed Condition Assessment Program (including projects); and Water Resource Technical Assistance (Figure 2).

Figure 1 - Water Resources Program FY05 Funding

Funding Available in FY05	$ 12,071,000
Pay Increase	19,000
Natural Resource Challenge Increase in FY05	528,000
	$ 12,618,000
Net across-the-board reductions	-182,000
Total available in FY05	$ 12,436,000

Figure 2 - Water Resources Program - FY05 Base Funding by Category

Water Resource Projects	
Water Resource Protection	$ 1,068,600
Competitive Projects	224,000
Other Projects	14,700
Water Quality Monitoring	2,837,800
Water Resource Protection – Aquatic Resource Professionals	1,205,000
Watershed Condition Assessment Program	2,762,800
Competitive Projects ($1,272,000)	
Critical Projects ($ 275,500)	
Coastal Projects ($ 534,400)	
Other Projects ($ 680,900)	
Water Resource Technical Assistance	4,323,100
Total	$ 12,436,000

A summary of accomplishments derived from the FY05 base budget and the FY05 increase is provided below.

WATER RESOURCE PROJECTS

The projects category includes three areas: Water Resource Protection Projects, WRD Competitive Projects, and Other Projects which are non-competitive. Water resource projects are funded in the areas of general water resources, water quality, wetlands protection, and water rights.

WATER RESOURCE PROTECTION PROJECTS

The Natural Resource Challenge resulted in an increase of $823,000 in the water resource

protection projects budget beginning in FY01. As shown in Table 1, FY05 expenditures for this budget increase expanded the NPS's capability to fund data collection and analyses that can be used to describe surface- and ground-water flow regimes and investigate the dependence of park resources upon water in support of the new Department of Interior Water Quantity Strategic Goal. These efforts are targeted toward development of scientific information that will benefit decision makers, including federal managers, court judges, or state administrators such as state engineers. Priorities are determined by the requirements of federal or state law. Presentation of results may occur in state or federal permit process documents such as rights-of-way and Clean Water Act permits, state water rights process documents such as applications, protests, or administrative hearing records, or federal or state court process documents such as adjudication claims, objections, or court hearing records. Results are often intended to support settlement negotiations conducted to avoid contested case hearings or contested land use decisions or to support the implementation of settlements.

Studies are conducted by scientists with expertise in fields that are appropriate for the park resources being examined. Hydrologic characterization is a need common to all water resources protection issues addressed by this budget. The majority of FY05 project funds were used to support ongoing studies designed to characterize surface- or ground-water flow systems. In the western U.S., ongoing projects are developing modeling capabilities for predicting effects of large-scale development in regional ground-water flow systems. In the eastern U.S., hydrologic studies are developing information on the effects of impoundments on surface river systems. These tools are needed by decision makers to understand the potential for impacts to park water resources in the future from a number of existing water development proposals. In addition, hydrologic data is often required to implement settlement agreements.

Additionally, project funds are used to study the relationship between water quantity and flow timing and water dependent park resources. In FY05, water dependent resources that were studied include riparian vegetation, fish migration, and geomorphology. These results are needed by decision makers to understand the potential effect on the water dependent resource of potential changes in stream or ground-water flow.

Finally, the results of these studies must be presented to decision makers in written or verbal format often in a forum dictated by law or regulation. For this reason, a portion of the water resources protection project funds were used to support the Department of the Interior Office of the Solicitor in providing legal advice and representation to the NPS.

Many of the issues being studied are also of concern to the programs of other federal managers, such as the endangered fish and National Wildlife Refuge programs of the FWS, the water supply programs of the BOR and the COE, and the research program of the USGS. In many cases, these other federal programs also provide funding for studies that are useful for resolving NPS issues. When this occurs, NPS coordinates its water resources protection funding with that of the other agencies to avoid duplicating studies.

To increase the effectiveness of its water resource protection funding, NPS partners with other non-federal entities. Some studies occur as a result of collaboration with State or private entities with common science objectives. For example, hydrologic data collected by NPS studies for Lake Mead National Recreation Area and Death Valley National Park are shared with the Nevada State Engineer, southern Nevada water purveyors, and private developers, thereby contributing

to the larger-scale investigation of water availability in southern Nevada. In another example, data and other science information collected at Chickasaw National Recreation Area contributes to an ongoing state-federal study of the Arbuckle-Simpson Aquifer in southeastern Oklahoma. In yet another example, hydrogeologic analyses conducted for Great Sand Dunes National Park and Preserve is being used in conjunction with work being conducted by The Nature Conservancy and local water conservation districts to support water rights protection for the park.

Table 1. Water Resource Protection Projects - FY05

Park	Region	PROJECT TITLE(S)	FY05 Funding $(000s)
ALL	ALL	Support to the Office of the Solicitor	192.0
CHIC	IMR	Hydrologic Data Collection, Participation in State Administrative Process	109.0
GRCA	IMR	Ground-water Study, Spring Protection	82.6
MEVE	IMR	Implementation of Water Rights Decree	2.9
MOCA	IMR	Hydrologic Data Collection in Support of the Adjudication of the Verde River Basin in Arizona	49.5
MT Parks	IMR	Implementation of the Montana-NPS Compact	4.5
SAGU	IMR	Investigation of Hydrology and Water Related Values	51.0
ARCH	IMR	Hydrologic Data Collection	3.1
BUFF	MWR	Investigation of Hydrology and Water Related Values	45.0
GRSA	IMR	Hydrogeologic Data Analysis	135.2
THRO	MWR	Investigation of Hydrology and Water Related Values	4.2
DEVA	PWR	Devils Hole and Spring Flow Monitoring, Ground-water Study, Participation in Ground-water Model Development	173.2
GRBA	PWR	Assessment of Hydrologic Conditions and Vulnerability of Park Streams to Ground-water Development	99.0
LAME	PWR	Spring Flow Monitoring, Participation in Cooperative Aquifer Stress Test, Ground-water Model Development	17.0
OBRI	SER	Stream Flow Monitoring, Investigation of Hydrology and Water Related Values	85.7
ALL	ALL	Technical and Administrative Support to All Projects	14.7
		TOTAL FOR WATER RESOURCE PROTECTION PROJECTS	**1,068.6**

WATER RESOURCES DIVISION COMPETITIVE PROJECTS

Water Resources Division competitive projects support many park based activities, including the design of information management systems, regulatory assessments, riparian/stream and watershed restoration and protection projects with water quality goals, or other water quality improvement projects. Projects may also include design and implementation of Clean Water Act best management practices required to improve water quality to meet state mandated polluted runoff or non-point source pollution control or other park water quality goals and objectives. In addition, projects may encompass one-time assessments or inventories of water quality baseline conditions or contaminants. Projects support NPS Strategic Goals I.a.4A and I.a4B (water quality) and I.a.4C (water quantity) and the new Department of Interior Strategic Planning Goals for Land Health, including I.a.1C (wetlands), I.a.1D (riparian and stream areas), and I.a.1F (marine and coastal areas).

In addition, WRD competitive projects may include wetland restoration design and implementation, impact or condition assessments, inventories, functional assessments, applied research, protection efforts, monitoring, and other wetland projects.

Projects also may include ground-water assessment and monitoring, well and spring inventories, stream and riparian habitat restoration, stream function assessments, channel and bank stability investigations, stream type classifications, watershed condition assessments, watershed management, surface-water hydrology studies, floodplain assessments, river management, water resources management planning, and other water resources related projects.

WRD competitive project funding for FY05 totaled $1,496,100. This funding was derived from WRD base project funds ($224,000) and support to the backlog of watershed and water quality assessment needs currently identified in NPS PMIS from the new Watershed Condition Assessment Program before it transitions to a long-term program of systematic park-based assessments of NPS watershed conditions ($1,272,000).

Once the Watershed Condition Assessment Program is fully operational, WRD's base funding will no longer be adequate to sustain the competitive project program. Therefore, it is scheduled to become inactive in FY07. Over the past ten years, in order to meet increased salary costs per FTE and budget rescissions, WRD has had to reduce funding to its project programs by $1.4 million. This has resulted in WRD's inability to support the WRD competitive project program after FY06.

Fully Funded Projects: Fully funded projects are projects that received the final funding installment in FY05. Although these projects will not receive additional funding from WRD beyond FY05, fieldwork, data analysis, report writing, or peer review may continue into the next year. A total of 24 projects received their last year of funding in FY05 (Table 2). Appendix A contains descriptions of these fully funded projects.

Table 2. Water Resource Division Competitive Projects
Final Year Funded Projects - FY05 (continued on following page)

Park	Region	PROJECT TITLE	FY05 Funding $(000s)
RUCA	SER	Karst Ground-water Delineation at RUCA and CHCH of the CUPN	10.3
CUVA	MWR	Evaluate Hydrology in Wetlands to Develop Vital Signs	14.3
GLBA	AKR	Evaluate East Alsek River Sockeye Salmon Habitat	17.3
DENA	AKR	Prepare a Water Resources Management Plan	25.0
DENA	AKR	Aquatic Resources Synoptic Study Along State-Proposed Road Corridor	25.0
NERI	NER	Technical Evaluation of Water Quality Monitoring Program	25.5
ACAD	NER	Develop Ground-water Flow Model	26.3
ZION	IMR	Develop Standards and Indicators for Aquatic Invertebrates for VERP Planning	26.5
CHIS	PWR	Final WQ Monitoring to Rescind Cleanup or Abatement Order	30.0
KAHO	PWR	Assess Nutrient Sources, Fluxes, and Water Quality of Ponds	30.8
BIBE	IMR	Repair Endangered Big Bend Mosquitofish Pond	30.0

Table 2. Water Resource Division Competitive Projects
Final Year Funded Projects - FY05 (continued)

Park	Region	PROJECT TITLE	FY05 Funding $(000s)
OLYM	PWR	Effects of Dam Removal on Marine Derived Nutrients	39.01
LACL	AKR	Characterize Water Quality, Hydrology, and Aquatic Biology in the Kijik River Basin	40.0
DEVA	PWR	Write a Water Resources management Plan	40.4
SACN	NWR	Survey Mercury Levels in Fish in the St. Croix River	40.5
ASIS	NER	Evaluate Relationships between Water Quality, Seagrass Habitat, and Fish Populations	46.6
BITH	IMR	Flood Pulse Systems: Analyzing Potential Changes in Corridor Dynamics Due to Changes in Stream Flow	49.4
BISC	SER	Developing Numeric Non-Degradation Water Quality Standards for Biscayne National Park	58.7
PORE	PWR	Develop Water and Aquatic Resources Management Plan	59.9
BISC	SER	Assessing the Occurrence, Dissipation, & Potential Risks of Glyphosate to Coastal Areas of BISC	66.8
ROCR	NCR	Retrofit Maintenance Yard Drainage Using Best Management practices to prevent Stream Pollution	92.0
AMME	PWR	Assess Hydrological Dynamics of a Pacific Island Wetland	98.4
OLYM	PWR	Lake Ozette Basin Sediment Source Analysis	100.0
DEWA	NER	Define Existing Water Quality for Development of Special Protection Waters Regulations	85.0
SAMO	PWR	Restore Habitat for Endangered Steelhead Trout: Dam Removal	100.0
		TOTAL	**1,177.71**

Table 3. Water Resources Division Competitive Projects
Continuing Projects - FY05

Park	Region	PROJECT TITLE	FY05 Funding $(000s)
BUFF	MWR	Delineate and Characterize the Karst Ground-water Recharge Zone of Tomahawk Creek at BUFF	30.0
GRTE	IMR	Hydrology and Geomorphology of the Snake River	42.2
SACN	MWR	Using Wetland Environmental Histories to Develop Management Strategies for the St. Croix Riverway	49.0
MULTI	PWR	Reference Site Data for Monitoring Biointegrity & Water Quality of Streams	50.0
JELA	SER	Assess and Map the Distribution of Submerged Aquatic Vegetation Communities at JELA	50.7
MORA	PWR	Assess Water Quality/biological Integrity with Invertebrates	56.0
ROMO	IMR	Ecological Restoration of a Willow Carr that was Destroyed in the 1982 Lawn Lake Flood	40.0
		TOTAL	**317.9**

OTHER PROJECTS

Cooperative Academic Program for Fisheries: Because of the limited professional fishery expertise within the NPS, this program uses a small amount of WRD base funding to further develop and increase cooperative relationships between the academic community and the NPS fisheries program. Funds are set aside to help foster graduate student research at National Park System units and to help cooperatively fund fishery students engaged in NPS park projects. Potential high priority projects suitable for graduate student research are identified through the PMIS project need data system and matched to student availability through discussions with fishery professors. The program helps introduce top caliber fishery students to NPS programs, as well as expanding the level of expertise made available to parks. In FY05, projects at Colorado State University and Montana State University received funding through this program. (Summaries provided below).

Project Title: Effects of water temperature on translocation and recruitment success of Colorado River Cutthroat trout in Rocky Mountain National Park – Colorado River Cutthroat trout now occupy <1% of their native range and have been considered for listing under the Endangered Species Act. One strategy used by state and federal agencies to prevent listing has been to establish new populations by translocating genetically pure trout to streams where either no trout occurred originally (above natural barriers) or where non-native trout have been removed. However, successful reintroduction of native cutthroat trout depends on the presence of adequate habitat and temperature regimes that allow for natural reproduction to occur. The success rate for past translocations has been low, and research suggests that cold summer water temperatures are a primary factor limiting success. Because translocation projects are expensive, a better understanding of factors that determine habitat suitability is needed. This project is evaluating stream temperature effects on egg development, trout fry survival, and recruitment. It is funded through Colorado State University with additional funding from a State Fish and Game, USFS, and DOI partnership. Results will be applicable to other NPS areas, as well as state and federal lands. Total project cost for FY05 was $244,000, of which $10,000 was funded through WRD. All of the money was obligated in accordance with the project's Detailed Implementation Plan.

Project Title: Adfluvial bull trout fishery investigations in Glacier National Park - Recent research has identified dramatic declines of bull trout over the past 25 years in the four largest lakes on the west side of Glacier National Park. These declines are associated with corresponding increases in numbers of invasive lake trout. Glacier also has three of the largest remaining lakes in the entire Columbia River basin that contain native bull trout populations uncompromised by the presence of non-native fish species. Protection of these lakes is a FWS recovery priority. To protect these lakes it is critical that a better understanding of the population ecology and potential threats of invasion by lake trout be understood. This study is evaluating bull trout population characteristics, spawning habitat, redd density, and barriers to lake trout invasion. This information will be used to develop a comprehensive action plan for protection and recovery of the bull trout in park lakes. This project is funded through Montana State University in partnership with the FWS. Total project cost for FY05 was $36,005 of which $5,000 was funded through WRD. All of the money was obligated in accordance with the project's Detailed Implementation Plan.

WATER QUALITY MONITORING

In FY05, the WRD received $2,837,800 for the Water Quality Monitoring component of the Natural Resource Challenge. This was the 5th year of funding for a program specifically intended to track and support the attainment of water quality standards in units of the National Park System as required by the NPS and DOI Strategic Plans. The program is now "fully-funded," minus rescissions.

The National Park Service is committed to a servicewide and DOI strategic goal to significantly reduce the number of stream and river miles and acres of lakes and marine areas that do not meet water quality standards. As part of this goal, the NPS is also committed to protecting unimpaired water quality in parks from future impairment, including waters classified as Outstanding National Resource Waters or state-equivalent listed waters. Additionally, the NPS is committed to working with state Clean Water Act programs, as well as taking appropriate management actions within parks, to support the restoration of impaired water bodies in parks to an unimpaired condition. Presently, about 118 park units have one or more waterbodies that do not meet state water quality standards for one or more pollutants on approximately 1,770 miles of rivers and streams and 1,100,000 acres of lakes, reservoirs, estuaries, and marine areas. Planning and design of the program continues to 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. In addition, 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 all 32 Park Vital Signs Networks in FY05 (Table 4). In addition, funds supported the development of an NPS servicewide water quality data management program within the EPA STORET national water quality database. While not shown in Table 4, WRD reallocated 20 work months involving five division staff to support program administration and the development of program technical guidance, technical protocols, detailed study plan and Quality Control/Quality Assurance plan guidance, and database management.

Table 4. Allocation of Water Quality Park Vital Signs Monitoring Funding - FY05 (continued on next page)

Network	Region	Number of Parks in Network	FY05 Funding $(000s)
Central Alaska	Alaska	5	97
Heartland	Midwest	15	81
NE Coastal and Barrier	Northeast	8	89
National Capital	National Capital	11	70
Cumberland/Piedmont	Southeast	14	58
Appalachian Highlands	Southeast	4	69
North. Colorado Plateau	Intermountain	16	106
Greater Yellowstone	Intermountain	3	70
Sonoran Desert	Intermountain	11	63

Table 4. Allocation of Water Quality Park Vital Signs Monitoring Funding - FY05 (continued)

Network	Region	Number of Parks in Network	FY05 Funding $(000s)
North Coast & Cascades	Pacific West	7	81
San Francisco Bay	Pacific West	6	69
Mediterranean Coast	Pacific West	3	75
Southwest Alaska	Alaska	5	137
Northeast Temperate	Northeast	10	59
Southern Colorado Plateau	Intermountain	19	122
Pacific Islands	Pacific West	9	149
Great Lakes	Midwest	9	121
Gulf Coast	Southeast	8	89
Rocky Mountain	Intermountain	6	60
Sierra Nevada	Pacific West	3	62
Eastern Rivers and Mountains	Northeast	9	62
Arctic	Alaska	5	159
Klamath	Pacific West	6	75
Southeast Coast	Southeast	17	119
Upper Columbia Basin	Pacific West	8	49
Southern Plains	Intermountain	10	29
Mojave Desert	Pacific West	6	79
Southeast Alaska	Alaska	3	41
South Florida/Caribbean	Southeast	6	145
Mid-Atlantic	Northeast	11	43
Chihuahuan	Intermountain	6	72
Northern Great Plains	Midwest	13	80
TOTAL: 2005 Network Monitoring	**7 NPS REGIONS**	**272**	**2680**
Servicewide Data Management			158
GRAND TOTAL			**2838**

Vital Signs Monitoring Networks: In FY05, 32 park Vital Signs Monitoring Networks fully committed their water quality funding to compilation of background information, analysis of issues and threats, detailed program planning, and supporting synoptic-level field assessments, and one network has initiated its monitoring plan. Network planning approaches included personnel hiring, in-house allocation of staff, university cooperative agreements, and USGS Interagency Agreements. In addition, some equipment acquisitions were made. All 32 networks accomplished one or more of the following activities:

- 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
- Development of water quality monitoring protocols

Individual network accomplishments are summarized in Appendix B (budget numbers are summarized and rounded; detailed budgets are provided in individual NPS Network Administrative Reports).

Servicewide Data Management: WRD continued to support network water quality monitoring programs by providing national program administration and reporting, establishing baseline inventories and analyses of available water quality data, supporting digitization of legacy data from analog reports and other archival materials, establishing a servicewide water quality database in the EPA STORET national water quality database, and developing the means to flow data from the networks into STORET. Three water quality research associates and a student worked to support this database development, management, and reporting activities through cooperative agreements with Colorado State University. A contract with Gold Systems, Inc., to migrate data from legacy STORET to modernized STORET was completed, resulting in an Internet-searchable servicewide NPS water quality database with over 2.5 million observations. This database has served as the starting point for most network water quality data compilation and analysis efforts. A contract with Research Triangle Institute to revamp automated water quality data retrieval procedures and reporting software to inventory and analyze water quality data from the three major national water quality databases (EPA legacy and modern STORET and the USGS National Water Information System) was continued. Much effort went into creating the two mechanisms by which networks will report water quality monitoring data to WRD for upload into STORET: NPSTORET and NPS_EDD. NPSTORET is a series of Microsoft Access-based templates for entering, managing, reporting, and analyzing network water quality data (projects, stations, metadata, and results) in a STORET compatible format. NPS_EDD is a set of Microsoft Excel-based spreadsheets that provide an electronic data deliverable content and format specification for those networks that don't employ NPSTORET.

WATER RESOURCE PROTECTION

Aquatic Resource Professionals

In FY05, the National Park Service received $1,205,000 to fund aquatic resource specialists in the field. Fifteen positions were fully funded in FY05. Twelve of the positions are duty stationed in parks, and one each is located in the Sonoran Network Office, the Center for Urban Ecology in the National Capital Region, and the Utah State Office. The specific aquatic resource disciplines represented by the new professionals, duty stations, and primary areas of focus are identified in Table 5.

Table 5. Water Resource Protection - Aquatic Resource Specialists
(continued on next page)

REGION	INCUMBENT	SPECIALIZATIOIN	DUTY STATION	GEOGRAPHIC FOCUS AREA	SUPERVISOR	WRD POC
AKR	Amy Larson	Aquatic Ecologist	YUCH	Central and Northwest Alaska Network Parks	Tom Liebscher, YUCH	Weeks
AKR	Dan Young	Fishery Biologist	LACL	Southwest and Southeast Alaska Network Parks	Judy Putera, LACL	Tilmant
IMR	Melissa Trammel	Fishery Biologist	Utah State Coordinators Office, Salt Lake City, UT	Upper Colorado River Basin Parks	John Reber	Wullschleger
IMR	Colleen Filippone	Ground-water Hydrologist	Sonoran Desert Network I&M Office Tucson, AZ	Arizona and New Mexico Parks	John Reber	Martin, L.
IMR/MWR	Sue Braumiller	Ground-water Hydrologist	CHIC	Southern Plains / Heartland Network Parks	John Reber/ Steve Cinnamon	Christensen
MWR	Brenda Moraska Lafrancois	Aquatic Ecologist	SACN	Great Lakes Network Parks	Steve Cinnamon	Vana-Miller
MWR	Jay Glase	Fishery Biologist	ISRO	Great Lakes Network Parks	Steve Cinnamon	Wullschleger
NER/NCR	Jeff Runde	Aquatic Ecologist	Center Urban Ecology Washington, DC	National Capitol / Mid-Atlantic Network Parks	Doug Curtis	Rosenlieb
NER	Alan Ellsworth	Hydrologist	DEWA	Eastern Rivers & Mountains / NE Coastal & Barrier Network Parks	Dave Reynolds	Flora
NER	Patricia Rafferty	Marine Ecologist	FIIS	NE Temperate / NE Coastal & Barrier Network Parks	Mary Foley	Tilmant
PWR	Marie Denn	Aquatic Ecologist	PORE	San Francisco Bay / Sierra / Klamath / Mediterranean Coast Network Parks	Superintendent, PORE	Wullschleger

Table 5. Water Resource Protection - Aquatic Resource Specialists (continued)

REGION	INCUMBENT	SPECIALIZATIOIN	DUTY STATION	GEOGRAPHIC FOCUS AREA	SUPERVISOR	WRD POC
PWR	Paul Kennard	Geomorphologist	MORA	North Coast & Cascades / Klamath Network Parks	Superintendent, MORA	Smillie
PWR	Tom Culhane	Ground-water Hydrologist	LAME	Mojave Desert Network Parks	Kent Turner, LAME	Van Liew
SER	Jim Long	Fishery Biologist	CHAT	Southeast Coast / Gulf Coast / Appalachian Highlands / Cumberland-Piedmont Network Parks	Sherri Fields	Tilmant
SER	Cherry Green	Wetlands Ecologist	CHAT	Southeast Coast / Gulf Coast / Appalachian Highlands / Cumberland-Piedmont / South Florida - Caribbean Network Parks	Sherri Fields	Wagner

These new professional staff provide technical assistance to parks, identify and conduct technical investigations to determine the condition of park aquatic resources, determine if actions of the NPS or external parties impair or impact resources, assist in developing and implementing aquatic resource mitigation and restoration projects, and interpret and implement NPS water resource related policies and regulations.

Prior to funding provided by the Natural Resource Challenge, only 20 parks had aquatic resource professionals on staff. Founders of the Challenge recognized the need to increase professional expertise and to employ more park based aquatic resource professionals to address water resource related issues facing the National Park Service, and to develop more comprehensive and programmatic approaches to aquatic resource protection at the park level. As called for in the Challenge, these staff will work on aquatic resources issues across a number of parks and will be managed in accordance with NR-PRO (i.e., FTEs are transferred to parks with annual funding provided by WRD following approval of an annual work plan).

Positions are fully funded and supported at the GS-11-1 grade. Any costs above the GS-11-1 grade are to be funded by the host park or region. As salary costs have increased, parks and regions are finding it increasingly difficult to cover those costs. To help address this situation, one position was lapsed in FY04 to help support the increased costs associated with the 15 funded positions. In the future, as attrition occurs, WRD does not expect to continue to maintain all of these positions.

WATERSHED CONDITION ASSESSMENT PROGRAM

WRD received $2.76 million in FY05 as part of the Natural Resource Challenge to assess watershed conditions on a system-wide basis. FY05 was the third year for the recently established Watershed Condition Assessment Program (WCAP), a program supported by a permanent increase to the WRD base. The WCAP will integrate data and knowledge pertaining to water and other watershed resources to help define desired conditions and assess existing conditions within park managed uplands, streams, riparian areas, wetlands, and coastal/marine areas. The information developed through assessments of watershed resource conditions will contribute to information needs of park planning, resource protection, and resource restoration activities. Establishment of this program is timely in light of the movement towards condition based resource planning and decision making by the NPS. Information developed by the WCAP will complement information from the Vital Signs Program (also a component of the Natural Resource Challenge) to develop science based information on conditions and trends relative to important park resources. Information from these Challenge programs will be useful to parks as they develop Resource Stewardship Plans as outlined in draft Director's Order 2-1. Resource condition information is also fundamental to the needs of the DOI Strategic Plan which identifies the health of landscapes and watersheds as a key Outcome Goal.

Significant program accomplishments in FY05 are described below. Table 6 shows the budget allocation in FY05 for the Watershed Condition Assessment Program.

Table 6. Watershed Condition Assessment Program FY05 Budget

Program Element	FY05 Funding $(000s)
Watershed Condition Assessment Workshops and Technical Guidance	24.9
Water Resources Competitive Project Program	1,272.0
NPS-USGS Water Quality Assessment Partnership Program	274.5
WRD Watershed Condition Assessment – Critical Projects	275.5
Coastal Park Natural Resource Assessments	534.4
Marine Science Advisor	130.0
Compendium of Assessment Methods	43.8
Other (incl. staff)	207.7
TOTAL	**2,762.8**

Implementation of long-range program plan: Program efforts in FY05 emphasized continuation of baseline condition assessments at coastal and marine parks, continued development of a compendium of watershed assessment methods and classification systems for potential use by parks, and funding of backlogged watershed resource and water quality assessment projects identified in NPS PMIS. Two full-time staff members provide dedicated support to implement long-range program components. This includes one federal employee, who serves as Program Coordinator, and a Coastal Resource Analyst, who assists coordination of resource assessments in NPS managed coastal/marine environments. These staff members are overseeing transition of the WCAP to a systematic program of park based assessments of NPS watershed resource conditions, conducted in close coordination with other NPS

programs and activities as they relate to DOI strategic planning, NPS resource management planning, inventory and monitoring, and disturbed lands restoration.

Coastal Park Watershed Assessments: Land areas that drain into the coastal zone are nature's dynamic hydrologic systems that create and sustain coastal ecosystems. Coastal areas differ from strictly upland environments because of salinity regimes, the potential transport of pollutants or invasive species from ocean/lake currents, and the high degree of development on the coast. In FY03, the WCA Program began funding a series of Natural Resource Assessments for parks that manage significant coastal and/or marine resources. As of FY05, WRD has initiated condition assessments of 41 ocean and Great Lakes parks, with more planned for FY06.

Through the Cooperative Ecosystem Studies Units (CESUs), university scientists review and synthesize existing information to determine the status of coastal park resources, including water quality, habitat condition, invasive and feral species, extractive uses, physical impacts from resource use and coastal development, and other issues affecting their condition. Recommendations are then made concerning the need for further studies to address known resource problems and/or fill information gaps in order to more fully evaluate conditions.

As of FY05, final reports have been published for Padre Island National Seashore, Cape Lookout National Seashore, Timucuan Ecological and Historic Preserve, Gulf Islands National Seashore, and Cumberland Island National Seashore. Draft reports have also been received for Redwood National Park, Sitka National Historical Park, Klondike Gold Rush National Historical Park, Fort Pulaski National Monument, and Cape Hatteras National Seashore. These reports provide baseline condition assessments and valuable insights into factors affecting the health of park resources for use by park managers. WRD is providing the Coastal Watershed Condition Assessment Reports to parks and the Inventory and Monitoring Networks to help guide resource management planning and support the development of Vital Signs Monitoring Plans. The NPS also plans to work collaboratively with programs such as the EPA National Coastal Assessment and with USGS, NOAA, state and local agencies, watershed councils, landowners, and other community stakeholders to address issues cooperatively on a local watershed or regional oceanographic scale. As shown in Table 7, WRD obligated $534,400 in FY05 to initiate assessments in 15 additional coastal parks and to provide supplemental funding to conduct GIS work for FY04 initiated assessments in 6 parks.

Table 7. Allocation of Coastal Watershed Condition Assessment Funding – FY05

REGION	CESU/University	STATE	PARKS	FY05 FUNDING $(000s)
Alaska	Pacific Northwest/ University of AK Southeast	AK	KEFJ, KATM, ANIA, LACL	$ 88.9
Alaska	Gulf Coast/Texas A&M, University of AK, Anchorage	AK	CAKR, BELA	$ 79.7
Midwest	Great Lakes Northern Forest/ University of WI, Stevens Point	WI, MI	APIS, PIRO	$80.0
Midwest	Great Lakes Northern Forest/ Michigan State University	MI	INDU	$72.6
Pacific West	Pacific Northwest/ University of WA	WA, OR	LEWI, OLYM, EBLA, SAJU (GIS supplement)	$23.3
Pacific West	Californian/ University of CA, Davis	CA	PORE, GOGA (GIS supplement)	$23.5
Pacific West	Californian/University of CA, Santa Barbara	CA	CABR, CHIS	$90.0
Southeast	South Florida Caribbean/ University of PR, Mayaguez	VI	VIIS, VICR, BUIS, SARI	$ 76.4
Total			**21 parks, including 15 new park startups in FY05**	**$534.4**

Watershed Condition Assessment Methods Compendium: In FY03, WRD initiated a contract with the Chesapeake Watershed CESU system member at George Mason University to conduct a review, evaluation, and classification of condition assessment methods and to develop a compendium of methods applicable to NPS needs, as well as guidance on how to select appropriate assessment methods. As of the end of FY05, substantial progress has been made toward completion of the method reviews. The compendium will become available for use by parks, universities, and the general public in FY06. It will be accessible through a USGS, National Biological Information Infrastructure (NBII) Program public accessible website. This website is being developed by the NBII Program through an Interagency Acquisition Agreement between NPS and the USGS Center for Biological Informatics. Supplemental funding in the amount of $43,800 was provided to support compendium related work in FY05.

Water Resources Competitive Project Program: There remains a backlog of watershed resource and water quality assessment projects identified in NPS PMIS. Twenty-nine of these projects were funded through the WRD Competitive Project Program process. Summaries of those projects that received their final year and continuing funding in FY05 are included in Appendix A.

NPS-USGS Water Quality Assessment Partnership Program: The NPS-USGS Water Quality Assessment and Monitoring Partnership Program was initiated under the Clean Water Action Plan and is funded primarily by the USGS. In FY05, NPS expanded the program by contributing $274,500 of Watershed Condition Assessment Program funds to support four multi-year partnership projects in parks. The projects funded in FY05 include studies at Canyonlands National Park, Niobrara National Scenic River, Lake Roosevelt National Recreation Area, and Yosemite National Park.

WRD Watershed Condition Assessment – Critical Projects: In FY05, WRD funded projects that addressed emerging, high-priority, park watershed condition issues that, because of the applicable timeframes, could not be appropriately directed through the competitive project funding program. Examples of FY05 new starts include water quality sampling and analyses to determine the concentrations of water quality parameters that may impact the overall health of the Devils Hole Pupfish in Death Valley National Park and a baseline evaluation of tributary stream conditions in Ozark National Scenic Riverways. Partnering with other federal agencies, state agencies, and/or local watershed groups in carrying out these projects was emphasized. Table 8 shows the funding allocation for this project category.

Table 8. WRD Watershed Condition Assessment – Critical Projects Funded in FY05

New Starts

Region/State	Park	Project Title	FY05 Funding S(000s)
IMR/AZ	CACH	Measure Upstream Water-Surface Elevations along Two Channels	3.5
IMR, PWR/ AZ,CA,NV,UT	CRCA, BLCA, CURE, LAME, CANY, GLCA	Estimating the Economic Values of NPS Resources within the Colorado River Watershed	40
IMR/CO	ROMO	Upper Colorado River Watershed Assessment	30
MWR/NE, SD	MNRR	Response of Freshwater Mussels to Changes in Discharge along Missouri National Recreation River	51.6
MWR/MO	OZAR	Rapid Response to Changes in Missouri Water Quality Regulations by Assessing Tributary Status	58.7
NCR/VA	GWMP	Evaluate Sediment Accretion and Subsidence for Dyke Marsh Restoration Planning	9.8
PWR/CA,NV	DEVA	Water Quality Evaluation of Potential Environmental Contaminants in Devils Hole	11
PWR/CA, NV	DEVA	Design, Fabricate and Install a New Access Platform for Devils Hole	30
PWR/CA	SEKI	Evaluate Reference Meadows and Develop Restoration Concepts for Halstead Meadow	12
SER/GA	CHAT	Genetic Integrity of Shoal Bass Isolated by Morgan Falls Dam	28.9
Total	**10 Parks**		**275.5**

Marine Science Advisor: The program continued to support Natural Resource Stewardship and Science's senior scientist/marine science advisor for an additional year.

NPS-USGS WATER QUALITY ASSESSMENT & MONITORING PARTNERSHIP PROGRAM

The NPS-USGS Water Quality Assessment and Monitoring Partnership Program was initiated under the Clean Water Action Plan and is funded primarily by the USGS Water Resources Division Office of Water Quality. Since 1999, more than $17 million has been allocated for partnership water quality projects in parks. Through 2005, 114 partnership projects have been initiated in 63+ national park units; 97 of these projects have been completed. Additional information on the program is available at: http://water.usgs.gov/nps_partnership/.

Table 9. USGS Water Quality Assessment and Monitoring Partnership Projects
Final Year Funded Projects - FY05

NPS REGION	PARK	PROJECT TITLE	FY05 Funding $(000s)
Alaska	LACL	Potential Effects of Logging on Water Quality in Crescent River Watershed	85.00
Intermountain	CANY	Streamflow and Water Quality Monitoring Station for Salt Creek	23.50
Intermountain	CHIC	Assessment of Sources of Septic Contamination of Rock Creek	44.10
Intermountain	CURE	Quality Assurance and Publication of Water Quality Data Collected from Streams, Rivers, and Reservoirs	31.40
Intermountain	SCPN	USGS Technical Assistance for Water Quality Vital Signs Monitoring	20.00
Midwest	HOSP	Delineation of Recharge Area for Cold Water Component of Geothermal Springs	67.60
Midwest	NIOB	Research and Monitor Water Quality of Niobrara National Scenic Riverway	84.20
Midwest	OZAR	303(d) – Source Identification of Fecal Indicator Bacteria in Water and Streambed Sediments	42.50
Northeast	ACAD	Determine/Model Sources of Ground Water and Nutrients	80.00
Northeast	CACO	Robowell: Automated Ground-water Monitoring	42.40
Pacific West	LARO	Effects of Trace Elements on Water Quality and Biological Health	85.00
Pacific West	LAME	Occurrence and Toxicity of Incomplete Combustion of PWCs	54.00
Pacific West	YOSE	Risk Assessment for Aquatic Ecosystems in Wilderness Areas	81.80
Southeast	BISO	Restoration of Federally Listed Mussel Species and Water Quality Monitoring in Heavily Coal Mined Area	99.50
		TOTAL	**841.00**

Table 10. USGS Water Quality Assessment and Monitoring Partnership Projects
Continuing Projects - FY05

NPS REGION	PARK	PROJECT TITLE	FY05 Funding $(000s)
Intermountain	AMIS	Water Quality and Biological Assessment along the Rio Grande	49.30
Intermountain	BIBE	Salinity and Source of Nutrients in the Rio Grande/Rio Bravo between Presidio and Amistad Reservoir	81.00
Intermountain	CURE	USGS Data Collection and Analysis of Required Water Quality Parameters: Outstanding Waters Designation	50.00
Intermountain	GLAC	Effects of Wildfire on Water Quality	100.00
Intermountain	GLCA	Evaluate Hydrocarbon Contamination in Lake Powell	100.00
Intermountain	SAGU	Determine Wildfire Effects on Water Quality of Lowland Leopard Frog Habitat	85.00
Midwest	CUVA	Develop a Method to Rapidly Estimate Fecal-Indicator Bacteria Concentrations	98.20
National Capital	CHOH	Ecological & Physical Effects of Sediment Loads to the Potomac River due to Flushing of Sludge from Reservoirs – Part 1: Chemical Evaluation of Sediments	100.00
Northeast	CACO	Review and Storage of Long-Term Water-Quality Monitoring Data for the Kettle-Hole Ponds	13.50
Northeast	CACO	Defining Nutrient Fluxes to Estuaries to Assess Alternatives for Nutrient Loading Remediation	99.70
Northeast	SHEN	Assess Effects of Human Activities and Recreational Use on Bacteria Concentrations in Streams	50.00
Pacific West	MOJA	Determine the Susceptibility of Springs in the Mojave Network to Climate Change and Development	100.00
Pacific West	OLYM	Transport of Suspended Sediment & Effect on Aquatic Habitat in Elwha River	98.60
Pacific West	PORE	Tomales Bay Watershed Sediment Transport Monitoring	100.00
Pacific West	SEKI	Fire Impacts on Nutrients and Sediments in Redwood Creek Watershed and Lilburn Cave	48.90
Pacific West	WHIS	Assess the Instream Biological, Habitat, and Water Quality Conditions	100.00
Southeast	CANA	Complete Phase Two Implementation of Water Quality Monitoring Program	33.30
		TOTAL	**1307.5**

APPENDIX C

SUMMARIES OF WATER QUALITY MONITORING PROGRAM FUNDING IN PARK VITAL SIGNS MONITORING NETWORKS

Appalachian Highlands Network (APHN)

The APHN received $70,000 in funding from WRD for water quality monitoring in FY05. That funding was used to forward fund a one-year agreement with the water lab which will conduct sample analysis for the network's long-term monitoring program (the water lab in the Environmental Sciences Department at the University of Virginia). WRD funding was also used to partially support network salaries and to purchase a vehicle which will be used by the network's water resources monitoring team.

The final APHN Monitoring Plan was approved by the NPS I & M program in September 2005. A draft APHN Water Resources Monitoring protocol was completed in FY05 and submitted for peer review. It describes, on a park-by-park basis, the justification for monitoring, the monitoring design, and the data collection, analysis, and reporting procedures which will be followed. Objectives for water quality monitoring in the network parks are to determine seasonal and annual variability in concentrations of bacteria, nutrients, sediment, selected trace metals, and physical parameters in streams, rivers, and wetlands within BISO, BLRI, and OBRI and to determine the rates of change of concentrations of these parameters over time. The Network Hydrologist will incorporate reviewers' comments into the final protocol. The draft protocol contains 11 standard operation procedures (SOP), including a detailed SOP on management of water quality data. The NPSTORET database will be adapted for use for the network water quality monitoring program. Staff gauges were installed at long-term monitoring sites at BISO and OBRI, and the first year of a characterization sampling project was completed at BLRI to identify appropriate long-term water quality monitoring sites related to acid deposition impacts. The macroinvertebrate sampling portion of that project yielded 16 new species to science from high elevation streams and seeps on the Blue Ridge Parkway.

Arctic Network (ARCN)

The Arctic Network received a total of $147,411 in funding from WRD in FY05 after the reduction for ATB rescission (1.4%) and regional contingency assessment (1%). This entire amount was passed through the University of Vermont CESU for work performed by freshwater ecosystem experts from that school, the University of Alaska (Fairbanks), the University of Alabama, Utah State, and the Marine Biological Laboratory.

In FY05 the ARCN completed and received I & M program approval of its Phase 1 report. The Phase 1 effort by ARCN staff included the identification of streams, lakes, and wetlands with significant or outstanding value or those having water quality issues (303d designated water bodies). ARCN is also in the process of compiling existing data and evaluating water quality information when available to determine where potentially impaired streams, lakes, and wetlands may occur. A cooperative agreement with Dr. Breck Bowden of the University of Vermont was initiated to collect baseline data for freshwater resources in GAAR. This project greatly enhanced the limited data and knowledge about the freshwater resources and water quality of the Noatak River watershed and will be used in monitoring plan and protocol development in FY06. Over the coarse of a two week field period, sampling teams collected a broad range of aquatic resource data, including measurement of stream physical characteristics, water quality physical and chemical parameters, and benthic algal

biomass from 20 different stream reaches and 12 lakes. Benthic macroinvertebrates were sampled both quantitatively and qualitatively, with representative specimens of key fauna saved for later taxonomic identification. Fish assessments were performed concurrently to facilitate the analysis of food web structure (riparian vegetation and macroinvertebrates) and assess integration of multiple aquatic vital signs resource components under a single field mobilization. Lake assessments included detailed bathymetric surveys by GPS-linked sonar depth sounding. Light, temperature, and dissolved oxygen were measured in selected vertical profiles of each lake using an automated sonde.

Central Alaska Network (CAKN)

CAKN received $98,000 in funding from WRD for the water quality monitoring program in FY05. A significant portion of these monies ($80,000) went toward water quality monitoring operations and equipment used in conjunction with field sampling efforts for freshwater fish inventory to effectively access more sampling sites across the network parks. $15,306 was used for contracts to assist in development of an integrated water quality monitoring plan with the other vital signs and to apply this information to the water quality protocol under development. The remaining amount was used to largely cover Alaska Regional Office administrative support (1% of total funding) and the rescission (1.4%) on water quality funding.
The final CAKN monitoring plan received formal approval by the I & M program in September 2005. The network has produced full protocols for the monitoring of 11 vital signs, and these protocols, including water quality, are in the process of scientific peer-review. The network is taking a two-pronged approach to developing the water quality monitoring program by focusing first on protocol development for shallow lakes, which make up a sensitive and extensive resource throughout the network, and then on protocol development of network flowing water bodies. FY05 saw the final year of pilot monitoring to support shallow/permafrost lake protocol development, the deployment of continuous water quality monitoring sondes to determine best times of the day to conduct synoptic monitoring, and the temporal variability in core parameter measurements to help identify key factors to incorporate into sample design. This protocol is now in peer review. The pilot monitoring of 7 new lakes led to the discovery of 20 new genera of macroinvertebrates. Plans were made to hire a network Stream Ecologist in early FY06 to develop a multi-year staged plan for the development of the moving water portion of the monitoring program. Immediate tasks for this position include the assessment of current methodologies for gaging of large, glacial rivers and smaller, headwater streams together with a biotic monitoring component of moving water systems, including macroinvertebrates, fish, and riparian vegetation.

Chihuahuan Desert Network (CHDN)

The network received $73,000 from WRD for Water Quality Monitoring (available budget $71,700 following a $1,300 assessment). Network staff salaries utilized $35,380. $13,336 was allocated to the USGS-WRD through an interagency agreement for the development of a monitoring plan. A conceptual modeling effort dealing with water quality/riparian issues by the Agricultural Research Service was allocated $16,500. The remaining funds ($6,480) were used to pay for office space and travel.

Completion of the network's water quality assessment Phase 1 report provides a sound basis for moving ahead with water quality monitoring planning. Additionally, Section 303d designated waters, as well as waters of special interest to CHDN parks, were identified. This assessment also brings together a sound understanding of state water quality management processes, existing park water quality monitoring projects, and initial identification of water quality issues and con-

cerns. Information in these areas provides a basis for improved, more uniform park water quality management. States-based issues, such as involvement with the nomination of Outstanding Natural Resource Waters, may now be addressed. The USGS New Mexico Water Science Center, USGS Surface Water Office (San Antonio, TX) and the Texas Council on Environmental Quality (Austin, TX) will collaborate and participate in the development and implementation of the network's water quality monitoring plan.

Cumberland/Piedmont Network (CUPN)

The network received $59,000 from WRD to continue the Water Quality Monitoring program. $28,000 was used to fund salaries of the MACA Hydrologist and the CUPN Data Manager to provide advisory services for the network. The remaining funds ($31,000) were used to pay for water quality analysis, laboratory supplies, and the salary of a lab manager at Western Kentucky University.

Sampling was conduced in six parks in FY05. In mid December 2004, the CUPN Advisory Hydrologist (MACA-Science and Resources Management Division's Joe Meiman) completed the draft network wide water quality monitoring protocol (and draft WQ monitoring plan) following NPS standards (Oakley et. al. 2003) and submitted it to SER and WRD for external review in conjunction with the CUPN-MACA Prototype ("Phase 3") Monitoring Plan. After receiving peer review comments, the draft water quality monitoring protocol and draft WQ monitoring plan were revised and the final versions submitted to SER for approval in late September 2005. The MACA Acting Superintendent facilitated several meetings to resolve key water quality monitoring issues. Consequently, two cooperative agreements were established for fee-for-service laboratory analyses, and cost-share arrangements were made to cover maintenance agreements and quality control tests, among other FY05 items. Several quality control tests were performed at the water laboratory, on-site technical assistance was obtained from a USGS-BRD analytical chemist, and the lab was awarded state certification following proficiency analyses. In 2005, the MACA Hydrologist also completed water quality reports for nine network parks, reviewed existing information for the other five parks, and made recommendations for the long-term monitoring program. The water quality baseline inventory has been ongoing for the past three years and provided much insight into the development of the current program. The MACA SRM Hydrologist also took the lead on beta-testing of the new servicewide database, NPStoret, which gave the CUPN a headstart on managing the huge volume of incoming water quality data. Over 8,000 NPStoret records were entered and/or uploaded from three years of baseline data.

Eastern Rivers and Mountains Network (ERMN)

In FY05, the ERMN received $61,500 from WRD. $9,830 was spent to expand a Level 1 water quality inventory to include fish and macroinvertebrate work at ALPO and JOFL; $38,800 was spent for water quality, fish, and macroinvertebrate work at FONE and FRHI; $12,350 was spent for conceptual model development and vital signs of tributary stream watersheds; and $540 was spent for water quality sampling at 12 mine openings at NERI.

Water quality sampling at locations in ALPO and JOFL continued. Additionally, the project was expanded to include biological sampling of macroinvertebrate and fish communities in stream reaches corresponding to the water quality monitoring station locations. The results of water quality and biological data analysis indicate the existence of aquatic ecosystem impairment in the headwaters of Blair Gap Run. Potential sources of this impairment include pollution from automobiles/roadway runoff, acid mine drainage from reclaimed surface mining operations, and acid deposi-

tion/atmospheric pollution. Additionally, the presence of two public drinking water reservoirs located within the Blair Gap Run watershed is likely having an effect on in-stream water chemistry and the diversity and population of macroinvertebrates and fishes in Blair Gap Run. A cooperative agreement was established with Pennsylvania State University to conduct the water quality assessment at FONE and FRHI. Most of the project work will be conducted in FY06.

ERMN identified 37 vital signs that represent a systems approach to our monitoring program. Five vital signs relate specifically to water. Through the network prioritization process of meetings and ranking exercises, a short list of the highest priority vital signs has been created that the network plans to develop monitoring protocols for and implement in the next three to five years. Tributary streams and large rivers are top priorities for integrated monitoring of water related vital signs. Based on the outcome of the ERMN vital signs prioritization and selection process and pending the Fall 2005 SAC and BOD meetings, the network plans to initiate protocol development on these two protocols specifically related to water resources.
Lastly, during FY05 the spatial datasets used in the creation of the reports reviewed last year were formatted according to NPS spatial data protocol and were supplied to the ERMN data manager with accompanying metadata. The water quality database assembled during the course of the project was also delivered to the NPS. The project was completed on June 30, 2005.

Great Lakes Network (GLKN)

The network received $121,278 in water quality funding for FY05. Approximately $57,000 was spent to make substantial progress on two protocols for monitoring water quality–one for large rivers and the other for inland lakes. Together with cooperators from the St. Croix Watershed Research Station (SCWRS, large rivers) and the Natural Resources Research Institute (NRRI, inland lakes) the network analyzed past data to determine the sample size and frequency of sampling necessary to meet our criteria for detecting change and began writing the narratives and SOPs. These two protocols will be used in monitoring water quality at eight parks and will include the mandated parameters (temperature, dissolved oxygen, specific conductance, pH, and water level or flow), as well as nutrients, major ions, clarity, total suspended solids, and chlorophyll a. Field work was begun on the diatom project at PIRO and SLBE. The network sampled routine parameters, including profiles of temperature, dissolved oxygen, pH, and specific conductance. Also measured were Secchi depths. Water samples were analyzed for nutrients, major ions, dissolved organic carbon, dissolved silica, and chlorophyll a. At the end of the season, sediment samples from all 15 lakes were collected with a drop corer, and long cores were collected from one lake at PIRO and three lakes at SLBE. The network spent approximately $55,000 on contracts, equipment, supplies, and park staff salaries to accomplish this initial season of field work.

Greater Yellowstone Network (GRYN)

The network received $71,000 in FT 2005 to finalize its Phase 3 water quality plan and monitoring protocol development. $69,300 was used to partially fund the salaries of three positions: the GRTE hydrologist, who is responsible for overall vital signs water quality implementation, and two aquatic ecologists, who are responsible for water quality monitoring and NPStoret maintenance for YELL and BICA. The remaining $1,700 was used to cover rescissions and regional assessments.

Major accomplishments included the completion of a monitoring protocol and SOP for the GRYN regulatory water quality monitoring program. It was peer reviewed by WRD and approved for implementation with only minor changes. This plan covers streams, such as Soda Butte Creek in YELL, which are

impacted by historic mining activities and do not meet water quality standards as required by the NPS's Strategic Plan Goal 1a4. This protocol outlines the rationale, justification, and monitoring objectives for streams that are listed as 303(d) water quality impaired by the Wyoming and Montana Departments of Environmental Quality. The SOPs provide a unified methodology for the collection of water quality core and regulatory parameters and establish plans for quality assurance and quality control. The SOPs also outline the roles and responsibilities for data management, analysis, and reporting.

In June 2005, GRYN began implementing its regulatory water quality monitoring protocol in BICA and YELL. In BICA, the Shoshone River was sampled for fecal coliforms and *E. coli* and samples were collected in the Bighorn River for nitrogen and benthic macroinvertebrates. In YELL, Soda Butte Creek was sampled for total and dissolved metals in water, metals in sediment, and benthic macroinvertebrates. Sampling was conducted by network-affiliated park staff Cassity Bromley and Jeff Arnold.

Gulf Coast Network (GULN)

In FY05, GULN provided $87,800 in funding to the USGS to develop the water quality monitoring plan in phases, with close coordination with both network and park staff. The project consists of 3 phases spread over several fiscal years. In Phase 1 the USGS was to compile existing water quality information on each of the GULN parks and visit each park to become familiar with specific water quality issues concerning each network park. Specific tasks included: 1) collection of spatial data that describe the natural and cultural factors influencing water quality in network parks, 2) completion of retrospective water quality data analysis, 3) identification of important management and scientific issues, and 4) summarization of ongoing water quality monitoring in the network. The USGS has been working on this but has not yet provided the network with a product to review. USGS presented a Phase 1 progress report at the April 2005 meeting of the Science Advisory Committee. Progress since then has not been satisfactory. However, a water quality scoping workshop was held in October 2005 to help move the project along.

Heartland Network (HTLN)

The network received $80,900 in water quality funding in FY05. Several projects addressed monitoring water quality of impaired EPA 303(d) listed streams. During 2005, WRD 303(d) money contributed to field testing, data collection, and cooperative ventures with state and county agencies tasked with determining and monitoring the total maximum daily load (TMDL) of pollutants. For example, scope of work was finalized concerning water quality monitoring for the purposes of establishing a TMDL of pollutants in the Yellow River, Iowa, and a draft report and QA/QC plan were developed for determining the effectiveness of related mitigation in this stream as it passes into EFMO ($14,955). An interagency agreement with the USGS was amended to continue implementing the USGS recommended monitoring plan for assessing bacterial contamination in the Jacks Fork River at OZAR ($22,000). Microbial source tracking was used in an effort to identify bacterial sources causing the unusually high contamination levels in this stream. The USGS also continued developing a monitoring protocol for lead and associated contaminant metals in streams at OZAR using Asian clam and riffle-dwelling crayfish ($4,620). A water monitoring update for Hoover Creek was submitted in March 2005, and monthly monitoring at four sampling stations was conducted. Analysis on trends in the data and pollutant loads also began this year. Benthic invertebrate and physical habitat assessments were scheduled to be completed in September 2005. A cooperative project between the USGS-WRD and NPS measured spring temperature in relation to

precipitation at HOSP in order to determine the influence of surface-water input into the thermal springs ($18,000). The remainder of the water quality funding was spent for salaries, administration, and miscellaneous expenses.

Klamath Network (KLMN)

In FY05, the network received $75,000 for development of Phase 2 of a Water Quality Monitoring Plan. A servicewide water quality funding rescission of $1,100 reduced the water quality budget to $74,900. The Klamath Network Data Mining Team used $11,700 to summarize water quality related reference material in all six parks and put this information into the NatureBib database. In partnership with USGS Forest and Rangeland Science Center, the network completed its Phase 2 Water Quality Monitoring Report ($62,776). This report summarized major aquatic resources and monitoring issues in each park of the network. These resources and issues included Outstanding Natural Resource Waters, Wild and Scenic Rivers, Aquatic Species of Special Concern, and Clean Water Act Section 303(d) Impaired Waters. The report provided an overview of regional Water Quality Monitoring and Research Programs that are relevant to the development of a long-term Water Quality Monitoring Program. The report also described a process for prioritizing water quality vital signs that was completed by USGS Scientists in partnership with Klamath I & M staff.

The network collaborated with WRD to develop a baseline water quality inventory in three parks with insufficient background water quality information: LAVO, LABE, and ORCA. WRD provided funding to Chris Currens, Aquatic Ecologist with the USGS Western Ecological Research Center, to conduct the inventory. Fieldwork began in Fall 2004 and will be completed in Fall 2005.

Mediterranean Coast Network (MEDN)

The MEDN received $74,900 in FY05 from WRD to support water quality monitoring activities in the network. Significant progress has been made in launching marine and fresh water monitoring in the MEDN. SAMO has been gathering baseline monitoring data on aquatic amphibians and stream water quality for the past four years in anticipation of completing and implementing aquatic amphibian and stream water quality monitoring protocols in FY06. The network also supported extensive stream reconnaissance water quality data gathering in SAMO to provide baseline data for selecting monitoring locations and to help define the water quality parameters to be monitored. To meet the network water quality monitoring objectives and to continue baseline data gathering, water quality monitoring funds were expended as follows: 1) $21,750 was directed to cover 30% of the network monitoring coordinator's salary as he was heavily involved in water quality monitoring planning and in administering task agreements with California State University, Los Angeles (CSULA), 2) $19,500 was obligated to the Geology Department of CSULA to prepare draft monitoring protocols for freshwater streams in SAMO and CHIS and the marine waters off CABR and CHIS, 3) $25,000 was used to support a half-time bio-technician performing stream bio-assay monitoring in SAMO, 4) $1,912 was used to cover a regional IT assessment for computers designated for use in water quality monitoring, 5) $3,678 went to purchase water quality sampling instrumentation and other expendable supplies to support stream bio-assay monitoring, and 6) the remaining $3,060 went to protocol peer review costs, administrative support provided by network parks, and miscellaneous expenses supporting the bio-technician performing stream bio-assay work.

Mid-Atlantic Network (MIDN)

The MIDN received $44,000 in FY05. WRD funding was spent on water quality supplies and equipment ($1,500) and a cooperative agreement with the University of Virginia for water quality plan development ($41,700). The

network established a cooperative agreement with the Department of Environmental Sciences, University of Virginia, to develop a water quality monitoring plan following the phased reporting of the I & M Program. As part of a cooperative agreement with the University of Virginia, a report was prepared that compiled information on state-identified "impaired" (305b and 303d-listed) waters within network parks, information on state-identified outstanding waters, or special protection waters, and information on other water bodies in the network not officially recognized as such (but that are thought to be both pristine and ecologically highly significant at the park or network scale), and identified ecologically significant "stressors" that have the potential to impact water quality within network parks. The information was presented as part of the Phase 1 report. In addition, the network and cooperators worked with park staff to conduct data mining and database review activities to determine the status of active and historic water quality monitoring within network parks, began compiling existing water quality data, began an analysis of the adequacy of current monitoring by NPS or others, and evaluated existing water quality monitoring programs.

Mojave Desert Network (MOJN)

The Mojave Desert Network was allocated $80,000 from WRD to initiate planning for water resource monitoring in network parks. The actual amount received was $78,900, representing a rescission of $1,100. WRD funds were allocated toward travel support for participants at the Mojave Desert Network Water Resources Monitoring Workshop ($1,600) and continued spring inventories in network parks ($77,300).

MOJN has completed a description of network water resources, summarization of existing data and information, identification of pristine and impaired water bodies, identification of related water quality regulations/criteria for network parks, development and prioritization of monitoring objectives, and development of other information required for the Phase 1 report. These activities built upon the results of the Mojave Desert Network Vital Signs Scoping Workshop held in Las Vegas, NV, in May 2004. The purpose of the Mojave Desert Network Water Resource Monitoring Workshop was to review and expand upon the work completed at the 2004 Mojave Desert Network Vital Signs Scoping Workshop for water related vital signs. The workshop products were: 1) network decision to develop a network vital signs monitoring plan that integrates water quality monitoring; 2) final list of reviewed, revised, and prioritized monitoring questions for each water related vital sign and identification of associated information (e.g., priority monitoring locations, parameters of interest, and sampling frequency) leading to development of specific monitoring objectives; and 3) identification of gaps in baseline data needed to generally inform the monitoring design process for parks within MOJN. The MOJN Water Resources Monitoring Workshop Report was approved by the network board of directors in September 2005. The products of this meeting were used to guide the direction and activities of the Mojave Desert Network related to water resource funding in FY05 and conduct planning for FY06.

National Capital Region Network (NCRN)

In FY05, the network's WRD funds ($70,000) were used for salary and benefits for the term hydrologist, who is responsible for the development of the NCRN water quality monitoring plan, and to complete a variety of major accomplishments. The selection of vital signs was approved by the Science Advisory Committee and the Board of Directors. This paved the way to complete the monitoring plan and prepare protocols for implementation. Draft water chemistry and surface-water dynamics monitoring protocols were completed. Pilot sampling began in May 2005 with the hiring of a STEP Hydrologic Technician. This field testing greatly assisted in

finishing the SOPs for submission for peer review. Protocols and SOPs will continue to be refined as field work progresses. As part of the pilot testing, water level loggers were installed at 8 parks with the assistance of USGS personnel.

A desktop version of NPSTORET has been configured with sampling metadata for water chemistry and flow data entry. All data collected by the I & M monitoring program since May has been entered into the database. The I & M Data Manager and Quantitative Ecologist are developing data flow from NPSTORET to analysis and graphing software. GIS coverages are being developed depicting the GPS'd sampling points and information regarding the hydrology (ephemeral or perennial) and other characteristics of stream segments within the parks.

Revision of existing stream monitoring by parks to more closely follow the I & M Program's Protocols and SOPs was also begun this year.

North Coast and Cascades Network (NCCN)

The NCCN received $80,900 in FY05 from WRD for monitoring water quality, which was used to fund aquatic monitoring protocol development and testing. A total of $63,200 was spent for personnel costs, $4,000 was spent for contracts, and $13,700 was spent for sample processing, equipment, and travel. Progress on the water quality component of the network monitoring program included work on the water quality monitoring plan, geo-referencing water quality data, creating land-use maps, identification of pristine and impaired waters, and developing numerous monitoring protocols. The first set of NCCN protocol development summaries are now nearing completion and the beginning of their peer review. Protocols for glaciers and large lakes will be in that first group.

The network's primary accomplishments related to water quality monitoring in FY05 include: updated geo-referenced databases used to select potentially impaired sites to be included in the NCCN water quality monitoring program; completed processing and identification of benthic macroinvertebrate samples from 40 lakes at MORA; selected GRTS spatially balanced samples for wadeable streams at NOCA, MORA, and OLYM; conducted macroinvertebrate sampling in eight rivers in OLYM in collaboration with NOCA and USGS to apply, adapt, and test methods using wadeable streams protocols in rivers; completed final selection of all wadeable streams monitoring components; completed sampling design methods; selected sites and data analysis protocols; collected and processed zooplankton samples from five reference sub-alpine lakes; and incorporated the Water Quality Monitoring Plan into the NCCN Phase 3 Vital Signs Monitoring Plan. In addition, network technical groups worked with USGS-BRD to initiate development of protocols for monitoring mountain lakes and ponds, stream resident fish, stream physical and chemical characteristics, stream water quality and biological integrity using benthic macroinvertebrates, aquatic-breeding amphibians, water quality of large lakes and reservoirs, marine water quality, and fish and macroinvertebrates in rivers. With respect to the last item, NPS and USGS biologists conducted the final year of pilot field work to be used in the design of a protocol to monitor trends in fish communities, physical habitat, and macroinvertebrates in rivers in OLYM, NOCA, MORA. Funds were distributed to cover personnel costs, equipment needs, and limited travel. NPS and USGS also established a contract with WEST Consultants for assistance in statistical design and data analysis.

Northeast Coastal and Barrier Network (NCBN)

Water Quality Monitoring Funds in the amount of $88,700 were allocated to: an interagency agreement with the USGS to

develop protocols for monitoring estuarine eutrophication ($78,119), a modification to the CESU agreement with the University of Rhode Island for database support for water quality projects ($9,694), and a 1% Northeast Region assessment on incoming funds ($887). In FY05, an interagency agreement with the USGS was modified to incorporate the development of a protocol for monitoring estuarine eutrophication. A draft protocol was completed and submitted to the network in December 2004. This protocol was peer reviewed both by outside NPS reviewers and WRD staff.

In addition to direct sampling of indicators of estuarine eutrophication, the network has continued to work through a cooperative agreement with University of Rhode Island scientists to develop a protocol to track sources of nitrogen to park estuaries. The draft report submitted to the network in FY05 demonstrates, through example, the application of a simple mathematical export model in order to calculate ground-water nitrogen loading to the coastal embayments of network parks. Ground-water loading estimates were calculated in a consistent manner from various nitrogen sources within each park to provide a first-order, network wide comparison of nutrient enrichment to each park's marine resources.

Finally, NCBN and CACO data management staff will be working jointly in assuring conversion and upload of all water quality data collected as part of this protocol to NPSTORET. A standard operating procedure will be developed and incorporated into the protocol.

Northeast Temperate Network (NETN)

The NETN received $58,610 in water quality funding from WRD in FY05 after the 1.4% rescission and 1% assessment by Northeast Region. These funds were allocated toward continuing the design of the water quality monitoring program in cooperation with the USGS through an interagency agreement. USGS-WRD-Maine cooperators worked closely with the network as a component of the core science team and were tasked to develop the freshwater monitoring protocols for the NETN Phase 3 report.

In FY05 NETN completed its Phase 2 report on schedule and received approval from the I & M program. Cooperators completed a freshwater resource scoping report for the NETN parks, and the network continued its agreement with USGS to begin developing the Freshwater (lakes and streams) Monitoring Protocol. The scoping report reviewed existing park monitoring programs, including the analysis of 10 years of ACAD lake monitoring data, and integrated the results into an example scorecard report as part of the protocol development process. Much of this information is included as appendices to the network's Phase 2 report. The lake monitoring review was critical to the integration of existing Acadia lakes monitoring with Vital Signs. Cooperators also 1) conducted a cost/benefit analysis to prioritize measures most appropriate for protocol inclusion, 2) developed sampling frame and defined sample units and scales of inference, 3) drafted all SOPs and the protocol narrative, and 4) reviewed state programs to ensure that NETN water quality is consistent with that of the states. Pilot monitoring has been initiated and will continue into FY06 to support protocol development. The network has identified further aquatic resource (rocky intertidal) protocol development needs within the vital signs program at ACAD and BOHA. Plans are to work cooperatively with the Gulf of Maine Council Habitat Monitoring Committee in the coming year to ensure any protocols developed for these two parks may be adopted throughout the Gulf of Maine.

Northern Colorado Plateau Network (NCPN)

In FY05, the network received $106,500 from WRD for their water quality monitoring program. A significant portion of this

amount ($65,000) went to support the NCPN Hydrologist engaged in the coordination of water quality monitoring in six network parks using established protocols, finalizing writing of the water quality component of the integrated monitoring plan, and beginning water quality protocol and SOP development. An interagency agreement was made with the USGS-WRD ($37,240) to provide support and training to the NCPN Hydrologist to conduct water quality monitoring at one site in DINO beginning in FY06 and to continue technical assistance in areas of data analysis, monitoring design, and protocol development. The remainder ($3,760) was spent on miscellaneous costs, including travel, field and office supplies, the IMR assessment (1%), and the rescission (1.4%).

The NCPN integrated Phase 3 monitoring plan was approved by the I & M program in September 2005, having included the water quality component of the network and prototype. Existing monitoring programs at four network parks were enhanced, and their integration with the ongoing monitoring programs at two additional parks under the network monitoring umbrella has begun. An agreement was reached with Utah DEQ to perform lab analyses on samples from 12 additional monitoring sites in the network. A data summary for identification of water quality monitoring needs was completed by USGS cooperators from the historical water quality data base, and this document was made an appendix to the monitoring plan. These data were used to identify high priority sites for water quality monitoring having an ecological or regulatory emphasis. Network options to build upon this historic data base and populate it with future monitoring information to meet the network and park water quality information needs were evaluated, and a jointly authored technical manuscript describing water quality database development, data acquisition, data analyses and syntheses, and monitoring plan development will be produced in FY06. USGS-WRD began testing monitoring methods for aquatic invertebrates under the joint efforts of NCPN and SCPN and coordinated this with the respective network riparian monitoring done in collaboration with USGS-BRD.

Northern Great Plains Network (NGPN)

In FY05, the network was sent $79,101 in WRD water quality funds (after a $1,899 assessment). Accomplishments in 2005 included completing water quality sampling runs at all parks ($22,610) and laboratory analysis–primarily for identifying biota– ($37,247). Other funds were spent for developing the monitoring plan, attending meetings, coordinating with others, and miscellaneous tasks. Through an agreement with South Dakota State University, the network conducted a third and final water quality sampling run at each of the network parks. The sampling runs collected data on physical, chemical, and biotic characteristics of park water resources. The results of the field work are expected to be completed in FY06. The data will be used to develop the network's water quality monitoring plan. Eventually, the data may also be used to develop an index of biological integrity that will benefit state agencies and others who monitor water quality in the region. The network conducted a vital signs selection workshop to get feedback on water quality experts from academia, experts from all water quality agencies from all 4 states in the network, and other federal agencies. The workshop not only identified water quality as a high priority for monitoring in the parks but also identified the relative value of the various water quality measures (e.g., biotic, chemical, physical). The workshop provided a springboard and framework from which the network can begin designing a water quality monitoring protocol and sampling design.

Pacific Island Network (PACN)

The Pacific Island Network received $151,000 for water quality monitoring in FY05. These

funds were used to initiate preparation of water quality and related Vital Signs monitoring protocols, including Water Quality protocol ($53,000), Freshwater Animal Communities protocol ($20,000), Ground-water Dynamics protocol ($25,000), and Benthic Marine Community protocol ($50,000). These vital sign monitoring protocols target known resource issues, and products received in FY05 include "Protocol Development Summaries" and study plans for completing the entire protocol. In addition, PACN revised its Vital Signs Monitoring Plan in FY05, adapting to national program standards and responding to reviewer comments. In an appendix to this monitoring plan, PACN identified over 13 types of freshwater and brackish ecosystems, including perennial and intermittent streams, riparian and estuarine wetlands, man-made fishponds, coastal marshes, swamp forests, anchialine pools, waterholes and springs, seeps, bogs and perched wetlands, and a crater lake. Impaired and pristine water bodies are also identified, along with trends in water quality conditions for all units in the Pacific Islands. The materials and information gathered as part of our monitoring plan preparation were used extensively by the USGS in analyzing geo-hydrologic conditions in a mangrove wetland at AMME, to assist park managers, and in Watershed Condition Assessment reports under the auspices of other NPS programs. With assistance from various interagency, educational, and non-profit partners, final draft reports were received for inventories of anchialine pools, stream surveys, and marine fish (near shore vertebrates). NPSpecies and NatureBib database entries were updated based on these inventories with an objective of including at least 90% of all vertebrates and other identified invertebrate taxa of special interest present in the park. The USGS, through a previously (FY04) funded interagency agreement, also completed compilation of all data not found in EPA's STORET database and provided this information in a revised MS Access database that the network can use for various purposes in the future. These varied efforts were completed with the assistance of the Hawaii-Pacific Islands CESU and included travel throughout the Pacific Island region by NPS staff and cooperators. Finally, the network selected a permanent employee to serve as the network Aquatic Ecologist to oversee water quality, aquatic, and marine related vital sign monitoring and inventories.

Rocky Mountain Network (ROMN)

In FY05, the ROMN received $61,000 in funding for their water quality monitoring program. USGS-WRD Colorado District Office (Alpine Hydrology Group) received $59,530 to conduct a water quality data mining and review project covering the network parks. The remaining WRD funding went toward the IMR assessment (1.4%) and the 1.4% rescission.

Network planning efforts for water quality monitoring continued under the auspices of the ROMN Water Quality Monitoring Workgroup, which assisted ROMN staff in the review of work by USGS-WRD-Colorado District in their development of a Geospatial Water Quality Database for the network. A draft database coupled with a Power Point presentation was presented by the USGS Principal Investigator in a June meeting with provisions made for adding new data and completion of the final project report by Fall 2005. These historical water quality data were subsequently installed on the ROMN park computers by the data manager. An interagency agreement with USGS-WRD has been initiated between ROMN and the Colorado District for the next phase of the project analysis and interpretation of ROMN water quality data. The results will be used in developing ROMN stream and lake monitoring protocols.

ROMN is also involved in establishing the aquatic condition baseline for the North Fork of the Flathead River in GLAC. This is a pristine area where Canadian Coal Bed Methane

exploration has recently been conducted and may threaten the downstream water resources of GLAC should the area go into production in the near future. A large volume of water quality data has also been collected and processed by the ROMN data manager covering the EPA Superfund Program concerning the Clark Fork and its tributaries in and around GRKO. These data and results from its analysis will serve as input for designing long-term monitoring of the Clark Fork drainage in and around GRKO. The network has begun protocol development summaries and has completed the Stream Aquatic Ecological Integrity protocol summary, which includes aspects of water chemistry, hydrology, and ground-water hydrology vital signs.

San Francisco Bay Area Network (SFAN)

The network received $69,000 for water quality monitoring in FY05. The majority of the funds supported a Water Quality Specialist ($62,690). $6,310 was spent on administration, travel, supplies, and vehicles. The SFAN Fresh Water Quality Protocol and attached Quality Assurance/Quality Control standard operating procedures were reviewed and considered outstanding examples for other NPS Vital Signs monitoring networks by WRD and various regional and national experts. The protocol provides guidance for monitoring the health of park streams by tracking pH, temperature, dissolved oxygen, and (in most locations) pathogens, sediments, and nutrients. The network also 1) completed incorporating WRD Baseline Water Quality Data Inventory and Analysis Report into the SFAN Preliminary Water Quality Status Report (an appendix to the SFAN Vital Signs Monitoring Plan), 2) facilitated completion of the SFAN 2004 benthic macroinvertebrate monitoring report, 3) conducted a water quality data and metadata inventory for all network parks and projects, 4) provided information on the SFAN water quality monitoring protocol to California State Parks and the Regional Board's Surface Water Ambient Monitoring Program, and 5) participated in meetings related to the Regional Board's pesticide, sediment, and pathogen TMDL.

Sierra Nevada Network (SIEN)

In FY05, SIEN received $62,100 for water quality monitoring planning (minus a 1%, $900 rescission). Most of these funds were used to support a term I & M Physical Scientist to do water resources monitoring planning and Physical Science Technicians to assist with nitrogen deposition cooperative agreement field work. The remainder of the funds was used for travel to meetings and the nitrogen deposition project ($4,171), operations and equipment ($2,822), and unspent funds ($32).

The final report S*ummary of Existing Water Resources Monitoring in Sierra Nevada Network Parks* was completed by A. Heard and J. Stednick. 242 references related to water resources research and monitoring in YOSE were documented and uploaded to the local Sierra Nevada Network Endnote library. Where appropriate, all water resources articles and reports identified for SIEN parks in FY04-05 were uploaded to NatureBib. The completion of a manuscript synthesizing research and monitoring in a long-term paired watershed study in SEKI was funded. Vital signs funds were added to a USGS-WRD agreement to complete a water quality geodatabase. The SIEN Physical Scientist provided datasets, metadata, and other assistance to complete the database. The Data Specialist created some additional forms and queries. The database was completed in July 2005 and was used to identify existing and historic long-term monitoring records and other data sets of value to planning for long-term monitoring. The Sierra Nevada Network, with Yosemite Air Quality Specialist Lee Tarnay, established an interagency agreement with USGS-WRD to acquire and synthesize air and water resources data associated with nitrogen deposition in high elevation lakes. This information will assist

the network in selecting the most effective indicators for nitrogen (atmospheric deposition vs. water chemistry) and developing monitoring protocols. The water resources portions of Phase 2 vital signs monitoring plan were completed, including a description of SIEN water resources and existing monitoring, development of conceptual models, and prioritization and selection of physical resources vital signs. Surface-water dynamics and water chemistry were both selected as high-priority vital signs, and wetland water dynamics are also under consideration. Additional collaborative relationships with the California Department of Water Resources and the Scripps Institute of Oceanography were developed to install the DEPO meteorological station. Protocols, publications, and reports for long-term air and water quality monitoring in Sierra Nevada USFS wilderness areas were acquired and reviewed. Legacy data were organized, archived, and digitized, including weather and water legacy data for DEPO where appropriate. Locations of historic and existing wells and associated well logs for YOSE were identified by WRD and YOSE staff.

Sonoran Desert Network (SODN)

The network received $64,000 in FY05, with just over 90% of the funds ($58,258) going to the Desert Southwest Cooperative Ecosystem Study Unit for integrated protocol development. $1,500 in water quality monies were garnished by both WRD and IMR. $4,047 partially fund the salary of a detailed Hydrologist to complete the Phase 3 monitoring plan; $195 went toward the purchase a pressure transducer and "bridge board" flowmeter system to establish a gauging station at GICL in FY06.

The planning process for the Sonoran Desert Network Water Quality Monitoring Program was integrated into the Phase 3 and final Vital Signs Monitoring Plan and augmented by a draft Water Quality Implementation Plan produced by network staff and cooperators. Although the completion of the Phase 3 plan was an important and time-consuming task in FY05, significant progress on protocol development for water quality and hydrology monitoring was made through a combination of 1) evaluating existing protocols and methodologies; 2) analyzing previously collected or "legacy" data on the hydrologic parameters of interest to evaluate questions of sampling design, statistical power, and cost; and 3) implementing pilot studies to field test logistical and technical issues in draft protocols and to generate sample data for evaluate data management, analysis, and reporting approaches. Results of these protocol development activities are summarized in draft protocol narratives and standard operating procedures in the NPS standard format.

Protocol development for water quality and hydrologic monitoring in Sonoran Desert Network parks builds on the established approaches of the USGS Water Resources Discipline, the EPA Environmental Monitoring and Assessment Program (EMAP), and the Arizona Department of Environmental Quality and uses the integrated sampling strategy of the EPA EMAP program. Water quality vital signs (core parameters, nutrient dynamics, pollutant metals, microorganisms, and aquatic macroinvertebrates and algae) were evaluated in FY05 for perennial waters in the network through pilot studies at TUMA, TUZI, ORPI, SAGU, and GICL. GICL, in particular, was the focus of an intensive, integrative effort in Spring and Summer 2005 to co-locate water quality vital signs with streamflow, channel morphology, and vegetation sampling in a modified version of the EPA EMAP spatially-balanced sampling design.

South Florida/Caribbean Network (SFCN)

The SFCN received $142,000 for water quality monitoring in FY05. The majority of the funding was dedicated to operations, travel, and administration for the network as well as to network staff (salaries) to facilitate

recruitment of the new Aquatic Ecologist position. Two pay periods of the Aquatic Ecologist salary were also covered with these funds. The SFCN hired Dr. Kevin R. T. Whelan in August 2005. Dr. Whelan has over 12 years of field research experience in the Greater Everglades Area, including research experience at four of the SFCN parks (EVER, BISC, BICY, and DRTO). The SFCN identified outstanding water bodies within network parks and impaired water bodies within the SFCN. At the Virgin Island reef sites, the data analysis on status and trends for the 16 year water temperature data set continues. Hobo temperature data loggers were placed with the last of the Ryan thermistors at Yawzi, Newfound, Haulover, and Windspirit Grounding reefs (Windspirit Grounding was lost during FY05 due to storm events). The network calibrated the Hobo and Ryan thermistors. Twelve Hobo temp underwater temperature loggers were placed at benthic monitoring sites in BUIS (2), VIIS (6), BISC (2), and DRTO (2).

Southeast Alaska Network (SEAN)

SEAN received $42,000 from WRD for their water quality monitoring program in FY05. Of that amount, the largest portion ($32,986) went toward holding a freshwater vital signs workshop and maintaining the Indian River water gauge station ($8,000). The remainder was used to cover the ATB rescission (1.4%) and the Alaska Regional Office contingency assessment (1%). In contrast to the water quality component, the SEAN did not reach the full level of service-wide I & M funding (roughly 50% funding level was reached) that was anticipated in FY05. This could slow completion of the 3-phase reporting system of the network and that of the water quality component due to their integration and, therefore, interdependent completion schedule.

SEAN's first year of WRD funding for water quality was used to work toward its primary objective of developing a network water quality monitoring system that is fully integrated with the Vital Signs Program and meets legal and national requirements, as well as park managers' information needs. The Phase 1 report is in final draft form and was submitted on schedule for WASO review. On February 1-3, 2005, the network hosted the freshwater vital signs scoping workshop in Juneau. Workshop participants included members of the SEAN technical committee, other NPS natural resource professionals, and invited scientists with expertise in fisheries biology, glaciology, hydrology, physical sciences, stream ecology, or water quality monitoring.

Southeast Coast Network (SECN)

The Southeast Coast Network received $121,000 to design and implement water quality monitoring at SECN parks in FY05. These funds were augmented by an additional $268,000 of monitoring funds to achieve several water quality related goals for the network. Watershed Condition Assessments were funded for the network's six riverine parks through cooperative agreements with University of North Carolina at Wilmington ($53,000) and North Carolina State University ($98,000). The network purchased equipment for and began deployment of permanent estuarine water quality monitoring stations at CUIS, CANA, CALO, and CAHA, using methods developed by the National Estuarine Research Reserve (NERR) to ensure data comparability with other programs along the Atlantic and Gulf Coasts ($137,000). The network hired an Aquatic Ecologist to oversee the planning and development of water quality monitoring protocol development and partnership development with other programs in the region ($88,000). During the fiscal year, the network partnered with the Florida Department of Environmental Protection to collect and analyze water quality data using the NERR protocols at TIMU, revealing a new understanding that preventing the inflow of contaminants and excess nutrients will be paramount to the long-term management and protection of the park's

water resources. The network also partnered with the EPA to assess existing data, develop survey designs, and select appropriate indicators for long-term monitoring of estuarine waters.

Southern Colorado Plateau Network (SCPN)

The SCPN received $121,100 for water quality monitoring in FY05. WRD funds were used to hire a water resources program leader for the network ($15,000), to conduct a springs and seep inventory ($20,000), to continue protocol development work for water chemistry, aquatic macroinvertebrates ($40,000), and riparian ($30,000) systems, and to purchase equipment ($15,000).

In FY05 the first draft of a comprehensive water quality database for SCPN parks was produced under an interagency agreement with the USGS. Data compilation consisted of retrieval of all electronically available water quality data collected from sources at sites located within, adjacent to, and upstream of the 19 park units. The sources of data compiled and analyzed included federal, state, and tribal agencies as well as volunteer monitoring organizations. Data analysis of the SCPN water quality database includes conducting quality-assurance, computation of summary statistics, and comparison of the data to federal and state standards. The cooperator has provided the Access database associated with the project but is behind schedule in providing a draft report.

The network hired a Hydrologist to coordinate the aquatic and riparian resources monitoring program. The aquatic resources monitoring program includes water quality, aquatic macroinvertebrates, and riparian ecosystem components. Collaborative work with the Northern Colorado Plateau Network and USGS scientists to develop riparian and aquatic macroinvertebrate protocols continued and will address a continuum of riparian environments ranging from small headwater streams to large perennial rivers. Also considered are intermittent and ephemeral streams. These streams are important because of their dominance in the regional landscape as well as their importance to ecosystem dynamics of the larger, extra-regional perennial streams. Long-term monitoring efforts will be directed towards: 1) the physical processes that create and maintain riparian ecosystems, 2) streamside plant communities, and 3) aquatic macroinvertebrates. Methods SOPs have been partially drafted. One focus of riparian field trials is the application of a hierarchical, process-based stream classification system, which is currently under development. When complete, the classification will be used to assess channel functional condition and potential response to natural or disturbance related changes in sediment supply and stream discharge across a range of spatial scales. Macroinvertebrate field trials are focused on comparing quantitative and qualitative sampling and on collecting multiple samples within the reference period. Cooperators from Northern Arizona University (NAU), in conjunction with NPS staff, completed springs inventory protocols and datasheets for site description, invertebrate, vegetation, water quality, flow, and geomorphology measurements. NAU research technicians completed springs related data and report syntheses for all SCPN units. Park staff, cooperators, and a NAU research technician compiled a list of possible springs to be inventoried and selected 80 springs based on spring type, elevation, park coverage, and park priority. A four person crew completed inventory work at 79 springs (36 in SCPN parks) in 27 national park units (15 in SCPN).

Southern Plains Network (SOPN)

SOPN received $29,000 in water quality money in FY05. This funded an aquatic conceptual model workshop, an agreement with Intermountain Region Hydrologist to develop aquatic conceptual models, and an interagency acquisition agreement with the BOR for a wetland inventory at BEOL. The

Southern Plains Network completed several aquatic conceptual models this year. These conceptual models are crucial to understanding the ecosystems, communicating information between scientists and park managers, and identifying potential vital signs. The IMR Hydrologist developed aquatic models for riverine, lacustrine (reservoirs), and riparian ecosystems. For each of these ecosystems, models were developed that consisted of driver-stressor models that depict the linkages between drivers, stressors, ecological attributes and vital signs; characterization models that show the relationships between biotic and abiotic factors; and tables that identify stresses, effects, and potential indicators. A palustrine freshwater marsh model was developed by network staff.

Southern Plains Network staff completed a network water resources report this year. This report reviews federal legislation, such as the *Clean Water Act* and the *Safe Drinking Water Act*, as well as pertinent legislation from the five states in the network: Colorado, Kansas, New Mexico, Oklahoma, and Texas. A section identifies the miles of perennial and intermittent rivers, miles of canal, acres of lakes or reservoirs, and miles of lake or reservoir shoreline within each park and as a total for the network. Also listed are impaired water bodies within the network, and the report states that there are no outstanding natural waters within the network. Summaries of the water resources at each park include sections on background, primary water resources, management and scientific issues, and past and present monitoring.

Southwest Alaska Network (SWAN)

In FY05, the network received $137,100 from WRD. These funds were spent on designing water quality monitoring in cooperation with the University of Washington ($19,300), river discharge measurements in LACL ($31,400), and salary and support of a network Aquatic Ecologist ($85,000).

A CESU agreement was established in FY04 with the University of Washington to provide SWAN with recommendations for aquatic monitoring. An advisory committee was created and a workshop was held November 8-10, 2005, to provide oversight and feedback on the development and design of the aquatic monitoring framework, including metrics for aquatic vital signs. A bibliographic database of selected past and present aquatic research in Southwestern Alaska was submitted in January 2005. A progress report was produced in January 2005, which included a workshop summary. Protocol testing of 4 capture methods for sampling resident lake fish (minnow trap, fyke net, gill net, and beach seine) was conducted in LACL during June 2005. A work order was written under the existing interagency agreement with USGS-WRD-Alaska for operation of the Crescent River gauging site in LACL, including collection of core water quality parameters plus turbidity. A term cartographic technician worked with the SWAN Data manager to digitize all existing bathymetric maps for SWAN parks. Data gaps or discrepancies within these maps were noted. The SWAN Data Manager and Cartographic Technician developed a draft SWAN lake Access database, using the new NHD for Alaska. Data gaps were again noted for future data collection.

Upper Columbia Basin Network (UCBN)

UCBN received $49,300 in water quality funding from WRD in FY05 after 1% and 1.4% went toward the regional office assessment and servicewide rescission respectively. Of this total, $42,280 went toward Ecologist (4 mos.) and Network Coordinator (.30 FTE) salaries for work associated with the water quality component of vital signs and $6,500 went toward an aquatic resource task agreement with the University of Idaho CESU to assist in development and integration of the water quality component into the overall Vital Signs Program.

In FY05, the network completed and received approval of its Phase 2 report (chapters) in monitoring plan development and continued its water quality data mining and database review activities to determine the status of active and historic monitoring within the network. A cooperative agreement was entered into with Dr. Caudill of the University of Idaho to provide summary information on water bodies in network parks. This included waters listed (303d) through the Clean Water Act's mandated water quality assessment reports and existing water quality monitoring programs in or adjacent to park waters. In addition, the same cooperator collaborated with network staff to develop conceptual models of aquatic and wetland-riparian ecosystem components and drivers for aquatic habitats of the UCBN. The conceptual models were based on available literature for the region and Dr. Caudill's expertise and current knowledge of aquatic ecosystem processes. The models were used to assist in the selection of parameters (water quality and other related vital signs) for long-term monitoring of ecosystem aquatic condition. Plans were initiated and task orders defined for the development and integration of monitoring protocols for water chemistry, macroinvertebrates, surface-water dynamics, and stream/river channel characteristics to be undertaken in FY06.

APPENDIX D

PUBLICATIONS/CONTRIBUTIONS AWARDS

PUBLICATIONS/CONTRIBUTIONS

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AWARDS

Kathryn Converse received a promotion to recognize her increased responsibilities in the processing and completion of station folders for surface- and ground-water gages operated by the Water Rights Branch.

Debi Cox received a Star Award for outstanding performance during the WRD management transition.

Christine Gable received an On-The-Spot award for her outstanding efforts to complete the backlog of station folders for surface- and ground-water gages operated by the Water Rights Branch.

Gwen Gerber received an On-The-Spot award for her outstanding efforts to complete the backlog of station folders for surface- and ground-water gages operated by the Water Rights Branch.

Roy Irwin received a STAR award for filling in during a staff shortage, helping administer the Vital Signs Water Quality Monitoring Program, providing leadership to Lake Roosevelt National Recreation Area on issues related to contamination from a Canadian zinc smelter, and providing statistical advice to networks and parks.

Kris Parker received a Star Award for planning the Aquatic Professionals Conference.

Pete Penoyer received a STAR award for filling in during a staffing shortage, serving on the Moab Mill Site Groundwater Subcommittee, and technical assistance to Indiana Dunes National Lakeshore CERCLA and RCRA investigations involving adjacent property owner investigations.

Gary Rosenlieb received a STAR award for serving as the Acting Chief of the Water Operations Branch.

Gary Smillie received a STAR award for superior performance in exhibiting leadership and assisting the acting Branch Chief in various required management duties, including transitioning the branch to the new Performance Appraisal System, providing guidance and supervision for the implementation of the Service's Watershed Protection Program, and provided invaluable service on the Directorate's Scorecard Implementation Task Force.

Lael Wagner received a STAR award from the Geologic Resources Division for her cheerful support during the vacancy filling of the Division Chief's secretary position.

Mark Wondzell received a STAR award for his outstanding efforts as the agency lead and technical representative for the Aspinall Reoperations EIS for BLCA.

APPENDIX E

STAFF

OFFICE OF THE DIVISION CHIEF STAFF

Bill Jackson: Division Chief, PhD in Hydrology. Specialty areas include sedimentation processes, fluvial geomorphology, and river assessment, restoration, and management.

Sharon Kliwinski: Water Resources Washington Liaison, BS in Environmental and Pollution Sciences. Specialty areas include environmental legislation and regulations, natural resource policy issues, and mining laws, policies, and programs.

Debi Cox: EEO Counselor, Program Analyst, BA in Anthropology. Specialty areas include coordination of interagency and cooperative agreements and project funding.

Kris Parker: EEO Counselor, Lead Administrative Assistant, AA in History and Business Management.

Carol Liester: Purchasing Assistant.

Laura Harte: Colorado State University Archivist, Web Developer, MA in Archival Science, BA in History with specialization in environmental and western history.

Kristin Martin: Administrative Support Staff, BA in Modern Languages (German).

PLANNING AND EVALUATION BRANCH STAFF

Mark Flora: Branch Chief, Hydrologist, MS in Environmental Science (Water Resources). Specialty areas include water resources management planning, water quality, and watershed management.

Joel Wagner: Wetland Protection Program Team Leader, MS in Environmental Science (Water Resources). Specialty areas include wetlands science, hydrology, restoration, and regulatory issues.

Kevin Noon: Wetland Specialist, PhD in Wetland Ecology. Specialty areas include wetland evaluation, management, restoration, and regulatory issues.

Jim Tilmant: Fishery Management & Marine Resources Program Team Leader, MS in Wildlife and Fisheries. Specialty areas include aquatic and marine resources management, fish biology, and population dynamics.

John Wullschleger: Fisheries Biologist, MS in Fish and Wildlife Science. Specialty areas include freshwater invertebrates, marine intertidal biota, fluvial ecology, and stream habitat restoration.

Kristen Keteles: Texas A&M University Coastal Watershed Condition Assessment Coordinator, PhD in Zoology, BS in Marine Science. Specialty areas include aquatic toxicology, marine ecology, assessment of coastal water resources, and trace metal contamination.

Cliff McCreedy: Marine Management Specialist, BA in Political Science with career emphasis on regulatory and ocean policy. Specialty areas include marine resource management and planning, marine protected areas, coral reefs, coastal watershed assessment, and interagency marine partnerships.

David Vana-Miller: Water Resources Planning Program Team Leader, MS in Marine Biology. Specialty areas include water resources planning, aquatic and marine resources management, water quality, and measures of biotic integrity.

Don Weeks: Hydrologist, MS in Geology

(Hydrologeology). Specialty areas include water resources management planning, ground-water monitoring, and wetland management.

Lael Wagner: Administrative Assistant.

WATER OPERATIONS BRANCH STAFF

Gary Rosenlieb: Acting Branch Chief, Water Quality Program Team Leader, MS in Water Resources. Specialty areas include water quality (chemistry and microbiology), ground-water quality, and hazardous materials management.

Jeff Albright: Watershed Condition Assessment Program Coordinator, MS in Watershed Management. Specialty areas include hydrology data collection and data management protocols, watershed assessments, integration of science and policy in resource protection/restoration programs.

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

Dean Tucker: Information Management Program Leader, Natural Resource Specialist, PhD in Forestry. Specialty areas include data management and reporting, hydrographic analysis, computer graphics, and water resources applications in GIS.

Larry Martin: Hydrogeologist, MS in Hydrology. Specialty areas include ground-water management, ground-water modeling, surface-water/ground-water interactions, water supply development, and source water protection.

Pete Penoyer: Hydrogeologist, Associate in Hazardous Materials, MS in Geology, Professional Degree in Hydrogeology. Specialty areas include ground-water analysis, ground-water contamination, site assessments under CERCLA, and water quality monitoring.

Rick Inglis: Hydrologist, BS in Watershed Science. Specialty areas include field hydrologic data collection and analysis, watershed condition and riparian zone assessment and management, and stream restoration.

Michael Martin: Hydrologist, BS in Environmental Geology, MS in Watershed Science. Specialty areas include open channel flow, geomorphology, flood analysis, wetlands hydrology, geochemistry, and water quality.

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

Roy Irwin: Senior Contaminants Specialist, PhD in Biology. Specialist in environmental contaminants, ecological/biological aspects of water quality, monitoring study design and development, measurement uncertainty, and QA/QC issues.

Kim Johnson: Hydrologist. BS in Watershed Science.

Mike Matz: Colorado State University Research Associate, Water Quality Database Manager, MS in Civil Engineering. Specialty areas include water quality planning and management, inventory and monitoring, and data analysis.

Caroline Goughis: Colorado State University Research Associate, STORET Database Project, MS in Marine Sciences.

Steve Mackie: Colorado State University Research Associate, STORET Database Project. MS candidate in Forestry. On Military Leave in 2005.

John Christiansen: Colorado State University Research Associate, Clean Water Act Impaired Waters Project, MS in Civil Engineering.

Hashem Faidi: Colorado State University Research Associate, Clean Water Act Designated Use and Impairment Database Manager, MS in Water Resources Engineering, PhD in Ground-Water Engineering. Specialty areas include GIS applications in water resources and ground-water and contaminant transport modeling.

Paula Galloway: Colorado State University Research Associate, NPSTORET Database Project, PhD in Chemical Engineering.

Pat Wiese: Colorado State University Administrative Assistant, BS in Biology.

WATER RIGHTS BRANCH STAFF

Chuck Pettee: Branch Chief, Supervisory Hydrologist, MS in Watershed Science. Specialty areas include water rights establishment and protection and water resources policy.

Bill Hansen: Supervisory Hydrologist, Adjudication Program and Information Management Program Leader, BS in Watershed Science, MS in Hydrology. Specialty areas include water rights policy and adjudication, surface-water hydrology, and wild and scenic rivers.

Dan McGlothlin: Supervisory Hydrologist, Monitoring and Enforcement Program Leader, BS in Watershed Hydrology. Specialty areas include water rights establishment and protection and water resources policy.

Jennifer Back: Hydrologist, MS in Watershed Science. Specialty areas include ground- and surface-water interactions and stable isotopes.

Paul Christensen: Hydrologist, MS in Geology. Specialty areas include hydrogeology, water resources, and water rights.

Paula Cutillo: Hydrologist, PhD in Hydrogeology. Specialty areas include subsurface hydrodynamics and hydrogeologic modeling.

Chris Gable: Hydrologist, BS in Watershed Science. Specialty areas include surface-water hydrology, field methods, instrumentation, and data analysis.

Gwen Gerber: Hydrologist, BS and MS in Geology. Specialty areas include hydrogeology and surface-water data collection.

Jim Harte: Hydrologist, BS in Forestry/ Watershed Sciences. Specialty areas include surface-water hydrology, sediment transport, and watershed management.

Jeff Hughes: Hydrologist, MS in Watershed Sciences. Specialty areas include water rights and surface-water hydrology.

Jennifer Miller: Student Trainee (Hydrology), BS in Natural Resources Management, MS candidate in Watershed Science.

Bill Van Liew: Hydrologist, BS in Civil Engineering, BS in Geology, MS in Ground-Water Engineering/Environmental Hydrogeology. Specialty areas include ground-water hydrology and ground-water/ surface-water interactions.

Mark Wondzell: Hydrologist, BS in Forestry, MS in Agricultural Engineering.
Mohamed Aldhamari: Colorado State University Research Associate, PhD in Civil Engineering/Ground-Water Engineering.

Kathryn Converse: Colorado State University Research Associate, BS in Earth Sciences.

Jennifer Friedman: Colorado State University Research Associate, BS in Natural Resource Management (Environmental Policy).

Eric Lord: Colorado State University Research Associate, BS in Mineral Land Management, JD, MS in Forestry.

Flora Romero: Colorado State University Administrative Assistant.

Telescope Peak reflected in water, Badwater, Death Valley National Park, California.

Water Resources Division

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