

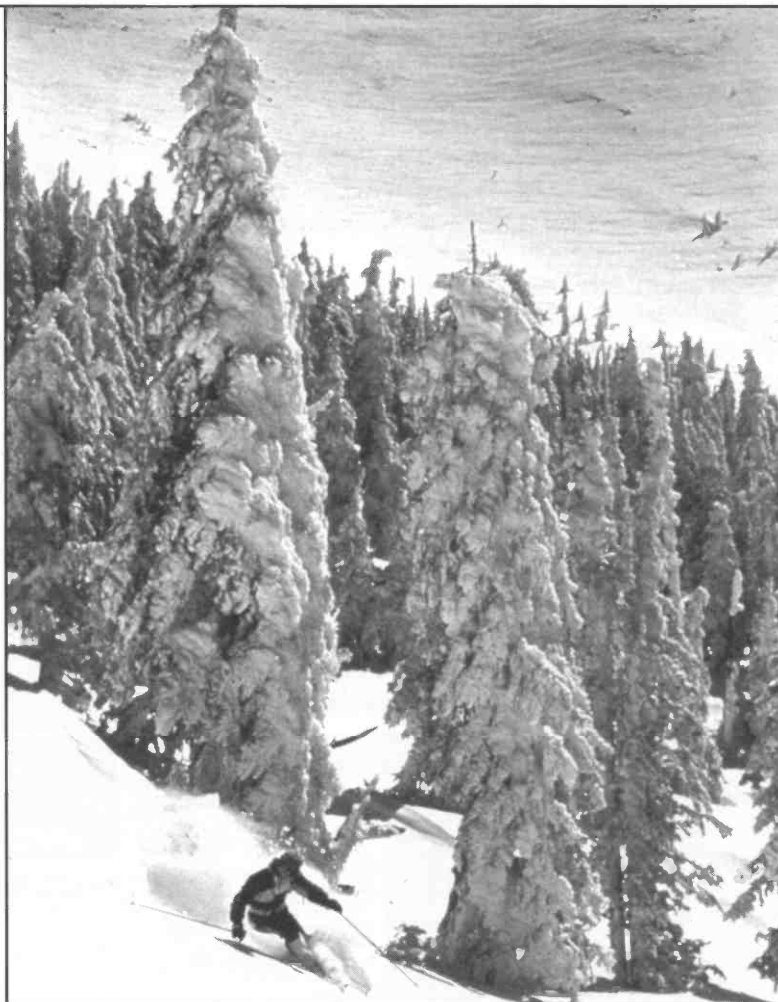
### Got Snow? Effects of Climate Variability, Change on Arizona Skiing

Skiing requires snow; snowfall depends upon atmospheric conditions. Simple and obvious as these statements are they raise a complex question: what effect will climate variability and change have on Arizona's ski industry? Two University of Arizona researchers, PhD candidate Rosalind Bark-Hodgins and Professor Bonnie Colby, are examining this question.

Information from climate change models show the ski industry to be very vulnerable. According to such models snowpack will decline, snow seasons become more variable and winter temperatures warmer. The effect will be an increased incidence of winter snowpack melt and sublimation loss. An earlier spring snowmelt will occur, with higher elevations required to maintain seasonal snowpack.

This situation does not bode well for attracting new interest to the sport. Skiing novices are more likely to learn at lower elevation "local" ski areas, those most vulnerable to the effects of climate change. These same beginners also are more likely to be discouraged by poor ski conditions and may lose interest.

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*Photo: Arizona Office of Tourism*

### Need Grows for CAP Tucson Reliability

*Two strategies proposed*

by Joe Gelt

Central Arizona Project reliability in the Tucson area was a major topic of discussion at a recent CAP Board meeting as water providers in the area consider the direct delivery of CAP water. To ensure the reliability of directly delivered CAP water during temporary outages a terminal storage or reservoir would be needed.

The direct delivery of CAP water and terminal storage are issues with which Tucson has had some previous experience, although with unexpected and unfortunate results. Recent developments are a new chapter in the Tucson CAP story

CAP reliability is becoming an important issue in Tucson with water providers considering the direct delivery of project water. Water providers northwest of the city are considering using their CAP allocation sooner than was anticipated; they are urging the construction of a reservoir. Tucson Water is considering the direct delivery of

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CAP but expects to rely on a recharge facility to provide terminal storage.

Tucson terminal storage in the Black Wash area was included in the original plans to bring CAP to Tucson. It became moot when Tucson decided to suspend direct delivery of CAP water. The decision had as much to do with politics as hydrology.

Tucson Water's ill-managed effort to directly deliver CAP water to its customers in the early 90s is part of state water lore. The utility aborted the effort when customers complained of water resembling ice tea coming out of their taps. In 1995 a voter initiative was passed, the Water Consumer Protection Act, that prohibited direct delivery of CAP water to homes in the city, requiring instead that it be recharged.

Tucson Water is now considering various options that will determine its reliability needs. Its options are to continue recharging and recovering CAP water or reactivate its water treatment plant to begin direct delivery. A third option combines the two strategies, with CAP water both recharged and recovered and directly delivered.

The city intends to gauge public sentiment about direct delivery through hearings, neighborhood meetings, opinion polls and focus-group sessions that will start in about six months. It confronts the challenge of winning over many citizens who were soured by the utility's previous effort at direct delivery of CAP water.

Whatever is eventually decided, however, the utility will not likely rely on a reservoir to ensure reliability. Its CAP allocation is now recharged and recovered at its Clearwater facility. Mitch Basefsky, Tucson Water spokesman, says Clearwater could provide the terminal storage the utility needs. He says, "The Clearwater facility would essentially be an underground reservoir. This would eliminate evaporative losses, and you would have more of a buffer in terms of water quality."

Meanwhile the communities northwest of Tucson are feeling a greater sense of urgency about direct CAP delivery and terminal storage. Groundwater pumping in the area is taking a toll: in 2004, Metro Water's wells dropped 5 to 13 feet, with some of its more productive wells dropping more than four feet annually over ten years. Oro Valley's water table dropped 2 to 12 feet in 2004; since 1999 it had declined at a 6.3 annual average.

As a result, northwest utilities expect to be using their allocated 30,000 acre feet of CAP water within ten years. They have formed a technical working group to study the issue.

The northwest water providers are Metropolitan Domestic Water Improvement District, Flowing Wells Irrigation District, Oro Valley and Marana.

Key decisions to be made include the type of treatment system to employ and the financing plan to adopt to pay for CAP. Marana's \$1,700 per home impact fee that is effective Jan. 1 is to cover the town's CAP cost. Oro Valley's \$300 home fee goes toward CAP costs.

It is expected that water bills will rise when CAP water comes online, although officials are reluctant to project exact figures without additional studies.

The northwest water providers will confront the same challenge



## Sol Resnick 1918 – 2005

It was sad news for the Tucson water community when Sol Resnick died Dec. 11. Sol will be remembered for many reasons: his world-wide experiences, especially his work in developing

countries, his hydrological expertise, his academic career, the esteem in which he is held by former students and colleagues, his unpretentiousness, not to mention his role in establishing the University of Arizona's Water Resources Research Center and his status as its director emeritus.

His career at the University of Arizona began in 1957, predating the establishment of the Department of Hydrology and Water Resources where he later became a full professor. In 1985 the UA awarded Sol an honorary doctor of science degree; the Arizona Hydrological Society acknowledged his accomplishments with its Lifetime Achievement Award in 1998.

Sid Wilson, former Sol student and general manager of the Central Arizona Project, described an essential Sol quality when he spoke at a ceremony naming the WRRRC conference room in honor of Sol. He described Sol's interest in water as actually an interest in people.

Sol was truly a rarity among water professionals; he will be sorely missed.

The funeral was held Dec. 21 in Milwaukee, with a Tucson memorial service to be scheduled in January.

Tucson Water faced when it inaugurated its direct delivery of CAP water to its customers: they will have to convince their customers that receiving more expensive, saltier and harder water is in their best long-term water resource interest.

An appealing selling point will be that the terminal reservoir providing backup for CAP direct deliveries also would serve as a recreational lake. A site has been identified, located near Interstate 10 and Tangerine Road; plans call for the 110-acre lake to include a beach, campgrounds, and a loop drive with picnic areas.

Basefsky says that the northwest water provider's plans do not impact Tucson Water, "except to the extent that there will be competition for those federal dollars. If they are going to get money for terminal storage then we would certainly be in line to get money to pay for terminal storage using our Clearwater project."

A CAP board member struck a wary note during the discussions. Noting Tucson's wayward and at times contrary CAP commitment, Jim Hartdegen said that Tucson has vacillated on accepting CAP water for years and asked: how can CAP now be sure that if it agrees to a reliability feature, Tucson would not reject CAP water?

In response, David Modeer, Tucson Water director and CAP board member, stated, "The fickleness of Tucson on water has long passed." ■



## Water Vapors

### WRRC Working on its Spring Conference



Planning is underway for the Arizona water community's premier event of the spring season: the Water Resources Research Center's Annual Statewide Water Conference. Scheduled June 20 and 21, the conference topic is "Providing Water to Arizona's Growing Population: How Will We Meet the Obligation?" Additional information will be provided on the WRRC web site, <http://cals.arizona.edu/AZWATER/> and via email. Contact us at [wrrc@cals.arizona.edu](mailto:wrrc@cals.arizona.edu) to have your name added to the conference email list or if you have questions.

### Susanna Eden (Re)Joins WRRC

Susanna Eden has recently joined the WRRC staff as coordinator of applied research. She had previously worked at the center as a research specialist from 1988 to 1990, shortly after graduating with an MS from the UA Department of Hydrology and Water Resources. (She later completed a PhD in the same program.) Between then and her present WRRC commitment, Dr. Eden has had broad experience in water resource science and policy issues, including managing the development of the Tucson Active Management Area's Groundwater Recharge Plan. While later working for the U.S. Climate Change Science Program's Global Water Cycle Program in Washington, D.C., Dr. Eden was involved in several international initiatives, including the UNESCO HELP (Hydrology for Environment, Life and Policy) Program.

See this issue's Guest View, p. 6, which was written by Dr. Eden, for further introduction to her and her work.

### BuRec Sponsors Supplement

This edition of the "AWR" contains a 4-page supplement sponsored by the U.S. Bureau of Reclamation with information about some of its projects. By sponsoring the supplement the agency is supporting the publication of this newsletter. We appreciate the opportunity to work with BuRec and the agency's generous support.

### What Happened to the Nov. - Dec. Issue of AWR?

That which is not there or did not occur often is newsworthy. Consider:

- Following is the entirety of Chapter XLII, "Concerning Owls," from *The Natural History of Iceland*, written by Niels Horrebouw in 1758: "There are no owls of any kind in the whole island."

- The Fort McDowell Yavapai Nation annually celebrates Orme Dam Victory

Days, Nov. 18-20, to commemorate the fact that the dam was never built. It would have flooded about 15,000 acres of its land.

- A recent Bureau of Reclamation report outlines nearly 1,000 water projects that it studied but never built throughout its 17-state Western domain.

And to the point at hand: there was no Nov. - Dec. issue of the AWR newsletter. Although this current newsletter immediately follows the Sept. - Oct. edition, this issue is dated Jan. - Feb., rather than Nov. - Dec. The reason for this is that the AWR has always been distributed during the last week of its bimonthly date: the Sept. - Oct. issue distributed the last week of Oct. This is contrary to the practice of most publications that are distributed prior to the month or months they cover. Thus rather than distribute a Nov. - Dec. newsletter at the end of Dec., we have dated it Jan. - Feb. to be distributed before January. Subsequent AWR newsletters will be dated accordingly.

### Harvesting the Falling Rains

The Water Resources Research Center and the Sonoran Institute recently hosted a rainbarrel water harvesting "open house" in Nogales, Arizona. A residence had been fitted with gutters, downspouts and six 55-gallon plastic barrels to capture rain for landscape use. Terry Sprouse, WRRC senior research specialist, and Amy McCoy of SI, were available to answer questions. The rainbarrel water harvesting guide that was distributed is available at the WRRC web site: <http://ag.arizona.edu/AZWATER/>



Arizona Water Resource is published 6 times per year by the University of Arizona's Water Resources Research Center. AWR accepts news, announcements and other information from all organizations

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## News Briefs

### Research: Tamarisk's Water Greed Overstated

Tamarisk have long been considered an outlaw plant in the West, an ecological misfit that has infested waterways at the expense of native vegetation and water supplies. What then would be the water savings if tamarisk, also called salt cedars, were removed from along rivers?

Recent research is questioning the general consensus that the water savings would in fact be significant. Pat Shafroth, a plant ecologist for the U.S. Geological Survey, found that cottonwood and willows, both native species, consume about an equal amount of water as do tamarisk. In areas where cottonwoods and willows grow as densely as tamarisk no measurable difference in water savings is apparent.

Replacing tamarisks with cottonwood therefore would not necessarily result in significant water savings.

Shafroth advocates looking at the system as a whole and not define the issue as tamarisk-versus-no-tamarisk. He calls for additional research to quantify actual water savings from removing tamarisk upstream.

Joe Lewis, an economist for the National Invasive Species Council, reported that a new tamarisk study to be completed at the end of the year offers similar preliminary conclusions.

The same report indicates that water savings were significant, however, in areas with growths of native grasses and shrubs instead of tamarisk. A minimum water savings of at least 30 percent and up to 60 percent were reported.

The above findings run counter to the position held by many ecologists and politicians that replacing tamarisk with native vegetation would result in significant water savings and help relieve drought conditions. This strategy is strongly advocated for along the Colorado River.

For example, in 2003 Sen. Pete Domenici introduced the Salt Cedar and Russian Olive Control Demonstration Act (S.177). The bill authorizes a research and

demonstration program to accelerate the eradication of salt cedar and other non-native species thriving along rivers in the western United States.

The research was presented at the Tamarisk Symposium held in Grand Junction, Oct. 12-14. The Tamarisk Coalition and the Colorado State University Cooperative Extension cosponsored the event.

### Report: Plan to Protect Grand Canyon Failing

Native fish populations continue to decline and sandbars along the Colorado River erode despite a decade's worth of efforts to regulate river flow within the Grand Canyon to ensure environmental benefits. That was the conclusion of a recent U.S. Geological Survey report.

Steps were taken in 1996 to protect the Grand Canyon by raising the dam's lowest water release level from 5,500 to 8,000 cubic feet per second and lowering its highest release from 30,000 to 25,000. The intent was to reduce the fluctuation of river flow that was believed to cause erosion. The decision reduced power production by a third.

The report found that populations of the endangered fish population have declined significantly and nonnative fish populations of rainbow and brown trout have

increased; nor have the low fluctuating river flows benefited beaches and sandbars.

The outlook, however, is not entirely bleak. About a year ago scientists released a single large burst of water from the dam. The 41,000-cubic-foot-per-second release washed about a million tons of new sand on beach areas and renewed sandbars. The release was timed to coincide with the canyon's tributaries sending peak sand loads. The tactic was successful and holds promise for future canyon reconstruction.

The drought may have provided an environmental boost by warming water temperatures below Glen Canyon Dam. This has provided a more hospitable environment for the endangered humpback chub.

Whatever steps might be taken to improve the situation would likely be at the expense of power generation – more water released, less power generated and less revenues.

In response to the report, two environmental groups, the Center for Biological Diversity and Living Rivers, filed notice that they intend to sue the responsible agencies to force a reconsideration of current river management practices.

The report, "The State of the Colorado River Ecosystem in Grand Canyon," is available at: <http://www.gemrc.gov/products/score/2005/score.htm>

### Babbitt Urges Strong Federal Land-Use Planning Role

*He says same federal strategy could be used that prompted Arizona's GMA*



Bruce Babbitt, former Arizona Governor and U.S. Interior Secretary, visited the University of Arizona Nov. 17 to promote his new book "Cities in the Wilderness, A New Vision of Land Use in America." His visit included a talk in which he said that explaining disasters such as what occurred in New Orleans as an act of God is to "give God a bum rap," whereas lack of planning is the true culprit. He called for the federal government to provide strong incentives for states and regions to undertake land-use planning, mentioning as a model the federal role that pressured Arizona to pass its 1980 Groundwater Management Act. The afternoon event was sponsored by the UA's Water Sustainability Program and the Water Resources Research Center. (See Publications, page 8 for review of Babbitt's book).

## Changing Times May Bring Water From Faraway Places

### Compact Heads Off Arizona's Claim to Great Lakes Water

Most Arizona water officials would readily agree that whatever additional water resources become available to the state would likely be the result of water management strategies or conservation efforts. Not high on any list would be acquiring water from a distant region of the country, say the Midwest, or from Canada.

Yet it may be a sign of the times — this era of drought and global warming — that the topic of tapping into very distant water sources is seeming in some quarters less a heroic and unlikely hydrological feat and more within the realm of the possible. Such projects are appearing less far-fetched.

Governors of the states bordering the Great Lakes see it that way, and they are taking no chances.

The eight governors have taken defensive action, working out what might be viewed as a Great Lakes' version of the Colorado River Compact. Called the Great Lakes Basin Water Resources Compact, the agreement identifies those who can and cannot draw water from the Great Lakes.

The document declares that the waters of the Great Lakes "are precious public natural resources shared and held in trust by the states."

The states want to ensure their control of the waters of the Great Lakes in the face of increasing national and even international demand.

#### Phoenix, Las Vegas got them worried

*"Today the economics are not there to say we're going to take all the water in the Great Lakes and ship it to Phoenix and Vegas," said Todd Amb, the water division director of the Wisconsin Department of Natural Resources. "But water's not getting cheaper. Twenty-five, 30, 40 years from now, the economics are going to be different. We've got to have a system in place to deal with that." Quote from New York Times.*

The Great Lakes states are taking the initiative before the federal government steps in and takes action. The governors want their standards included within U.S. law prior to the 2110 census. At that time Arizona and other western and southwestern states are expected to gain additional congressional seats.

Water is increasingly viewed as a commodity, and the governors are concerned that Congress, which regulates interstate commerce, will be having more say about its distribution and use. The governors fear that water-needy western states with burgeoning populations and scarce water resources will have the political muscle to stake a claim on Great Lakes water.

As the compact evolved greater emphasis was placed on efficient water use among the states. An official said, "It's hard to say no to Arizona if we're not being smart with our own resources."

After the governors sign the compact on Dec. 13 in Mil-

waukee, the agreement must then be approved by the eight state legislatures and Congress. This is likely to be a formidable undertaking.

The cluster of lakes contain about one-fifth of the world's and 90 percent of the U.S.'s fresh water.

### Will Canadian Water Flow to the U.S. — Then to the Southwest?

One of the seemingly unlikeliest of water resource strategies was the proposal to acquire water from the Yukon, transport it through Canada into the Great Lakes and ultimately to the Southwest. Proposed in the 1970s, the idea did not make much headway in water affairs.

That was then; now is now. Change is literally in the air, with green house gas emissions warming the earth. According to an article that recently appeared in *The Walrus*, a Canadian publication, thinking big or outside the box are strategies for coping with the results of global warming.

Titled "The Melting Point," the article is subtitled "How global warming will melt our glaciers, empty the Great Lakes, force Canada to divert rivers, build dams, and, yes, sell water to the United States."

Journalist Chris Wood says global warming bodes major changes for Canada. Thawing will be a force to be reckoned with for a country whose most bountiful and prevailing natural resources are snow and ice. He says Canada's water infrastructure is designed to cope with the current timing, frequency, quantity and distribution of snow and rain. The changes that global warming portend will disrupt the pattern.

Some parts of Canada will be wetter than ever before while others dry up. For example, northern British Columbia's share of the "water wealth" is expected to increase while the Great Lakes Basin will likely dry and record a deficit.

Wood says the current infrastructure will be unable to cope with massive floods nor reduce the stress of droughts of the future. He says some bold proposals are gaining scientific credence: the diverting of major rivers to drought-plagued regions and the constructing of massive dams to contain runoff from rain that previously froze as snow and ice in the Rocky Mountains.

Wood then describes an even broader issue. Unconfined by borders, droughts and floods will affect both Canada and its southern neighbor, the United States; international water politics will likely come to the forefront. What previous international stratagems have been unable to accomplish atmospheric change might achieve: international Canadian-U.S. water transfers and management of river systems.

In this regard Wood quotes the Meteorological Service: "The stresses of climate change make coordinated binational management of Great Lakes waters (as well as other boundary waters) more imperative. Resolving these issues may involve changing

*Continued on page 10*



## Guest View

# AZ Has Much to Offer, Learn by Taking Part in Global Water Affairs

*This Guest View was written by Susanna Eden, new WRRC coordinator of applied research. See page 3 for additional information about Dr. Eden.*

At Arizona's universities, the level of interest and activity on state and regional water resource issues has never been higher. At the same time, it's important to remember that there is a larger world beyond the borders of Arizona. Globally, the need for more information and knowledge sharing, innovation, and technology transfer is great. There are great opportunities to learn and expand the inventory of ideas that can be applied to Arizona, as well.

The United Nations has proclaimed the years 2005 to 2015 the International Decade for Action "Water for Life." The goal of the decade is to fulfill the commitments of the international community on water for sustainable development, including preservation of the natural environment and alleviation of poverty. These commitments include the Millennium Development Goals to halve the unmet need for safe drinking water and stop the unsustainable exploitation of water resources.

This UN system wide effort is coordinated by UN-Water. The UN Educational, Scientific, and Cultural Organization (UNESCO) is a key actor in the Decade activities. Since its recent reentry into UNESCO, the United States is playing a more active role in that organization's direction. In the fall of 2004, freshwater was one of the top priorities on the agenda presented by Louise V. Oliver when she took up her post as U.S. Ambassador to UNESCO. U.S. scientists made contributions to UNESCO's International Hydrology Program (IHP) throughout the period following the U.S. withdrawal and continue to contribute. In addition, UNESCO and the U.S. State Department now are working together to attract more U.S. citizens to take positions in UNESCO.

The Hydrology for Environment Life and Policy (HELP) program of UNESCO IHP has active participation in Arizona. The Upper San Pedro River basin is a member of the HELP network of basins and functions as a model for implementing HELP principles: applying hydrologic science to the needs identified by stakeholders.

National governments and intergovernmental organizations support development goals by sponsoring and cooperating in specific projects and programs of research, education and the capacity building. The World Bank, for example, has dedicated programs that provide assistance to the developing world for research on meeting water and sanitation needs and protecting the natural environment. Groundwater and transboundary waters have been focus areas for these programs.

An intergovernmental activity that is receiving a lot of attention now is the Global Earth Observation System of Systems (GEOSS). GEOSS functions as an international collaboration at the level of national governments and involves scientists from government, universities, and the private sector. Concerning itself with observations and monitoring, its goals include developing and employing new tools for observations and data, reversing the worldwide

trend of shrinking monitoring networks, developing international protocols, and improving international cooperation and coordination. Water resources managers are specifically named as intended beneficiaries of GEOSS.

Individual and independent organizations have additional pathways for international participation. The International Association of Hydrological Sciences (IAHS), an organization of scientists, leverages the resources of national governments, semi-governmental organizations, and private entities directly and through UN agencies to coordinate programs of international research on the full gamut of water science. Participation on IAHS subcommittees puts scientist in touch with their peers in other countries and provides for a cross-fertilization of ideas over national boundaries.

Climate and global change are particularly rich areas of international collaboration on water issues. Changes to weather/climate and the global water cycle have enormous implications for water resources in already vulnerable areas. A few years ago, interest in global change issues led to the formation of the Earth System Science Partnership, which coordinates activities of four preexisting programs of global change research and outreach (biodiversity, geosphere/biosphere interactions, human dimensions, and climate). A first priority project of the new partnership focuses on the global water system, a comprehensive system that includes the water resource and control systems engineered by humans.

There are many parallels between research on Arizona issues and research needs and activities internationally. Water in arid and semi-arid environments, deserts and desertification, riparian ecosystems, drought and associated issues, groundwater science, management concepts and institution building, transboundary water management, pollution and public health, and the list goes on. There are international programs and collaborations in all of these areas.

Not just scientists, but managers, community organizers, and businesses can contribute internationally. The 4th World Water Forum will be held in the spring of 2006 in Mexico City. The mission of the World Water Forum, which has been held every three years in a different city, is to create dialogue among stakeholders in the water community for the resolution of water related problems. A ministerial conference is held in conjunction with the Forum, which produces water policy recommendations. This year the Forum is focusing on local actions. The themes are: 1) water for growth and development, 2) implementing Integrated Water Resources Management, 3) water supply and sanitation for all, 4) water management for food and the environment, and 5) risk management.

This has been only a small, selective view of the complicated and diverse world of international water resources activities. My selections are based on my personal experience in that world and consequently are skewed. The message, however, is straightforward.

It's an exciting time to be involved with water work in Arizona. It's also an exciting time to extend that work beyond Arizona. The world wants to hear from us. ■■■



## Water Quality Improvement Center Improves Water Quality to Increase Water Availability

More than 20 million people in Arizona, California, Nevada, and Northern Mexico depend on Colorado River water delivered by the Bureau of Reclamation through publically-funded dams and distribution systems. Water delivered is used to grow our nation's crops, supply our cities, and serve our industries.

For the last six-to-nine years, the Colorado River basin has suffered a drought that affects both water quantity and water quality. As of the end of calendar year 2004, Lakes Powell and Mead, the primary storage reservoirs for the lower Colorado, were 37% and 43% full, respectively. Some states (Nevada, Colorado) have already imposed mandatory water conservation measures; others (Arizona) are considering them.

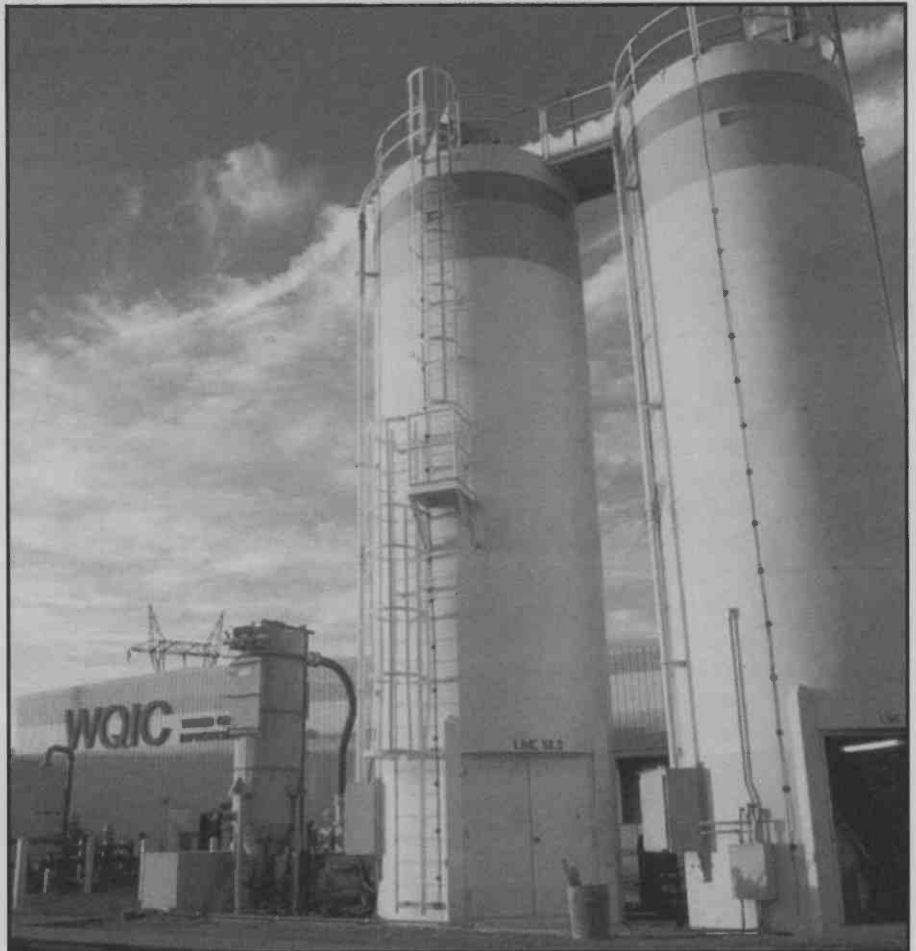
No one can predict when the drought will end, but even when it does, water supply and quality issues will still remain.

Water quality is key to water availability. If a water is naturally low-quality (high in minerals, for example) or has been impaired by industrial or municipal use (such as sewage effluent or plant wastewater), it typically is not re-usable for potable purposes unless it's treated. Once treated, it could be re-used, and this would increase the amount of water available for drinking, bathing, etc. However, treating low-quality water increases the overall cost of the water, and in many places in the U.S., this additional treatment is not economical.

That's where water treatment research comes in. Research develops technologies and methods to economically improve water quality. These improvements make more water available for use (agricultural, municipal, or environmental) in the U.S. and Mexico. Technology developed through research is also used to treat agricultural drainage for return or reuse. This gives Reclamation more options to manage groundwater.

WQIC research staff pursue two goals:  
— identify processes and technologies to reduce the cost of op-

### New Technologies to Stretch Water Supplies



The Water Quality Improvement Center helps increase usable water supplies by pioneering technologies and processes to improve water quality and make impaired water usable.

erating the Yuma Desalting Plant (a 73 million-gallon-per-day, reverse osmosis desalting plant; the site of the WQIC)  
— identify technologies and processes to advance the state of water treatment technology, and reduce the costs to treat impaired waters.

Waters the WQIC uses in tests include custom-mixed formulations, but primarily consist of lower-stem Colorado River water and brackish groundwater.

# Water Research at the Water Quality Improvement Center

## In-House Projects

(Authorized under Colorado River Basin Salinity Control Act, Title I)

### Yuma Desalting Plant: Our Primary Focus



The Yuma Desalting Plant was constructed to salvage salty agricultural drainage water and return it to the Colorado River, saving water that would otherwise need to be released from Hoover Dam for delivery to Mexico. The water saved is used in communities like Los Angeles, San Diego, Phoenix, Tucson, and many small towns adjacent to the River.

## Program Management & Development

### Title I Salinity Control (TISC) Program Management and Water Quality Improvement Center (WQIC) Efficiency

The purpose of the TISC Program is to find ways to operate the Yuma Desalting Plant (YDP) at a lower cost. The WQIC supports that purpose by serving as the primary site for this research. The WQIC is a 14,000 square foot building housing membrane water treatment research equipment from bench-scale to full-scale. It is one of only two Reclamation-operated applied research facilities searching for desalination solutions. Research conducted at the WQIC is valuable outside Reclamation because results can be applied at other reverse-osmosis desalination plants in the U.S. and around the world. A technical assistance team meets twice annually to provide technical guidance regarding best utilization of the WQIC for testing improvements to the YDP, developing new water treatment processes, evaluating improvements to existing processes, and troubleshooting problems with existing plants.

### WQIC Technical Support & Program Development

The purpose of the WQIC is to support the Title I Salinity Control Research program and Reclamation's efforts to accomplish its mission by finding ways to stretch water supplies and develop new water supply technologies. The WQIC provides critical infrastructure not available at any other Reclamation office. Development and evolution of the WQIC presents new technical challenges, requiring support of process and equipment designs and modifications of these designs, preparation of test programs, review of potential CRADAs, chemical engineering analyses, experimental design recommendations, and data analyses.

### FY05 YDP-Related Research Projects

- Title I Salinity Control Management & WQIC Program Assistance
- Membrane Storage Study
- Chlorine-Resistant Membranes
- High-Purity, High-Rejection Cellulose Membranes
- Investigate CA/PA Membrane Replacement for YDP
- Well Analysis to Investigate Desalting Yuma Mesa Conduit
- Development of Forward Osmosis Water Purification Process
- Non-Toxic Storage of Cellulose Acetate Membranes
- Upgrading YDP Pretreatment And Reverse Osmosis Processes

## Plant Technology Retrofits

### YDP Aluminum-Bronze Life Analysis

High-pressure, low pH flows appear to be corroding YDP equipment fabricated from aluminum-bronze. This equipment includes process piping, pumps, and valves. This project evaluates the ability of various high-carbide stainless steels, high-nickel alloys, and aluminum-bronze to stand up to conditions that occur at the YDP and other brackish water desalting plants. The findings from this study will be used to calculate the expected life of aluminum-bronze fluid-handling equipment at YDP, and will provide information about suitable replacement materials.

### Nontoxic Storage of YDP RO Elements

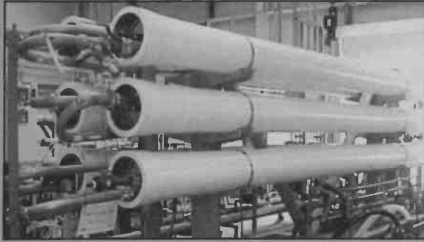
RO membranes stored for use at the YDP are subject to damage by microbiological agents such as bacteria, fungi, and chemicals, cutting short their useful life and increasing plant operating costs. One method of arresting this damage is to store membranes in a biocide; however, this method of storage has problems at all stages from prep for storage to post-storage handling. This project evaluates the effectiveness of gamma irradiation in providing non-damaging sterilization of Fluid Systems 12-inch membranes. Results have been promising enough that staff are planning to patent the process. **(PATENT)**

### YDP Pretreatment and RO Technologies

When the YDP was designed in the 1970s, the design was based on the most reliable water treatment and desalting technologies available. YDP uses RO desalting and "conventional" pretreatment: partial-lime softening-clarification and gravity filtration. Over the past 20 years, an array of advances in RO pretreatment and RO systems has occurred. These technologies need to be evaluated to determine how suitable they would be for use at the YDP. This research enables YAO not only to comply with legislation on finding ways to run the plant cost-efficiently, but in satisfying that legislation, YAO satisfies its responsibility to taxpayers to protect their investment in the plant.



### Cutting Costs by Increasing Product Water Recovery, Reducing Chemical Use



Engineers designing the YDP in 70s-80s planned for the YDP to recover 73% of the water it processed. They also planned to use a chemical anti-scalant in the process. While the plant was being constructed, Reclamation began exploring new ways to operate at higher recovery levels and with fewer chemicals. Using our demonstration scale test unit, Pilot System 1, our engineers perfected a new operating process that increased our product water recoveries to 80%, without anti-scalants. There is also the potential to get to 85% recovery, though at that level, anti-scalants would be required.

### Identification of Replacement Elements for YDP

In the early 90s, Reclamation purchased elements to use in YDP. These membranes have been in cold storage since their purchase, except for a portion of them that were successfully dried and are now stored in ambient conditions at the YDP. The formula used to create the original membranes has been modified over the years, and no cellulose acetate element on the market currently matches the elements originally specified for use at the YDP. New elements must be tested and evalu-

ated for use at the YDP to ensure the lowest-cost operations. This project involves identifying, describing, and testing cellulose acetate and polyamide elements for possible use at the YDP. The final outcome will be a list of elements that are optimal for use at the plant.

### Fluid Systems 12-Inch Membrane Drying

Previous research efforts resulted in identification of a process to “dry” part of the membranes to be used at YDP; those membranes are currently stored on-site. YAO currently keeps the remainder of YDP membranes in cold storage off-site at the cost of approximately \$150,000 per year. This project will identify a method to dry the remaining membranes so they can be stored at the YDP, eliminating the need to keep them in cold storage. This will also eliminate the need to pay for storage off-site, saving about \$150,000 per year or up to \$1,500,000 over a 10-year period.

### Pioneering new technologies

#### Forward Osmosis Water Purification Process

Conceived by University of Arizona physicist John Kessler, unpressurized FO holds great potential for significantly reducing capital and energy costs of desalting. The proposed project builds on previous work funded by DARPA. The focus of the proposed project is to pursue a radical new strategy to achieve significant size, cost,

### Solving the Mystery of Membrane Degradation



In the early 90s, engineers noticed that YDP membranes made from cellulose acetate were inexplicably degrading. They conducted testing and determined that an interaction of iron and chlorine caused the membranes to lose integrity. The process changed and now ammonia is added to form chloramines. This has slowed the degradation to a pace that doesn't affect the life of the membranes.

and energy improvements through the development of innovative new FO membrane water purification processes. The proposed FO water purification processes will mimic the energy-efficient osmotic processes utilized by biological systems. The objective of this project is to develop and demonstrate unpressurized FO desalting processes as quantum improvements over existing pressurized RO desalting systems.

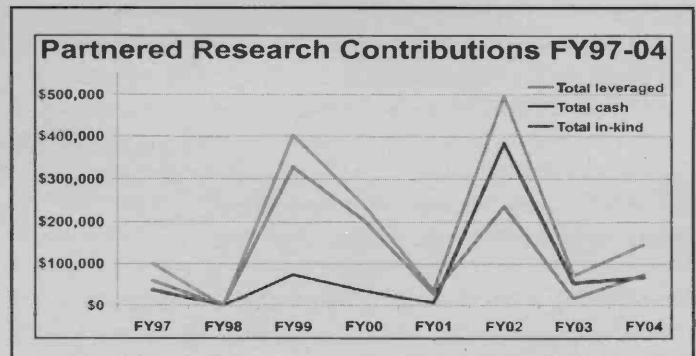
#### Chlorine-Resistant Low-Pressure Membrane Study

A primary limiting factor in the spread of RO is that the process is energy-intensive, which makes the process

relatively expensive. One way to reduce the cost of RO is to create low-pressure membranes, which require less energy to operate. Low pressure membranes do exist, but they are degraded by one of the most common and low-cost disinfectants in water treatment - chlorine. Industry describes the “holy grail” of membranes as a low-pressure membrane that will work with chlorine. This project seeks to perfect the formulation for such a membrane. Upon successful, replicable formulation, the membrane will be patented and mass marketed. (PATENT)

#### High-Purity High-Rejection Cellulose Acetate Membranes

While industry seeks a low-pressure, chlorine-resistant membrane, cellulose-acetate membranes continue to hold promise, if certain shortcomings can be overcome. One such shortcoming is that, while the intrinsic transport properties of CA membranes can exceed 99.5% salt rejection, in actual practice CA membranes operate



at about 95% salt rejection. Modifying CA membranes to achieve 99.5% salt rejection would require only relatively minor modifications in the production process of cellulose to CA in the final membrane. This project focuses on finalizing these modifications and beginning the process of applying for a patent on the process. (PATENT)

## Partnered Research Projects

(Authorized under Technology Transfer Act of 1986)

### Desalination Research with Metropolitan Water District

MWD's mission is to provide its service area (17+ million consumers in Southern California) with adequate and reliable supplies of high quality water to meet present and future needs in an environmentally and economically responsible way. The Colorado River is a major source of water for MWD. A planning goal at MWD is to meet or exceed the 500 mg/L total dissolved solids secondary USEPA non-health standard. One way to accomplish this goal is through desalination. Since the district is planning to use desalination equipment similar to that used at the Yuma Desalting Plant, Reclamation benefits by partnering with them.

MWD is conducting research associated with various aspects of membrane water treatment. These aspects consist of: 1. Evaluation of new, high-performance reverse osmosis (RO) membranes; 2. Investigation of hybrid-membrane processes (i.e., combining RO and nanofiltration (NF) membranes) to achieve 90 percent total water recovery; 3. Evaluation of high-voltage, capacitor-based technology to prevent colloidal, biological, and precipitative fouling; 4. Develop a pilot-scale, membrane crystallizer to minimize brine residuals. The research project is expected to last for one year. MWD will also be supplying supplemental equipment. Burns & Roe Services Corporation will provide operations and maintenance services. *Partner: Metropolitan Water District of Southern California in Los Angeles, CA.*

### Somerton Surface and Ground Water Blending Study

In some locations such as Tucson and the Yuma County Foothills area, corrosion problems have been reported when Colorado River water has been blended with existing well water sources. The City of Somerton is planning to blend Colorado River water with Somerton well water in the near future. This study investigates corrosion issues of the blended water in order to anticipate possible problem areas. The corrosion properties of various materials of construction in the water treatment, distribution, and customer piping areas will be studied. City of Somerton well water, Colorado River water, and blended water will be used to investigate corrosion rates under static & dynamic conditions. The goal of this project is to evaluate the corrosion characteristics of typical materials of construction with City of Somerton water supplies and blends. The effectiveness of water treatment with the addition of corrosion inhibitors and other chemicals will be determined.

*Partner: City of Somerton, AZ, Nicklaus Engineering.*

**Proof-Testing a HotWater Engine for Use in Desalination**  
Arizona company Deluge, Inc has developed an engine that is

powered by hot water. The engine was originally developed through a CRADA with the Department of Energy and has recently been selected to power crude oil pumps in Missouri. Deluge management wants to apply the technology to desalting and is proof-testing the engine's ability to power desalting pumps using equipment from the WQIC. After tests demonstrate the engine can effectively power pumps used in the desalting process, Deluge plans to construct a larger test system and test it using geothermal energy.

*Partner: Deluge, Inc., Phoenix, AZ*

### Computer Modeling to Predict Membrane Performance

University of California is developing a computer model to predict how various membranes perform under various operating conditions. This is a component test. The data produced will be combined with that from other tests to help scientists create a multi-functional piece of equipment that engineers can use to assist them in planning and designing membrane water treatment plants. The equipment will rely on software to model various treatment processes, diagnose operational problems, and generate treatment solutions. If successful, the project will enable more accurate testing of treatment processes at a smaller scale, decreasing the cost of designing a membrane water treatment plant.

*Partner: University of California - Riverside, CA*

“PATENT” means patent either is being or will be applied for.

## Supporting Rural Communities in Water Resources Management



The City of Somerton, AZ, approached Reclamation for assistance planning for an upcoming change in the mix of water they deliver to their residents. WQIC staff helped the City conduct a taste test and are now working with the city to evaluate how different metals will respond to their expected new type of water. Small rural communities like Somerton can access the WQIC for help with water resources management questions like this one.

### WQIC

Water Quality Improvement Center  
Yuma Desalting Plant  
Yuma, Arizona  
Yuma Area Office  
Lower Colorado Region  
Bureau of Reclamation  
U.S. Department of the Interior

Teh-An (Daniel) Hsu  
Research Coordinator  
Phone: (928) 343-8229  
Fax: (928) 343-8225  
Email: dhsu@lc.usbr.gov  
Website: www.usbr.gov/yuma

For more info. about the Title I Salinity Control Research Program or the WQIC, contact Daniel Hsu



## Legislation and Law

### Arizona Sides With Nevada to Back Canal Lining Project

Arizona has sided with Nevada in opposition to a legal effort to halt the lining of the All-American Canal, an action the two states say could reduce their Colorado River supplies. Mexico now uses the seepage from the unlined canal.

At issue is a class-action lawsuit filed by a coalition of Mexican business leaders and California environmental groups to stop the canal lining. Lining the canal with concrete would capture much of the seepage, about 67,000 acre feet per year, with "saved" water then going to the San Diego County Water Authority per a complicated Colorado River deal brokered by the federal government.

The lawsuit claims that Southern California's water gains would be at the expense of Mexican farmers and south-of-the-border wetlands. The wetlands are home to more than 100 bird species including some that are endangered. It is argued that widespread environmental and economic harm would result.

The situation once again demonstrates that allocating scarce water resources in the West often is zero-sum proposition: water gained by San Diego is water lost to other users and other uses. It is another situation of interests claiming and protecting shares of an over allocated river and squeezing out every available drop.

Plaintiffs argue that seepage from the All-American Canal and its predecessor, the Alamo, has recharged the aquifer supplying Mexicali Valley for over 100 years and has been used to develop and support an agricultural economy. They further argue that the blending of seepage with the groundwater stabilizes salinity levels and maintains water quality in the Mexicali aquifer. Without it groundwater quality would deteriorate; the aquifer could become unusable.

The suit further alleges that lining the canal violates U.S. environmental laws because its effects on Mexican wetlands and migratory birds have not been studied.

Mexico has raised strong objections to U.S. plans to line the canal and has indicated it will send a diplomatic note to the United States protesting the project. Foreign Relations Secretary Luis Ernesto Derbez said his country prefers a negotiated settlement but considers Mexicans' right to the water to be "inalienable." A press statement said Mexico will "totally defend" its access to the water.

Claiming that Mexico is merely taking advantage of a temporary bonus, U.S. interests argue that the cross-border seepage in fact belongs to California as part of its Colorado River entitlement. The International Boundary and Water Commission supports this position.

If the canal remains unlined and seepage to Mexico continues, the federal government may have to dip into other water sources to cover demands; a drawdown from Lake Mead would be a likely option. The reservoir stores water for Arizona, Nevada and California. Whether the deficiency would come from California's allocation or whether all the lower basin states would share it is uncertain.

This suit has the distinction among Colorado River cases of raising questions relating to international law as it pertains to the ownership of the river water. Complications are inevitable. For example, the case could likely take years due to the complexity of adjudicating international water rights.

Extending from 20 miles northeast of Yuma, the All-American Canal, a 65-year-old aqueduct, dips south and runs along the U.S.-Mexico border into Imperial County east of San Diego. The Coachella Canal is a branch of the All-American Canal, serving communities north of the Salton Sea, including Palm Springs, Palm Desert and Indian Wells.

### High Court's Wetlands Review May Limit CWA's Reach

In cases with far-reaching consequences, the U.S. Supreme Court agreed to hear two appeals by developers claiming they were penalized by an excessively broad interpretation of the 1972 Clean Water Act. The developers are seeking reversal of lower court rulings upholding the Army Corps of Engineer's authority to prevent protected wetlands from being filled in.

What in effect will be addressed by the two cases — *Rapanos v. U.S.*, 04-1034, and *Carabell v. Army Corps of Engineers*, 04-1384 — is the contentious issue of environmental regulation and the rights of private property owners.

Much is riding on the outcome of these two cases, with the high court's decisions likely to determine the future course of wetlands policy. Interest in the cases is further heightened since these are likely to be first environmental decisions by new Chief Justice John Roberts.

The former case involves John Rapanos, a Michigan landowner found in violation of the CWA for filling in protected wetlands on three sites he intended to develop. He argued that the law only applies to navigable waterways and to streams and wetlands adjacent to such waters, not to his properties located 20 miles from any navigable water.

When authorizing the federal government to prevent certain discharges the CWA does in fact indicate discharges into "navigable waters." The Environmental Protection Agency and the Army Corps, however, adopted regulations to protect distant ponds and wetlands. Their rationale was that if such wetlands were polluted or destroyed, rivers and bays could be adversely affected.

This meant that regulators would not at times allow private wetlands located miles from a river or bay to be drained for development since pollution can flow downhill to navigable waters. The debate is about how far upstream the regulations can be applied to protect those waters. In other words: what is the reach of a hydrological connection? The court ruled in favor a broad, far-reaching interpretation.

*Continued on page 9*



## Publications & On-Line Resources



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### Rainwater Harvesting for Drylands, Volume 1: Guiding Principles to Welcome Rain Into Your Life and Landscape

Brad Lancaster, 183 pp., \$24.95, self-published by Rainsources Press at <http://www.harvestingrainwater.com/>

This is the first volume of what is to be a three-volume guide on conceptualizing, designing and implementing sustainable water-harvesting systems for home, landscape

and community. The concept is explained, with specific information provided about effective water harvesting strategies for various site conditions. Information ranges from designing new water-harvesting landscapes to retrofitting existing ones. Amply illustrated, the volume is written in a clear, nontechnical style to attract the interest

of nonprofessionals and homeowners as well as planners, designers and landscapers. Water-harvesting Earthworks, volume 2 in the series, is scheduled for summer 2006 and Roof Catchment and Cistern Systems, volume 3, will be out in fall 2006.

### Arsenic and Groundwater: Questions, Answers and Solutions

Jan. 23 is the deadline for water agencies to meet new Environmental Protection Agency standards for arsenic in drinking water. Left on their own are the many suburban homeowners and resident of rural areas who depend on their own wells for drinking water. How do they find out if there's arsenic in their wells or coming out of the taps in their home? What steps can they take to get the arsenic contamination down to the level that EPA has determined to be safe. The American Ground Water Trust, a non-profit public service agency, recently published a guide to answer these and many other questions about arsenic and groundwater.

The 24-page guide explains the geologic origins of arsenic, its occurrence in groundwater, arsenic related health issues and methods to remove or reduce arsenic levels. Check the AGWT's web site for information about the publication: <http://www.agwt.org/>

### CITIES IN THE WILDERNESS

a new VISION of land use in America

BRUCE BABBITT

### Cities in the Wilderness: A New Vision of Land Use in America

Bruce Babbitt, Island Press at [www.islandpress.org](http://www.islandpress.org), 200 pp., \$25.95.

Babbitt offers a proposal for a new national land use policy, one that protects our rapidly disappearing landscapes and dwindling rivers and controls urban sprawl. He argues that heedless development has too often had its way, with government subsidizing sprawl and local officials mostly unwilling or unable to halt the momentum for development. Babbitt's aim is not to join the chorus lamenting and condemning land developers. Instead he wants to get to what he sees as the root of the problem: the failure of state and local governments to adopt effective land use regulations to control sprawl.

The solution to the problem according to Babbitt is stronger federal leadership in land use planning. He realizes he will be raising some hackles with this proposition; land use has come to be seen as very much a local matter. He argues, however, that the national government's involvement in land use planning can be traced to the early days of the republic.

In making his case for a strong federal role in land use planning, Babbitt identifies issues that are of national and, therefore, federal interest: protecting endangered and threatened species, the health of rivers that cross state lines, coastlines, forests, and regions of special scenic, ecological or historic significance.

The various chapters are case studies of success stories, each

demonstrating elements that can be applied to other regions of the country. In the discussions Babbitt at times calls for additional federal legislation to improve land use planning.

He lauds the Endangered Species Act as one of the most effective federal laws influencing land use. He says it served Tucson well. In response to a development moratorium on lands occupied by the spotted owl, Pima County Supervisors took the extra steps to enact a county-wide general plan to protect riparian areas, sensitive species and core biological areas throughout the county.

Babbitt also argues for a revision of the Clean Water Act to promote firmer federal-state partnerships in managing water resource use and in regulating the effects of land use on rivers and lakes.

Babbitt's suggestion of extending the ESA to encourage protection of critical ecosystems and open space throughout the country comes at a time when, according to one newspaper headline, the ESA is in the cross hairs. Legislative efforts are underway to make the 32-year-old law more friendly to landowners and builders, with less accommodation to environmental interests. In fact, much of what Babbitt proposes in his book might seem sadly out of step in the prevailing political climate.

Undeterred, Babbitt calls for "an armistice followed by a peace conference to which not just westerners, but all Americans, are invited. The outcome should be a new constitution for public lands, in the form of federal legislation that subordinates but does not eliminate mining, grazing, and logging to an overriding public mandate for long-term biological diversity, abundant wildlife and fisheries and the ecological integrity of our streams and watersheds."



## Special Projects

*Skiing...continued from page 1*

Snowmaking can reduce a facility's vulnerability to climate change by increasing snowpack depth, durability and season reliability, but at a high cost. Variable costs of snowmaking in the Southwest are about \$923 per acre foot of snow, and it takes about .43 af of water to make 1 af foot of snow.

Arizona ski areas already experience high variability in snowfall and season length. Climate change might account for some of the increased variability, but annual and decadal scale climate oscillations explain much of it. The researchers tested this premise by modeling Arizona's two major ski areas (Sunrise and Snowbowl) season data as a function of a key oscillation — El Niño Southern Oscillation (ENSO) and also the Pacific Decadal Oscillation modulated ENSO (ENSO-PDO).

The modeling results show that ENSO and ENSO-PDO significantly and positively predicted snow depth at the snowpack telemetry site (SNOTEL) at Mt. Baldy near Sunrise. Climate oscillations also predicted snowfall at Snowbowl located near Flagstaff.

Bark-Hodgins and Colby also found that climate oscillations significantly explain variability in ski season length and visitation. For example, the model predicts that a one unit increase in the intensity of ENSO increases season length by 18 days and visits by 23,653 from the annual average at Snowbowl. The figures increase to 31 days and 41,449 visitors during an ENSO-PDO year.

The researchers note that climate oscillations, although their effects are significant, account for less than a fifth of the variations in season length and visitations. For example, Snowbowl relies entirely on natural snowfall; other factors that explain season length and visits include timing of first snowfall, snow depth, the incidence of warm spells and powder events and general economic conditions.

Bark-Hodgins and Colby also considered snowmaking as an adaptive strategy to climate variability and change. By enabling ski operators to build snowpack in the absence of natural snow, snowmaking improves the consistency of ski seasons, allowing resorts to open for the crucial Thanksgiving holidays, winter break and Rodeo week vacations. Sunrise's snowmaking capability covers 10 percent

of its terrain; Snowbowl has plans for 100 percent snowmaking capacity. Snowbowl management anticipates applying a base of 64 centimeters over the terrain at the season's start during a 'wet' season to ensure good skiing conditions over the Thanksgiving break, one and half times in an 'average' season and two times in a 'dry' season, equivalent to 427 af, 640 af and 854 af of snow per season, respectively.

Higher temperatures resulting from climate change will increase energy costs and water losses of snowmaking. Snowmaking then may become uneconomical. Further, more warm spells may significantly shorten the ski season, and the costs to replace melted snowpack may become too high.

The models are able to predict the effect climate change will have on the ski industry at Snowbowl and assess the economics of snowmaking. For example, the models predict that a 100 cm snowpack decline at Snowbowl could contract its season 11 days, reduce visits by 7,348 and economic output by \$0.91 million. Meanwhile making snow could become more costly; replacing all the snow with manmade snow would increase costs by \$0.77 million and water use by 380 af. This leaves little room for snowmaking demands for a resort with an overall water supply of 486 af for snowmaking.

The researchers suggest various non-snowmaking adaptations. Skiing could be limited to top slopes where snow is more reliable. Also resort operators could use ENSO forecasts to determine hiring and marketing, and they could restructure prices to encourage opportunistic skiers.

For additional information contact project researchers: Rosalind H. Bark-Hodgins (rbark@email.arizona.edu), PhD candidate, UA's Office of Arid Lands Studies or Bonnie Colby (bcolby@ag.arizona.edu), professor, UA Department of Agricultural and Resource Economics.

This research was funded by the National Oceanic and Atmospheric Administration's Climate Assessment in the Southwest (CLIMAS) grant, Contract No.: NA16GP2578, Variability, Social Vulnerability, and Public Policy in the SW US States: A Proposal for Regional Assessment Activities. ■

*High Court...continued from page 7*

Rapanos is now challenging the constitutionality of the CWA by arguing that Congress improperly applied the clause on interstate commerce to regulate "non-economic intrastate activities like the filling of remote, nonnavigable intrastate wetlands in this case."

Much of the CWA's regulatory authority derives from passages in the Constitution empowering Congress to regulate commerce between the states. Wetlands warrant federal protection because they are said to provide flood control and habitat values affecting interstate commerce. If the Court decides otherwise this could limit the federal government's ability to protect resources in reference to interstate commerce. This in turn could

affect federal actions in response to the Endangered Species Act, the Safe Drinking Water Act, and some health and safety regulations.

Some western wetlands may be especially vulnerable if changes in wetland regulations result from the court's decision. The region has isolated wetlands that are dry most of the year; their protection could be undermined.

The high court will consolidate the Rapanos' case with *Carrabell v. U.S. Army Corps of Engineers*. The latter case involves a condominium developer challenging the corps's authority to restrict development on a wetland area; a manufactured barrier separates the proposed fill area from forested wetlands. A lower court ruled that federal regulations applied in the situation.



## Announcements

### UA Water Sustainability Program Issues RFP, Sponsors Workshop

#### RFP: UA Water Researchers

The University of Arizona Water Sustainability Program is accepting proposals for the competitive grants program through the Technology and Research Initiative Fund, administered by the Arizona Board of Regents. TRIF funding to WSP supports UA water research, education, and outreach in water-related areas of importance to the state.

It is expected that \$800,000 will be available to fund new projects in FY 2006-07, subject to final ABOR approval. Proposals must be submitted by January 31. Funding will begin July 1. Single and multi-year proposals will be accepted; single-year proposals, however, are preferred.



Only UA faculty and staff are eligible to submit proposals; however, partnerships with and support

from private and public sector agencies are strongly encouraged.

WSP is coordinated by four UA water centers: Water Resources Research Center; Water Quality Center; Center for Sustainability of semi-Arid Hydrology and Riparian Areas; and

Engineering Research Center for Environmentally Benign Semiconductor Manufacturing. Links to these centers are on web site mentioned below.

For additional information check the web site: <http://uawater.arizona.edu/grants/rfp.html> or contact Jackie Moxley, WSP coordinator, 520-792-9591, X 17 or [jmoxley@ag.arizona.edu](mailto:jmoxley@ag.arizona.edu)

#### Workshop: Innovations in Arsenic Management for Water Providers

This half-day workshop/training session offers information on response options for the new arsenic MCL. Leading Arizona experts on arsenic occurrence, regulatory activities, health effects, water treatment for arsenic removal, and management of arsenic-bearing residuals will participate. This session is for everyone with an interest in arsenic regulation as it affects Arizona water supply.

Sponsored by University of Arizona Water Sustainability Program; Feb. 17, 2006, 10 AM to 3 PM, University of Arizona. Registration and agenda information on the WSP website, <http://uawater.arizona.edu>

### WaterReuse Foundation Calls for Abstracts

The WaterReuse Foundation is accepting abstracts for technical presentations for the 10th Annual Water Reuse Research Conference, to be held in Phoenix, May 15-16. The conference will showcase latest "cutting-edge" research on water reuse and desalination. Abstracts will be selected with the goal of forming a program covering such topics as waterborne pathogens, pharmaceutical agents,

endocrine disrupting compounds, membrane applications and limitations, salinity management and indirect potable reuse. The conference is billed as the event "you need to attend to learn what will likely become mainstream, accepted technologies in 5 - 10 years." Conference information and abstract forms are available at <http://watereuse.org/Foundation/2006conf/index.html>. Abstracts must be received by January 27.

*Canada...continued from page 5*  
current policies or legislation."

He believes that Canadians need to reconsider their attitude of "aqua-nationalism," a view that holds as anathema that Canadian water be traded as a commodity, especially with the United States. He writes, "We'll need to open our minds to new ways of sharing water and its management with the United States."

As Canada builds dams and diverts rivers to serve its needs cooperative arrangements with the United States will become more feasible. For example, one proposal for delivering water from northern Canada to parched southern regions is to divert water from Shuswap Lake, water that would eventually flow into the American reaches of the Columbia River. Dams along the river system could be managed to benefit both nations.

Fears that climate change may diminish the Great Lakes by

as much as 40 percent has prompted speculation that fresh water entering St. James Bay could be diverted to replenish the lakes. Such a massive project would clearly have to be a bi-national undertaking. The proposed project even has a name: the Great Recycling And Northern Development (GRAND) Canal.

Wood even foresees possibly implementing elements of the Northern American Water and Power Alliance. Conceived in 1964, NAWPA would have transported 110 million acre-feet of water annually (about eight times the average annual flow of the Colorado River) from Alaska and northern Canada to the western United States and northern Mexico. He suggests that the United States might be more than willing to contribute billions of dollars to complete transfer projects if they also include delivering much needed water south to the United States.

The article is available on-line at [http://www.nwra.org/fea\\_water.pdf](http://www.nwra.org/fea_water.pdf)



## Public Policy Review

by Sharon Megdal

# Revised AWS Rules, Key to Efforts to Reduce Groundwater Overdraft

*"Layperson's Guide" to final rules would be helpful*



When I give introductory talks about groundwater management in Arizona, I note that the linchpin to our approach to reducing groundwater overdraft in the Active Management Areas is the Assured Water Supply Rules. The AWS Rules are of critical importance in forcing — I choose this word deliberately — new municipal demand to

be met with renewable water supplies, either directly or through groundwater replenishment. Certainly, water providers believe they are responsible purveyors of our most precious resource; however, it is not always realistic to expect voluntary actions since significant expenses can result from using renewable water supplies. Investment in water treatment facilities, water storage and recovery facilities, and/or purchase of services from the Central Arizona Groundwater Replenishment District contribute to the high cost of showing that water demand will be met or offset predominantly by renewable water supplies for 100 years.

Like the municipal sector, the industrial and agricultural rightholders have mandatory conservation requirements, established through the Management Plans for each AMA. However, the latter two sectors have no renewable water supply use requirement. In Central Arizona, agriculture's significant use of CAP water is not in response to law but to special pricing structures that provide economic benefits. Economy also drives industrial rightholders to heavily invest in conservation and reuse technology. In addition, golf courses use reclaimed water in response to ordinances.

The seminal 1980 Groundwater Management Act mandated that a program of assured water supply be adopted. Assured water supply approval processes developed in the 1980s addressed the program's requirement for a demonstration of a physically available 100-year supply. But it was not until 1995 that the Assured Water Supply rulemaking processes included the renewable supply requirements currently in effect.

The rules are complex, with detailed provisions varying by AMAs. There are designations versus certificates. The AWS Rules do not force all water providers to become "designated." Designation has the significant, extra requirement that a water provider's pre-existing municipal demand (not just new demand) switch to use of renewable water supplies. A "certificate" of assured water supply, on the other hand, establishes that a new subdivision will depend on renewable supplies. Pre-1995 demand could continue to rely on mined groundwater.

To establish a 100-year assured water supply the following must be demonstrated: (1) A sufficient quantity of water is physically, legally and continuously available for 100 years to satisfy the water demands of the subdivision or service area; (2) The water source meets water quality standards; (3) The proposed water use is

consistent with conservation standards; (4) The proposed water use is consistent with the AMA management goal (safe yield for several AMAs); and (5) The applicant is financially capable of installing the necessary water distribution and treatment facilities.

Revising the AWS Rules is one among many tasks that the Arizona Department of Water Resources is undertaking. Last session, via House Bill 2174, the Legislature authorized the establishment of the Assured and Adequate Water Supply Administration Fund. This is to include fees ADWR collects for processing assured water supply applications and determining adequate water supply — the less rigorous program in force outside AMAs. The fees are to cover the administrative costs of the program. The bill established an advisory committee to assist the Director in identifying statutory or rule changes to make the application process more efficient. The bill provided deadlines for a report to include the Director's recommendations for change (December 15, 2005) and required the notice of proposed rule making be filed with the Secretary of State no later than January 1, 2006.

According to ADWR Deputy Director Karen Smith, who conducted a seminar at the WRRRC in late November, the agency, while attempting to make the rules more efficient, has worked to rethink the process and simplify it for themselves. At that time, draft rules were being finished to meet statutory deadlines. ADWR anticipates approval of the rules in May or June 2006, with new fees effective July 1, 2007.

I followed the first rulemaking very closely. Over the years, I have had to explain — without the assistance of an attorney — how the rules work. The initial adoption experienced a long gestation period. Reader friendly concept papers helped people like me understand the rules.

Rule making is an administrative process, with certain formatting and procedures followed. I know from my various experiences, most recently as a member of the Arizona Medical Board, that the gist of the rulemaking often can get tangled in the legalese style of rulemaking language. When the Director submits the notice of rulemaking, I hope a "layperson's guide" will be circulated. The rules are arguably the centerpiece of our efforts to achieve safe yield in the safe-yield AMAs.

I am likely not alone in needing help in understanding changes to these very important rules. Such assistance not only provides guidance on the changes but a welcome refresher course for the program as well. It could also help us to understand what might be at issue should portions of the assured water supply program be applied to communities outside AMAs. This is a controversial issue and outside the scope of the rulemaking process. But a better understanding of the rules will help us determine the implications of any and all changes to our framework that ensures Arizona communities will grow on sustainable water supplies. ■

## ADWR Urged to Protect Surface Water With New Well Rules

Some argue an opportunity will be lost to protect riparian areas and surface water rightholders from damage caused by new wells and replacement wells if the Arizona Department Water Resources decides not to address the issue in its rules on the spacing and impact of wells.

In working this past year to develop new well rules, ADWR has had a stakeholder process that invited input from various groups. Input from Pima County and the Salt River Project urged the agency to apply the new well rules to protect surface water.

They argued that statute directs the agency to take such action. A.R.S. section 45-598 (A) states, "The director shall adopt rules governing the location of new wells and replacement wells in new locations in active management areas to prevent unreasonably increasing damage to surrounding land or other water users from the concentration of wells."

Pima County and SRP argued that the "other water users" provision in the above section should be applied more broadly to include surface water users as well as groundwater pumpers.

Robert Glennon, a University of Arizona law professor who represented Pima County, says, "The critical language is 'to prevent unreasonably increasing damage to surrounding land or other water users from the concentration of wells.' What I've been arguing is that 'other water users' should include surface water users; that harm to surrounding land could be subsidence or harm to riparian vegetation from pumping that sucks water out from underneath and basically kills the habitat."

ADWR, however, interpreted statute differently saying that the issue was beyond the scope of the well spacing rules. The agency's interpretation is based on its reading of A.R.S. section 45-598 (B). The agency says that subsection B, by referring to groundwater and those needing a permit, restricts the scope of subsection A to apply only to groundwater pumping, not to the pumping of appropriable surface water. The agency therefore says it lacks the statutory au-

thority to address concerns raised by Pima County and SRP.

Glennon says, "If you just look at section 598 (A) it's striking; it says 'to prevent other water users.' It doesn't say 'other groundwater users.' ... I think (ADWR's decision) is not a very sensible interpretation — not that it's implausible."

The incident might be viewed as another skirmish in the battle to overcome the limitations of Arizona's bifurcated water laws that applies one set of rules to surface water and another to groundwater. The risk this situation poses to surface water users, whether the water is for consumptive or environmental uses, prompted the recent effort to interpret well rules to control pumping that threatens surface waters.

SRP has a vital interest in the issue; its surface water rights to the Salt and Verde rivers serve SRP customers in the Phoenix area. Any reduction in the flow of those rivers threatens those surface water rights, and the threat is real from pumping in the Verde Valley. A rapidly growing area, the Verde Valley is meeting its water needs by increased groundwater pumping and sinking new wells. SRP's interest would be well served by regulations requiring well operators to ensure their pumping will not harm surface water right holders.

Not having well rules to provide such regulations, SRP will have to rely on the Gila River Adjudication to clarify which wells are pumping "subflow" — subsurface water that has the legal character of surface water. Any results from the adjudication process, however, will be a long time in coming. Glennon says, "It been going on for 31 years and has not adjudicated a single water right. The argument I'm making to SRP and others is that we need to break this cycle."

The stakeholders' process recently concluded; DWR officials expect to announce by the end of the year a public hearing for comments on the draft rules, to be likely conducted in late February or early March. The rules then go to the Governor's Regulatory Review Council for adoption. ■



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