



## Research Director's Message

Water management is an increasingly complex task. System reliability, efficient use of limited water supplies, expansion of useable supplies through water quality management and treatment, and endangered species challenges dominate water management in the West. The Bureau of Reclamation has an impressive history of developing innovative ways to address the West's water management needs. To succeed as a water management agency, Reclamation must continue to provide creative, cost-effective, and environmentally beneficial solutions for the American public.

The Science and Technology Program forms Reclamation's crucial scientific and technical backbone through researching, developing, demonstrating, and deploying state-of-the-art technology needed for these solutions. The program anticipates water management challenges and develops and demonstrates new technologies to meet these challenges. This research helps to create Reclamation's flexibility that will continue our rich tradition as a water manager into the 21st century.

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## Developing and applying new technologies to meet Reclamation's needs

Water management requires involving multiple interests and applying state-of-the-art data, models, ideas, and technologies. Informing both the public and decisionmakers of the possible choices and their potential ramifications is critical. The Science and Technology Program uses and enhances the technical expertise of Reclamation's Technical Service Center, universities, non-profit research organizations, and corporate sectors to:

- ◆ Find new ways to continue and increase reliable water deliveries
- ◆ Find ways to increase the life of our facilities and look for ways to lower operating and maintenance costs for this crucial infrastructure
- ◆ Demonstrate cost-effective solutions that are broadly supported, in part, because they provide multiple benefits
- ◆ Advance water management and, thereby, maintain the agency as the federal leader in water management

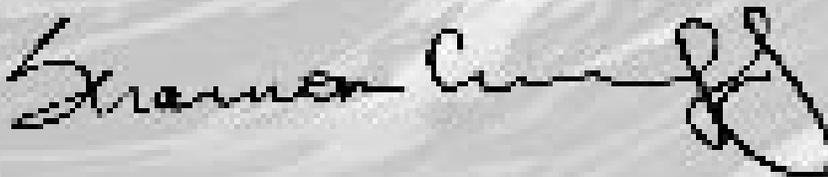
In 2000 - 2001, four out of the five regional research coordinators and over two-thirds of our staff changed. These changes present unique and significant opportunities—and a steep learning curve. We have been hard at work, learning about the needs of and desires for the program and to strengthen our relationships within and outside of Reclamation. We've talked with:

- ◆ Staff and managers in Reclamation's regions and area offices
- ◆ Researchers at the Technical Service Center and in regional and field offices
- ◆ Representatives of the National Institutes for Water Resources, the National Research Council's Water and Science Technology Board, the National Water Research Institute, and other water resource research organizations in governmental, corporate, and academic sectors
- ◆ Stakeholder groups representing the breadth of Reclamation's constituencies: agriculture, large and small municipal and industrial users, recreation, and environmental

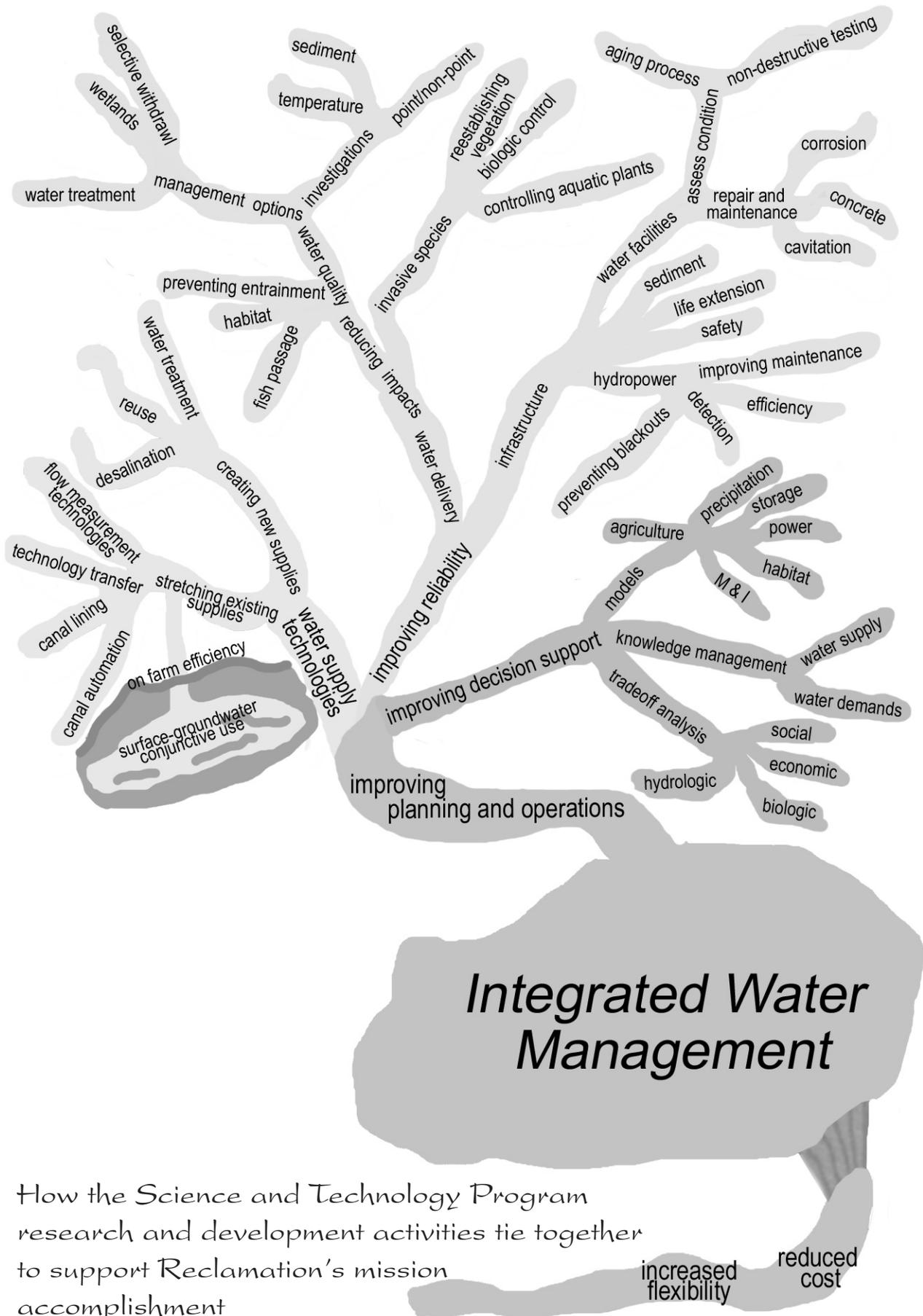
To what end? We are building understanding of and respect for Reclamation's capabilities, increasing our understanding of research needs and priorities, and soliciting others to address water resource research needs. We have broadened Reclamation's research steering committee by adding representatives from the U.S. Department of Agriculture and the U.S. Geological Survey, a water district, and universities to represent a broader range of expertise in water resources management.

We chartered a Business Practices Team composed of regional and area offices, operations, and the Technical Service Center to recommend areas for program focus and improvement. Based on their input, we are revising our program formulation process to be more readily transparent and understandable, and to make research funding more readily available to projects demonstrating broad support and addressing high-priority Reclamation needs.

I hope that this report will inspire you to join us in our search for the best way to meet the water management challenges that face our Nation and the world at large.



Director of Research and Natural Resources



How the Science and Technology Program research and development activities tie together to support Reclamation's mission accomplishment

## Contributing to integrated water management

The Science and Technology Program's key goal is to pursue and promote innovation in water management through applying science and technology. By involving end-users, we are collaborating more effectively. We are transferring new technology through training and outreach demonstrations.

The diagram on the opposing page shows the range and relationship of Science and Technology focus areas. If we imagine Reclamation's activities and challenges as an interconnected watershed, then the Science and Technology focus areas can be seen as main tributaries on this "watershed" diagram. The primary activities that support these focus areas are shown as subtributaries. These focus areas are also the chapter headers in this report: enhancing water supply technologies, improving water delivery reliability, improving water and power facility reliability, and providing decision support.

This multidiscipline, integrated approach recognizes and considers the complex interrelationships of the various issues and needs that revolve around watersheds and water supply projects. Our challenge is to ensure that Reclamation has the cutting edge skills and abilities and research to effectively carry out these tasks and address these issues.

The Science and Technology Program is building and maintaining the solid foundation of sound science, accurate information, and state-of-the-art capabilities. This foundation will support Reclamation's mission and lead to more holistic, supportable solutions for today's—and tomorrow's—challenges.

For technical information on our programs and projects, please contact our lead technical contacts, whose expertise cuts across our research focus areas.

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## Reclamation faces tough challenges

A lot has changed since Reclamation was established in 1902 to provide water to the arid West. Ever increasing, competing demands for water make managing and protecting water and related resources ever more complex. In the next half century, Reclamation will be judged by what we do, or do not do, during the next decade.

The Science and Technology Program provides the research support to help Reclamation meet these challenges.

**Aging infrastructure.** . . More than half of our facilities are over 50 years old, with some approaching 100 years. Not only are some facilities outdated and inefficient, many are nearing the end of their planned life span.

**Thirsty people and industries.** . . The population surge in the West is expected to continue. The 2000 census shows that the population in the West has increased 2 to 3 times faster than the average United States rate in the past 10 years. This growth places more and more stress on the limited western water supply.

**Aquatic habitat.** . . We need to ensure continued agricultural and other authorized uses while sustaining natural resources and addressing endangered species issues.

**Agriculture** . . . Reclamation's projects provide water to irrigate the arid west and develop our nation's agriculture. Projects support 10 million farmland acres, which produce 60 percent of the nation's vegetables and 25 percent of the fruits and nuts. Agricultural water and lands are now facing strong competition and heavy use. We must find innovative ways to nurture and sustain these valuable waters for agriculture.

**Native Americans.** . . More than 200 tribes in the 17 Western States have unsettled water rights issues. Most of these tribes have inadequate water supplies and lack safe drinking water.

**Water quality.** . . With increasing industrialization and populations, meeting water quality standards is more important than ever to sustain beneficial water uses and local economies.

## This program provides answers

# Science and Technology Program

The Science and Technology Program anticipates water management challenges Reclamation faces and provides new tools to meet those challenges. Our research helps develop and demonstrate:

- ◆ State-of-the-art models and decision support systems to show possible options and their potential ramifications
- ◆ New technologies and capabilities that are less costly, more reliable, more effective, and address many needs

### **With advancing technology. . .**

Many of the tools Reclamation applies now come from yesterday's Science and Technology Program's research and development activities. Today's projects are developing new solutions that will become the standards to address tomorrow's problems.

**With our customers. . .** The Science and Technology Program works closely with a wide range of Reclamation staff, customers, and stakeholders. This coordination helps better understand problems, identify priorities, develop integrated sustainable solutions, and broadly transfer solutions and capabilities.

### **With innovative, cost-effective solutions. . .**

The Science and Technology Program evaluates solutions and adapts the most workable to Reclamation's unique needs and facilities. We transfer these technologies and capabilities "on-the-job" to our customers and Reclamation field managers as part of our standard set of technical tools.

**With partners . . .** The Science and Technology Program coordinates with other Reclamation projects and programs; federal, state, tribal, and local governments; universities; and the private sector to leverage our resources and strengthen our ties with the water and related resources community.

## Keeping our resources up to date

The Science and Technology Program reports to the Director of Research and Natural Resources. The Science and Technology Program currently has two employees, a research program coordinator and a budget manager, who administer and manage the program. A technology transfer liaison also reports to the Director to support commercializing innovations developed by Reclamation, including the Science and Technology Program. An administrative assistant, shared with the Director, helps implement the program. Reclamation's five regions also assign a staff person as a Science and Technology Program Coordinator as a collateral duty.

The program relies on about 260 people in Reclamation—well-known experts in their fields who spend part of their time as researchers. Senior Technical Service Center managers advise and help formulate the program. Research staff are mostly in the Technical Service Center but are also in the regional, area, and field offices. Having a broad base of highly qualified staff familiar with Reclamation's challenges keeps us up to speed with innovative technology, allows us to work with the best in the research fields, and keeps us aware of customer needs. All of this helps us find the solutions we need for Reclamation's unique challenges.

### Coming from all perspectives

Our researchers come from a wide variety of disciplines: civil, chemical, electrical, hydraulic, and mechanical engineering; chemistry; botany; biology; ecology; sociology; geography; economics; meteorology; physical sciences; and more.

### Using our resources

Other Reclamation research resources include:

- ◆ Water-related federal laboratory facilities using integrated, multidisciplinary research and development approaches
- ◆ 348 reservoirs and related watersheds and river systems for field-based applied research and development
- ◆ Talented researchers with advanced degrees in our regions and area offices

### Working with expert staff

Technical Service Center researchers have a full range of water and facility expertise and qualifications, including:

- ◆ Average of 18 years of experience
- ◆ 25 PhDs
- ◆ 41 advanced degrees

### Pooling resources and talent

The program uses resources in government, private sector, universities, municipalities, technical organizations, and water resource organizations. Because the program works closely with a wide range of professionals and specialists, we can ensure coordinated, quality research. We also leverage costs at approximately 75-100 percent—making the most out of everyone's limited research dollars.

## Providing guidance

The Science and Technology Steering Committee and the Formulation Team:

- ◆ Guide research priorities
- ◆ Ensure that the program's objectives and priorities further Reclamation's Strategic Plan
- ◆ Integrate the program with our customers' needs
- ◆ Provide a way to actively engage stakeholders and Washington, regional, and area office staff to understand issues and needs and apply the latest developments and technologies to meet these needs

### Steering Committee

The Steering Committee meets annually to provide strategic guidance, review and prioritize needs, and review the current and next year's programs.

#### Members

Director, Research and Natural Resources; an upper management representative from each of Reclamation's five regions; the Deputy Director, Office of Policy; the Director, Technical Service Center; the Director, Operations; and outside experts and customers in fields relevant to Reclamation's mission and issues.

### Formulation Team

Research managers and principal investigators work together to identify needs and develop and manage research activities to meet priority needs. The Formulation Team reviews proposed research activities and recommends activities that best address Reclamation's priorities.

#### Members

Director, Research and Natural Resources; Science and Technology Program coordinator; five regional research coordinators; and research managers and technical experts representing specific research disciplines.

### A practical application of imagination

To be successful in today's fast-paced, complex world, we need new products, processes, and services. Innovation is creating an invention, adapting a process to meet a different problem, and testing new processes. Our principal investigators are innovators who:

- ◆ Are skilled in problem detection and solutions
- ◆ Use their breadth of experience and interests
- ◆ Work across disciplines
- ◆ Bring imagination, enthusiasm, and initiative
- ◆ Observe carefully
- ◆ Build partnerships

These traits help our investigators identify research needs, determine what Reclamation research can accomplish, and develop devices, processes, software algorithms, and other technologies.

## Cooperative Ecosystem Study Units

Management and stewardship of the Nation's public lands and waters require skillful public service supported by sound science and responsive technical assistance. To help in providing sound science for land resource managers, the Department of the Interior created a network of cooperative study units to provide research, technical assistance, and education to agency managers and resource professionals.

These units, Cooperative Ecosystem Study Units (CESUs), are structured as a working collaboration among federal agencies and universities. Maps of these units are at the CESU web site, <<http://www.cesu.org/cesu>>. CESUs are based at universities and focused on a biogeographic region of the country. Universities provide space, basic administrative support, and access to university faculty, students, staff, and resources. Federal agencies provide guidance and can contribute research scientists and/or other professionals located and working at CESUs under formal agreements between their respective bureau and universities. CESUs will create additional opportunities for interdisciplinary and multi-agency research, technical assistance, and education.

Currently, 11 university-hosted CESUs are spread across the United States. Reclamation is a formal partner to the Colorado Plateau CESU, hosted by the Northern Arizona University, and is joining the Great Plains CESU, hosted by the University of Nebraska-Lincoln, and the Pacific Northwest CESU, hosted by the University of Washington.

Reclamation management is considering joining several of the other CESUs located in the Western United States, including the Great Basin CESU, the Rocky Mountain CESU, and the Southwest Desert CESU.

Reclamation has been attending the individual CESU planning meetings to both identify and learn what other problems are being addressed by the respective CESUs and other federal agencies that are of concern and interest to the problems and needs of Reclamation. While all of the CESUs are currently in their initial development phase, it appears that there are common interests and goals that are of significance to Reclamation. By cooperatively defining land and water resource issues with other land management agencies, along with expertise from the CESU university and associates, it is anticipated that research plans and approaches can more adequately reflect agency needs.



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The CESU structure provides an opportunity to broaden the scope of scientific services available to Reclamation or to work on issues relevant to Reclamation. For example, Reclamation operated the Grand Canyon Monitoring and Research Center (GCMRC) through FY00. GCMRC and Reclamation worked closely over the past decade with CESU partners, such as Utah State University and Northern Arizona University, on several research and monitoring efforts concerning impacts of Glen Canyon Dam flow management on downstream ecosystems. One such project, funded through the CESU, was to evaluate changes in campsite availability along the Colorado River in Grand Canyon. The number of people who can visit the bottom of the Grand Canyon depends on the number and distribution of campsites. This study looked for correlations between flow management strategies and campsite availability. These partnerships have continued. The Colorado Plateau CESU, with its streamlined award process, facilitated the award of research contracts to evaluate campsite stability and changes over time. Dam management may affect changes in vegetation and sandbar size which, in turn, may affect campsite availability. Knowing what kind of operations maximize the availability of campsites will help Reclamation decisionmakers make informed, balanced decisions.

