



JULY 2003

B U L L E T I N
University of Hawai'i at Mānoa
WATER RESOURCES
RESEARCH CENTER

Over 200 Attend the WRRC Tropical Pacific Water Conference



Conference chairman
Roger Fujioka welcomes
delegates

Over 200 people attended the two-day (January 15–16, 2003) Water Resources Research Center (WRRC) conference at the Pagoda Hotel in Honolulu. This was the fifth in a series of conferences, which WRRC sponsors to fulfill its mission of meeting with water agencies in Hawaii and other Pacific islands to discuss current water issues. The focus of this conference was “Scientific, Regulatory and Cultural Factors Influencing Water and Environmental Issues in Tropical Pacific Islands.” The conference was sponsored by WRRC and co-sponsored by the Pacific Water Association and the United States Geological Survey (USGS). Four distinguished speakers were invited to this specialty conference.

On day one (January 15, 2003), the invited plenary speaker, Dr. Stephen Anthony of the USGS office in Honolulu, gave a presentation on “Hydrogeology and Water-Related Issues in Hawaii and the Pacific.” Anthony explained how the physical makeup and features of islands in the Pacific determine their hydrogeology as well as their impacts on water issues. This presentation enabled conference attendees to understand why water problems in Pacific islands are not the same as those published descriptions of water problems in North America and Europe.



Ernest Lau from Kauai's Dept. of Water Supply talks about current water problems

After the plenary session, the conference divided into two concurrent sessions. As has been the tradition of WRRC conferences, the managers of drinking water agencies and wastewater agencies in Hawaii were invited to discuss current water problems. Morning Session A (Issues Facing Drinking Water Utilities) was moderated by Dr. Roger Babcock and Dr. James Moncur. Morning Session B (Issues Facing Wastewater Management Agencies) was moderated by Dr. Victor Moreland and Dr. Roger Fujioka.



Panel on Climate, Drought, Floods, and Alternate Sources of Water: Clark Liu, Roger Lukas, Pao-Shin Chu, Eileen Shea, and Thomas Giambelluca (left to right)

The invited luncheon speaker was Dr. Peter Englert, the new chancellor for the University of Hawaii at Manoa. The topic of his presentation was “University’s Role in Addressing Water Issues in Hawaii and Other Tropical Pacific Islands.” He acknowledged the valuable contributions that WRRC has made since its inception in 1964 as the organization of the University of Hawaii that assists in

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From the Desk of the Director

Resources for Water Research

When President Lyndon Johnson signed the Water Resources Research Act in 1964, he considered it one of the major achievements of his presidency. The act authorized creation of water resources research institutes at land grant universities in each state. The institutes program goal was, and is, to provide a sound scientific basis for decisions involving water resources and to transmit the resulting information to agencies responsible for allocation and management of water. In the process, the institutes are to aid in educating forthcoming generations of water scientists and managers.

From the beginning, our university has provided salaries for a small number of faculty and staff as well as office and laboratory space. Although WRRC has suffered through Hawaii's economic doldrums along with the rest of the university, water research continues to enjoy basic support from the University of Hawaii administration.

Over the years, funding sources have gravitated more and more toward competitive grants to work on specific problems and away from general research support to be allocated by each institute according to state or regional concerns. In the 1960s, the federal government allocated to each institute a research budget of \$100,000 annually. In today's inflated dollars, this is about \$550,000. But in fiscal 2003, the federal support for each institute had fallen to \$84,234—a decline in real terms of 85 percent.

Have water-related research issues declined by 85 percent in 35 years? I think not. Growing water demands in both quantity and quality dimensions pose new challenges almost daily to conventional habits of water use and delivery. At the same time, various mandates impose substantial technical and economic challenges—raising drinking water quality, preserving wetlands and endangered species, maintaining recreational waters, treating and recycling wastewater, managing demand, and so on. However much we may approve of these goals, they present

substantial new burdens on the stock and production of knowledge about water, not to mention on the application of that knowledge.

Most of the institutes, including Hawaii's, have actively tapped state and local agencies as well as established federal agencies—NSF, USEPA, USDA, and the like—for funding

of specific projects. In one sense, Hawaii has an uphill battle for its share of such money, in that many of our state's water issues relate only to tropical climates and do not appeal to agencies concentrating on problems of national or regional scale. Such problems will be researched here or not at all.

Nationwide, the institutes have done a good job of developing alternative research funding. Data from the National Institutes for Water Resources (the national organization of state and territorial water research centers) show that the average state institute now gets only about 4 percent of its total budget from the federal institutes program (the Hawaii center is very close to average in this respect).

However, this 4 percent is disproportionately important, basically providing seed money to develop larger and longer-term grants. Without the leverage it provides, many research proposals would not get developed, and policy makers would not have the guidance of solid scientific understanding. Thus WRRC participates enthusiastically in NIWR efforts to restore federal water institutes program funding and to secure other support for water research.

The Water Resources Research Act requires "careful and detailed evaluation" of each institute at least once every five years, most recently in 1999. The review panel found that "there are few federal programs that leverage federal dollars with non-federal dollars to the extent that the Water Resources Research Institute Program does" and that "the vast majority of the Institutes are strong and thriving." In my admittedly biased view, this is one federal program more than worthy of its modest cost.

— James Moncur



Researchers collecting water samples from the Hanalei River, Kauai, as part of the activities for a project funded by the U.S. Geological Survey

Tropical Pacific Water Conference

Continued from page 1

identifying and solving the water problems of the state of Hawaii as well as other Pacific islands.

Afternoon Session C (Cultural, Economic and Legal Impacts on Water) was moderated by Moncur and Dr. Jacquelin Miller. Afternoon Session D (Climate, Drought, Floods and Alternative Sources of Water) was moderated by Dr. Clark Liu and Dr. Gordon Tribble.



Session A was well attended, as were all other sessions of the conference

Day one concluded with a no-host cocktail and lots of pupu to allow attendees to meet each other and to discuss the issues raised during the day.

On day two (January 16, 2003), invited plenary speaker Ms. Alexis Strauss of the USEPA Region 9 office in San Francisco gave a presentation on "USEPA's Priority in Hawaii and the Pacific." She identified three prioritized problems for Pacific islands: (1) drinking water and wastewater issues, (2) nonpoint source pollution, and (3) coral reef protection. She then discussed some specific problems identified for Hawaii, Guam, Saipan, and American Samoa. One of her take-home messages was that staff members from USEPA Region 9 are accessible for discussions on water issues for these Pacific islands.

Following Strauss' presentation, the conference divided into two concurrent sessions. Morning Session E (Groundwater/Soil Contamination and Remediation) was moderated by Dr. Chittaranjan Ray and Dr. Charles Kinoshita. Morning Session F (Special Water Issues for Small and Remote Pacific Islands) was moderated by Mr. Michael Dworsky and Mr. Peter Rappa.



Ms. Rhonda Bower of South Pacific Applied Geoscience Commission

The invited luncheon speaker was Ms. Rhonda Bower of the South Pacific Applied Geoscience Commission (SOPAC). In her presentation on "Regional Consultation on Sustainable Water



Panel on Environmental Water Quality and Watershed Management: Roger Fujioka, Maile Bay, Robert Bourke, Anne Brasher, and Aly El-Kadi (left to right)

Management and the Third World Water Forum in Kyoto in 2003," Bower mentioned that representatives from several Pacific islands met in several meetings and workshops to develop a "Pacific Regional Action Plan on Sustainable Water Management." The plan was prepared for presentation to and adoption by the Third World Water Forum, which was scheduled to convene in Kyoto, Japan, on March 16–23, 2003. The value of Bower's presentation was to reveal the successful effort of SOPAC in the organization of at least 11 Pacific island nations to prioritize their water problems. An outcome of the conference was an agreement of cooperation between WRRC and SOPAC.

Afternoon Session G (Environmental Water Quality and Watershed Management) was moderated by Fujioka and Dr. Aly El-Kadi. Afternoon Session H (Water Issues Related to Crop and Animal Production) was moderated by Dr. Carl Evensen and Dr. Ping-Yi Yang.



Conference participants gather informally

Day two also concluded with a no-host cocktail and lots of pupu to allow attendees to meet each other and discuss the issues raised during the day.

A summary of each session will be published in a conference document. This document will be used as a planning guide for future studies to be undertaken by WRRC.

*By Roger Fujioka
Water Resources Research Center, University of Hawaii*

Water Issues Facing Oahu: A Perspective of a WRRC Conference Attendee



Between 1950 and 2050 the world's water supply will have decreased by 74 percent. A rising global population will undoubtedly face a water crisis without new technologies and strategies for better managing water sources and for recycling of existing water. While depletion of natural resources is a growing concern globally, an island environment faces

specific challenges based on the natural and anthropogenic factors that affect the sustainability of its water resources. These factors include climate, geology, soil, biota, topography, and hydrology, as well as population, land use, water use, and point- and nonpoint-source pollution. Hawaii is challenged with issues affecting its use of water for urban, agricultural, and conservation purposes because of a growing population and a finite supply of water. The State of Hawaii has begun to explore issues surrounding water supply and quality, wastewater management, groundwater and soil contamination and remediation, watershed management, and alternative sources of drinking water. These are just some of the conclusions that came out of the conference on "Scientific, Regulatory and Cultural Factors Influencing Water and Environmental Issues in Tropical Pacific Islands" held in Honolulu, Hawaii, January 15–16, 2003. The conference was sponsored by the Water Resources Research Center and co-sponsored by the United States Geological Survey (USGS) and the Pacific Water Association. Among the findings presented at the conference were the following.

Water supply and quality

Engineers at the City and County of Honolulu Board of Water Supply (HBWS) claim that Hawaii's drinking water quality is among the best in the nation. The HBWS currently pumps an average of 155 million gallons per day (mgd) of water.

Sources—Approximately 92 percent of the water supply on Oahu comes from underground aquifers fed by rainfall along the Koolau and Waianae mountain ranges. During normal years, an average of about two billion gallons of rain falls on Oahu every day. Some of the rain runs off to the ocean and some is lost to evaporation, but some soaks into mountain slopes and is purified naturally as it percolates through porous volcanic rock deep into the

basal, or water-bearing, aquifers. Fresh drinking water is pumped through wells into reservoirs and pipelines, ready for public use. The whole cycle from rainfall to use takes about 25 years to complete. High-level dike tunnels, such as the Waihee and Luluku tunnels, provide about 8 percent of the island's water. The Halawa Underground Pumping Station, or Halawa Shaft, supplies about 10 percent of the total water supply for Honolulu. Other Oahu sources include 77 well stations with 180 potable water wells; 2 nonpotable wells at Barbers Point and Lualualei; 3 shafts at Pearl City, Makaha, and Kalihi; 18 tunnels in the Honolulu, Windward, and Waianae areas; 2 springs at Alewa and Makiki; and 1 nonpotable spring at Kalauao.

Storage—Oahu's storage facilities include closed potable water reservoirs, closed nonpotable water reservoirs, and open nonpotable reservoirs. There are 163 reservoirs on Oahu, with 169.63 million gallons total storage capacity; 2 nonpotable reservoirs hold a total of 2.5 million gallons. The standard storage capacity for a reservoir is 1.5 days worth of water.

Pipelines—One of the challenges facing HBWS engineers is the replacement of aging pipelines whose design life is 50 years. HBWS currently maintains 1,842 miles (9,725,760 lineal feet) of pipeline 3/4" to 42" in diameter and replaces approximately 40 miles of it each year. In addition, HBWS maintains 17,513 fire hydrants.

In 2003 HBWS expects 300 water main breaks and plans to spend \$60 million on pipeline replacement and repairs; as the process moves along, engineers expect a reduction in the number of breaks each year. With a 20 percent rise in population expected by 2025, HBWS plans to increase its output to 185 mgd and maintain a 200-million-gallon supply. However, with a cushion of only 15 million gallons, HBWS claims there is a need to find alternative supplies.

Wastewater management

Recycled, or reclaimed, water is wastewater that has been rigorously cleaned through a chemical process. In 2000 HBWS acquired the Honouliuli Water Reclamation Facility, which produces approximately 12 mgd of recycled water. Agricultural use is 6.5 mgd, as regulated by the Hawaii Department of Health (DOH); and industrial use, such as by power and petro-refining companies at Campbell Industrial Park, is 2 mgd.

A planned deep-ocean water applications facility on Oahu may capitalize on ocean thermal energy conversion and the use of deep-ocean water. The facility would provide another source of fresh water, generate electricity, support air cooling and refrigeration, and support a base structure for further development of an aquaculture industry.

Groundwater and soil contamination and remediation

The hygienic quality of water is defined as the quality of water related to the degree of contamination by fecal matter or sewage due to poor hygienic or sanitary practices. Each year, the HBWS laboratory analyzes over 10,000 water samples island-wide locations for coliform bacteria, which are indicator organisms used to detect the possible presence of disease-causing microorganisms. However, researchers at the University of Hawaii Water Resources Research Center contend that U.S. Environmental Protection Agency's standards are compromised, stating that the inherent environmental characteristics of the tropics affect the relationships between indicators of fecal

contamination (*E. coli*, fecal coliforms, enterococci) and health effects observed in bathers. They recommend that recreational water quality guidelines for the tropics/subtropics be supplemented with additional alternative indicators, such as *Clostridium perfringens* and coliphages.

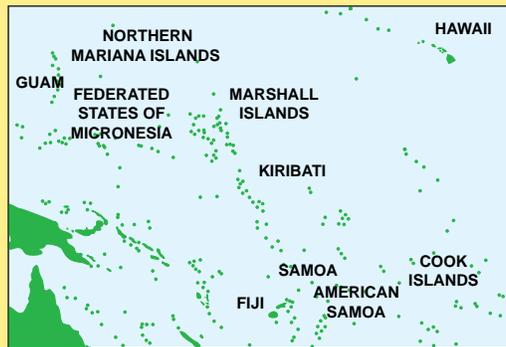
USGS scientists have found that other metrics developed as indicators of water quality in streams in continental settings also may not be appropriate for Hawaii. As a result, USGS has begun a project with DOH to develop and test benthic invertebrate metrics specific to Hawaii. University of Hawaii molecular biologists are testing the use of plants for the biodegradation of chemically contaminated soils.

*By Priscilla Billig
Sea Grant, University of Hawaii*

Water Resources Research Center Conference Draws High-Level Participation from Pacific Islands

The conference on "Scientific, Regulatory and Cultural Factors Influencing Water and Environmental Issues in Tropical Pacific Islands" drew a large contingent from many Pacific islands outside of Hawaii. Participants came from American Samoa, Samoa, Cook Islands, the Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, the Republic of the Marshall Islands, Fiji, and the Republic of Kiribati to partake in a forum that discussed common problems and potential solutions. Two important regional organizations—the Pacific Water Association (PWA), one of the co-sponsors of the event, and the South Pacific Applied Geosciences Commission (SOPAC)—were also well represented at the conference.

Ms. Rhonda Bower, a sanitation officer with SOPAC, gave a key luncheon presentation on "Regional Consultation on Sustainable Water Management and the Third World Water Forum in Kyoto in 2003." The world forum met this past March to discuss the looming crisis in delivering clean drinking water to most of the world's population. Bower gave a synopsis of the regional consultation conferences that took place in Fiji and Vanuatu last year as well as looking ahead to Kyoto and beyond.



agencies. Parish made Water Resources Research Center (WRRC) an honorary member of PWA, in recognition of WRRC's work with island water agencies.

In a session devoted to Pacific issues, participants got to hear about water agencies in the region. Mr. Amataga Penaia, an engineer with the Samoa Water Authority, spoke on water and culture in Samoa, focusing on the trials and travails of running a utility on a traditional Pacific island. Dr. Shahram Khosrowpanah from the Water and

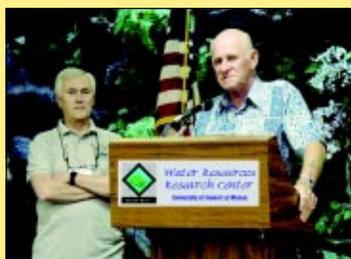
Energy Research Institute, University of Guam, reported on the state of water utilities on Guam, with special emphasis of the impact of the latest typhoon on the water distribution system. Mr. Everette (Skeet) Arasmith, director of the Micronesian Water and Wastewater Operator Training Program, outlined the training program developed for water agency personnel in the Federated States of Micronesia. Mr. Taboia Metutera, director of the Public Utility Board of Kiribati, spoke on the use of infiltration galleries for getting rid of sewage without contaminating the nearby lagoon.

The conference sessions were informative and stimulating, but the real benefit to the participants may have been the in-between meetings that took place during the breaks and evening mixers. Participants renewed ties with each other and discussed future

projects. The Pacific island delegation met with Dr. Roger Fujioka to discuss WRRC's participation in the Third World Water Forum and ways in which WRRC can partner with Pacific island utilities and regional organizations to promote better water quality.

*By Peter Rappa
Water Resources*

Research Center, University of Hawaii



Mr. David Parish of the Pacific Water Association lauds the work of WRRC

bodies, non-governmental organizations, and aid funding

PWA's executive director Mr. David Parish gave an outline of the organization's activities in the region. PWA, a regional association of Pacific island organizations operating in the water sector, works to promote cooperation among its members and other professional



Much of the conference business gets conducted outside the sessions

Aloha... Dr. Doak Cox

Dr. Doak Cox, the first director of the University of Hawaii Water Resources Research Center (WRRC), passed away on April 21, 2003. Cox's long and illustrious career spanned 60 years and included positions with the United States Geological Survey (USGS), Hawaiian Sugar Planters' Association (HSPA), and the University of Hawaii. Cox was with the University of Hawaii from 1960 to his retirement in 1985 and was an Emeritus faculty member until his death.

Cox was born in Wailuku, Maui, in 1917 but spent much of his childhood on the island of Kauai. He graduated from the University of Hawaii with a BS degree in Physics and Mathematics in 1938. He then moved to the mainland for graduate work at Harvard University, where he received his MA degree in Geology in 1941. Following completion of his MA degree, he was employed by the USGS as a field geologist. In 1946, he was offered a position with HSPA to direct their Geology Department and conduct research on geology, hydrology, and water resource development in Hawaii. In 1960 he left HSPA and officially became a faculty member at the University of Hawaii where he was appointed to the rank of professor in the Department of Geology and Geophysics and was put in charge of the Tsunami Research Program at the Hawaii Institute of Geophysics.

Cox served on the organizing committee for the University of Hawaii Water Resources Research Center in 1964 and was appointed its first director. He spent the formative years of WRRC developing long-term goals and the research agenda. Some of the investigations undertaken during Cox's tenure at WRRC include the behavior of pesticides with percolating water soils, development of monitoring stations in the Pearl Harbor aquifer, use of radio soundings to explore groundwater tables in the islands, and study of estuarine pollution in Kaneohe Bay, an activity which eventually led to the placement of a deep-ocean outfall pipe outside the bay in the early 1970s.



Cox was instrumental in developing the Environmental Center and became its first director in 1970. The Environmental Center, a program of WRRC, is a leader in research on Hawaii's environmental impact statement system and in the development of the Environmental Studies Program. He headed the Center until his retirement in 1985.

Cox held many honorary positions. He was active with the Hawaiian Academy of Sciences for over 50 years and served as president of that organization in 1958–59 and again in 1984–85. From 1960 to 1962 he was a councilor of the American Association for the Advancement of Science. From 1964 to 1972 he was a member of the Alaska Earthquake Committee and chair of the Oceanography Panel for the National Academy of Sciences. He was appointed to the Governor's State Water Commission from 1977 to 1979. He also was a member of the Hawaii Water Commission in 1980–81. Cox was a charter member of the Conservation Council and was an active member of the board and select committees since its establishment in Hawaii. In April 1985, he received the prestigious award for Conservation Achievement given by the National Wildlife Federation and the Conservation Council of Hawaii. Cox's many accomplishments were formally recognized in 1985 by his receipt of the Governor's Award for distinguished service to the University and State of Hawaii. This award was given

...to recognize an individual who has excelled and provided leadership of an extraordinary nature, in a multiplicity of fields and endeavors. Throughout his long and productive work efforts, his exceptional perception and personal expertise have provided guidance over a broad spectrum of academic, governmental and societal issues that has resulted in significant long term benefits both to the State of Hawaii and the world.



Hawaii Water Environment Association's 25th Annual Conference

The 25th annual Hawaii Water Environment Association (HWEA) conference was held on January 29–31, 2003 at the Hawaii Convention Center in Honolulu. The conference theme was “25 Years of Protecting Hawaii’s Water Resources.” Conference attendees were able to choose from a total of 36 technical sessions, including several by WRRC faculty. There were also 60 different exhibit booths featuring water/wastewater products and services.

Participants by WRRC faculty included the following:

- Dr. Roger Babcock made two presentations “The Honouliuli Membrane Bioreactor Pilot Study” and “Analysis of Bacteria and Virus Transport Through Surface Soils Irrigated with Recycled Water Using Genetic Fingerprinting (DGGE).”
- Dr. Victor Moreland’s topic was “Not All Secondary Treatment Processes are Equal: Collimated Beam Evaluations.”
- Dr. Roger Fujioka presented a poster on “Hawaii’s Response to USEPA’s National Monitoring Day,” which focused on water quality data from the Big Island, Maui, Kauai, and Oahu.

The eight student posters at the conference included four by WRRC students:

- Mr. Yingyot Chanthawornsawat —“Sequential Anaerobic-Aerobic Treatment of PCBs”
- Mr. Tieshi Huang —“Genetic Fingerprinting (DGGE) of Bacteria in Soil and Recycled Water”
- Mr. Sumon Kanpirom —“Chemical Regeneration of Spent Granular Activated Carbon”
- Mr. Dong Won Yoon —“Isolation and Characterization of Antiviral Marine Microorganisms and Their Active Principals”

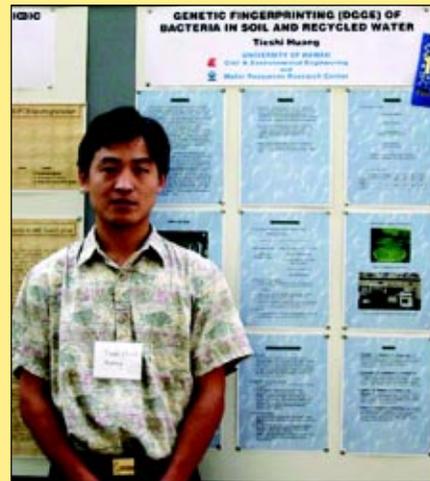
Huang won the first place prize of \$150 for his poster and Yoon won \$100 for second place. Huang also won one of two \$2,000 HWEA student scholarships.

The conference was attended by more than 200 participants.

*By Dr. Roger Babcock
Civil and Environmental Engineering
and Water Resources Research Center,
University of Hawaii*



Graduate Student Wins HWEA’s Scholarship and Poster Contest



Mr. Tieshi Huang and his award-winning poster

Mr. Tieshi Huang, a graduate student in Civil and Environmental Engineering and a graduate research assistant with the Water Resources Research Center, won the prestigious Hawaii Water and Environment Association’s (HWEA) graduate scholarship for 2003. Huang’s poster on “Genetic Fingerprinting of Bacteria in Soil and Recycled Water” was awarded first prize at the annual HWEA conference this past January. His poster reported on research conducted for a project on the “Evaluation of Infiltration to groundwater at Waiialua, Hawaii,” which was funded by the U.S. Army. Huang worked with principal investigator Roger Babcock on the project to determine the impacts of treated effluent with high nutrient content on groundwater. Huang who is from Tianjin City, China, was awarded the scholarship based on his research and his superior work in the classroom.

2003 Conferences

The following is a listing of national and international conferences gleaned from various sources.

World Water and Environmental Resources Congress 2003

June 23 – 26, 2003

Adam's Mark Hotel

Philadelphia, Pennsylvania USA

<http://www.asce.org/conferences/ewri2003/register.cfm>

International Congress on Watershed Management for Water Supply Systems

June 29 – July 3, 2003

Millennium Hotel New York Broadway

145 West 44th St., New York City, New York 10036 USA

http://www.awra.org/cgi-bin/sc_newyork_conference.cgi?html

New Zealand Water and Waste Association's Annual Conference and Expo 2003

September 17 – 19, 2003

Aotea Centre, Auckland, New Zealand

<http://www.nzwwa.org.nz/conferenceinfo/defaultns.asp>

Water Resources Management in the 21st Century International Water Resources Associations XI World Congress

October 5 – 9, 2003

Madrid, Spain

http://www.cedex.es/iwracongress2003/en/hoja2_en.html

Achieving Sustainable Water Resources in Areas Experiencing Rapid Population Growth 2003 American Institute of Hydrology Annual Meeting and Conference

October 19 – 22, 2003

Sheraton Gateway Hotel

Atlanta, Georgia USA

<http://dnrnet.dnr.state.ga.us/aih/registration.htm>

First Interagency Conference on Research in the Watersheds

October 28 – 30, 2003

Benson, Arizona USA

<http://www.tucson.ars.ag.gov/unit/ICRW.htm>

American Water Resources Association (AWRA) 2003 Annual Conference

November 3 – 6, 2003

Hilton San Diego Resort

San Diego, California USA

<http://www.awra.org/meetings/California2003/registration.html>