

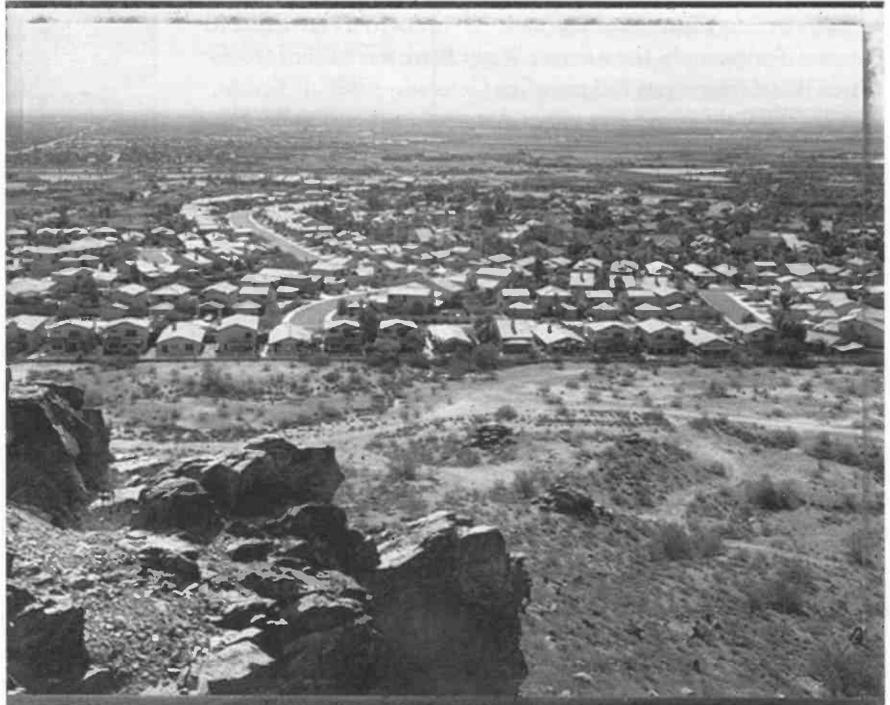
Urban Ecology, Nature in an Urban Setting

The poet Frank O'Hara was obviously on the side of the urbanist when he wrote, "I can't even enjoy a blade of grass unless I know there's a subway handy." The urban ecologist looks beyond this view, with its division of the world into the natural environment and areas inhabited by humans, a dichotomy variously expressed as city vs. country, urban vs. rural, or the great outdoors vs. crowded city spaces.

Whereas traditional ecology is mainly about connectedness within the natural world, between organisms and their environment and their interactions with each other, urban ecology broadens the concept to consider humans and the human environment. The urban ecologist considers the importance of human attitudes, blades of grass, urban water ways and the subway.

Urban ecology is attracting increased national attention. In Arizona its concepts have guided urban planners, and at state universities urban ecology is the focus of academic programs and research.

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Urban growth into desert lands is considered an environmental issue because more growth means less desert lands. Attracting increased attention, however, are environmental conditions within urban and suburban areas. Instead of considering such areas as an intrusion, an unsightly blight on the landscape, some officials accord them more respect as the environments humans most interact with. The issue then is to integrate and preserve natural values within urban and suburban spaces. This is the task confronting the urban ecologist. See side feature.

(Photo: Mark Klett)

New Arizona Power Plants Pose Water Questions, Raise Issues

No issue better dramatizes Arizona's long-standing conflict with its neighboring state of California than water, more specifically use of Colorado River water. California's simmering energy crisis demonstrates water's importance in various other matters between the two states, beyond direct Colorado River allocations.

Arizona has lately acquired distinction as an attractive site for the construction of generating plants, with 19 plants proposed thus far. (This development has met with mixed reviews. Not feeling the pinch of a power crisis and wary of the effects of plant operations, some Arizonans are not overly enthusiastic. A "Tucson Citizen" headline bemoaned that "Arizona could become dumping ground for power plants.") Although in-state energy needs will be served, much of the power from these plants likely will flow to California, with Northern Mexico and Texas also slated to receive a share. The water resource issue that is thus raised demonstrates

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Power plants...continued from page 1

once again the link between water and power or, in this instance, a blurring of the distinction between water and energy.

Some argue that in using its water to generate power for California Arizona is in effect exporting water to its western neighbor. They say Arizona has taken considerable care in controlling its water resources, to ensure their use under circumstances favorable to the state. For example, the Arizona Water Bank was established to ensure that Arizona gets full use of its Colorado River allocation, thus ending California's free use of Arizona's hitherto unused portion. Critics ask: Doesn't using water thus protected to generate energy for California enable that state to recapture some of Arizona's water resources?

Not all see it that way, arguing that using water to generate power is like using water to generate any other economic output. For example, Arizona now uses water to grow cotton and citrus and to mine minerals, with much of these products for out-of-state sale. Power generation represents a similar use of water, a natural resource invested for economic gain.

Others see a difference. They say Arizona has certain climatic and geologic conditions favorable to some forms of agriculture and mining. The presence of copper determines a copper mine. No similar conditions predispose Arizona to be a center for power production. In using its water to generate power, Arizona is supporting an industrial activity that California chose to avoid, to its extreme disadvantage as it turns out.

Not surprisingly profit is determining power plant sitings. Communities and the state expect a suitable profit from whatever costs are borne, to compensate for use of water or other resources. Supporters of the Toltec plant, located about ten miles south of Eloy, say the plant would benefit Pinal County by producing annual tax revenues of \$3 million to \$5 million and creating 60 full-time jobs along with an additional 200 secondary positions.

An economic analysis to determine if a power plant is justified would look at various factors; e.g. whether construction of a power plant precludes other economic activities in an area; the status of the created jobs; the plant's effect on other business activity in the vicinity; its environmental effects, etc. Such an analysis would determine whether the plant represents a good economic use of water resources.

Also some thought should be given to long-term considerations of power plant construction within the state. As it is now, plans for such plants are subject to varied review via public hearing, a Line Siting Committee and then by the Arizona Corporation Committee for final approval, with each plant evaluated individually. But what of the collective effect? Can the state accommodate an unlimited number of power plants or is there a certain number beyond which the construction of more plants becomes a liability, with regards to economics and use of water resources?

Water again enters the picture when one of the possible consequences of the energy crisis is considered. Energy uncertainties and the high cost of power may prompt California companies and families to relocate to Arizona. The in-migration of Californians accounts for much of Arizona's dramatic population growth over the last decade. From 1993 through 1999 about 120,000 Californians annually crossed the Colorado River to take up residence in Ari-

Power Plant Operations Generate Research Needs

The increased number of power plants operating in the state means research will be needed to study issues relating to their operations. Some such research is presently underway. Ed Glenn and Jim Riley, both of the University of Arizona's Environmental Research Lab, are working with Tucson Electric Power to study power plant blowdown. Some plants discharge their blowdown water from the cooling towers to sewage systems which tends to add to the TDS of the systems. The researchers are evaluating the potential for irrigating halophytes or other landscape plants with the blowdown. Their work also is demonstrating contrasting priorities of different state organizations. Arizona Department of Water Resources favors power plants recycling the water as much as possible, although each cycle increases the TDS of the blowdown and may increase the utility's sewage fee. Blowdown with a high TDS then becomes a water quality problem of concern to Arizona Department of Environmental Quality.

zona. A depressed economy plus some natural disasters spurred this growth. What kind of migration might an energy crisis provoke? Increased population means increased water use.

In fact Arizona is taking an active role in efforts to entice California high-tech companies to reallocate in Arizona in the wake of the energy crisis. The times are ripe for "cherry picking" or "vulture capitalism," as the process is variously called, as recruiters tout energy-cost comparisons to lure California companies to Arizona. The Arizona Department of Commerce is working on a marketing strategy, to guide its activities during the summer months when energy anxieties will be especially acute in California.

What kinds of businesses might respond to Arizona's beckoning call? And what would be the water needs of such companies? Intel, which has a plant in Chandler, has announced that it will not construct any more plants in California. Can Arizona realistically recruit large computer manufactures whose processes require large quantities of water? (See "Special Project," page 9, for a description of research of water-conserving techniques for the micro-chip industry, to better fit its operations for semi-arid regions.)

Also, if Arizona is in fact on its way to becoming what Tim Horgan, executive director of the Arizona Center for Law in the Public Interest, calls "the power farm for the Southwest," the state will be producing a surplus crop of energy, at least for in-state needs. About 20 in-state plants now produce 15,000 to 16,000 megawatts, with out-of-state sources supplying an additional 1,500 to 2,000 megawatts. An additional 17,120 megawatts would come on line if all 19 of the plants now proposed for the state are actually built. Last summer's peak usage in the state was 10,000 to 11,000 megawatts.

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Water Vapors

Your Tax Money at Work

Thanks to the voter approved statewide education sales tax each of Arizona's three public universities faced the satisfying task of developing spending plans for their share of the funds. Starting this summer the new tax is expected to provide \$45 million annually to the universities, to be divided among Arizona State University, Northern Arizona University and University of Arizona. In determining areas to support with the funding the universities generally built on existing strengths.



Sales tax funding will support UA's water education outreach efforts. Photo: Val Little

UA is spending a part of its share of the tax money on water research, education and outreach, with funds devoted to increasing UA's already sizable commitment to water studies. The roster of UA individuals and programs specializing in water includes over 40 faculty and staff from various social sciences and technical areas, across different academic departments, from hydrology, to geography to law.

The first two years of funding will be used to strengthen the existing four UA water centers: Engineering Research Center for Environmentally Benign Semiconductor Manufacturing (See page 9 for description of this center); Water Quality Center; Sustainability of semi-Arid Hydrology and Riparian Areas; and the publisher of this newsletter, the Water Resources Research Center. \$500,000 will be divided among the centers for specific projects and for developing a grants program.

Funding will gradually increase to a \$3.5 million in year five and be spent primarily for faculty-student research, student fellowships and internships and community outreach. To maximize benefits to the community, most of the faculty-student water research funds will be distributed competitively through a process designed to fund projects dealing with problems an external advisory committee identifies as significant to the state and/or local regions in Arizona. Emphasis will be on projects that involve interdisciplinary studies, including the physical sciences and other areas such as environmental law, public health, or economics. Research proposals will be reviewed by an external peer review committee to assure objectivity and fairness.

Student fellowships for studies in water-related fields also will be distributed university-wide with emphasis on grants to students doing interdisciplinary work. Finally, an internship program will offer students opportunities to work in business or government to gain real-world experience in water-related fields. The Water Resources Research Center will manage these programs as well as promote community outreach and environmental education activities.

In explaining UA's commitment to water education, research and outreach, UA President Likens said, "Unless we manage water as a precious resource, using the most advanced scientific research to assure water quality and water supply, all other efforts to develop a globally competitive economy in Arizona will come to naught."

Letter to the Editor

A very informative and timely publication—thank you. However, I must take slight issue with the latest article on power plants in Arizona (Jan.-Feb. *AWR*). The Calpine Plant on the AZ property of the Fort Mojave Indian Community is treated as if there was no environmental work done. Not true! A complete EIS with the BIA as agency of record was completed through Record of Decision, as well as an EPA mandated air quality review—Prevention of Significant Deterioration. In support of ancillary facilities, three additional EPA documents were completed to FONSI through BLM and BIA. If anything, the CP plant was under greater scrutiny than the non-reservation plants. Also, the water to feed the plant comes from the FMIT's existing Arizona allocation from the Colorado River. It is one of the earliest priorities on record and has precedence over CAP and many downstream users.

I realize that the Certificate of Environmental Compatibility is a State permit and that CP is exempt since it is on the reservation; however, it was not without environmental consideration.

Thanks.

Allen W. Gross,
Principal, Hallock/Gross, Inc.



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News Briefs

Groups Urge Improved U.S. Water Infrastructure

According to various organizations the U.S. water infrastructure has been sorely neglected and the bill is coming due. Although speaking individually the organizations registered a collective concern.

In February, the Water Infrastructure Network released a report calling for a 5-year, \$57 billion federal investment in drinking water, sewer, and stormwater infrastructure to replace aging pipes, upgrade treatment systems and continue to protect public health and the environment. The report says the increased funding is urgently needed to help close a \$23 billion per year gap between infrastructure needs and current spending.

WIN membership includes water systems, municipal government organizations, environmentalists, labor unions and construction trade groups. The report is available at the website: www.amsa-cleanwater.org

In March, the Environmental Protection Agency issued a report stating that a \$150.9 billion investment is needed over a 20-year period to meet the drinking water infrastructure needs of U.S. public water systems. The infrastructure investments are needed to support public health projects, established in compliance with the Safe Drinking Water Act. The report states that large and medium-sized drinking water systems will need to make the largest investments in infrastructure. Small systems, however, face higher infrastructure costs per-household. For more information on the EPA needs survey visit: www.epa.gov/safewater/needs.html

Shortly after EPA released its report the American Society of Civil Engineers issued its "2001 Report Card for America's Infrastructure." The ASCE report finds that the nation is not making the grade; in fact, in a review of 12 infrastructure areas, including water and wastewater, the nation scored a collective D+. Both wastewater and drinking water infrastructures earned "Ds."

The low grades are the result of the antiquated condition of many wastewater and drinking water systems. The reported shortfall of \$11 billion for drinking water and \$12 billion in wastewater relates to needed improvements to the current system. The needs of a growing population was not a consideration when computing that amount. The ASCE report blames the investment shortfalls on consistent underfunding of federal

drinking water initiatives coupled with increased demands on water utilities financial resources.

The report indicates that improving Arizona's drinking water infrastructure will cost \$1.35 billion over the next 20 years, with the state's wastewater infrastructure in need of \$2.5 billion. For additional information relating to the report, including data from individual states, check the following website: www.asce.org/reportcard

The American Water Works Association endorsed the ASCE assessment, calling on Congress to address the problems. Along with increased funding AWWA also advocates improved local management and more cooperative relationships between utilities and all levels of government.

ADEQ Announces Grant Awards

The Arizona Department of Environmental Quality recently announced successful applicants for funds under the Water Quality Improvement Grant Program. The agency allocates money from the U.S. Environmental Protection Agency to interested parties for implementation of non-point source management and watershed protection. The distribution of EPA grant funds is provided pursuant to Section 319(h) of the Clean Water Act and administered by the ADEQ Water Quality Division Planning Section. ADEQ uses these federal funds to implement on-the-ground water quality improvement projects to control non-point source pollution in Arizona

The seven projects receiving Cycle 2, Year 2000 funding are: Apache County, \$152,580 for Alpine/Luna Lake Improvement; U.S. Forest Service, Springerville Ranger District, \$162,073.79 for Murray Basin/Saffel Canyon Phase II; James W. Crosswhite, \$51,540 for EC Bar Ranch Turbidity Reduction Project-Phase II; Coronado Resource Conservation and Development, \$168,000 for Borderlands Storm Water Runoff Control Project and \$38,100 for Road Rehabilitation to Re-

"Think Native - Give a Sucker a Break"
To attract the attention of anglers, bait dealers, pet store managers, educators and the public Arizona Game and Fish in cooperation with the U.S. Bureau of Reclamation has developed a "Think Native" promotional campaign. Thinking native is way for people to understand the precarious plight of Arizona's native fish.

Initiated in 2000, the promotion will run for four years. The first year was dedicated to developing a logo, slogan and artwork, and work now is underway to produce brochures, posters, decals, pens, school material and video, for distribution later in the year. Each year a new four-color poster will be developed that represents a different aquatic habitat. This year's poster focuses on the Colorado River.

duce Sediment in San Simon River; Overgaard Townsite Domestic Wastewater Improvement District, \$34,080 for Overgaard Townsite Water Protection Project; and Raymond C. Keeler, \$71,833 for Peppersause Cave Water and Cave Restoration

There are two grant cycles per year. The deadline to submit grant applications for Cycle 1, Year 2001 will be May 23, with award announcements planned for July. For additional information contact sw1@ev.state.az.us or call Susan Ward at 602-207-4635 or, toll free in Arizona, 800-234-5677, Ext. 4635.

Gilbert Errs: Lake Fills, But No Annexation

Perhaps the best way to describe the origins of the water filling a 13-acre ski lake south of Gilbert is not groundwater, but an oversight or blunder. Gilbert gave away groundwater recharge credits to enable San Tan Lakeside estates to create the lake as an amenity to the luxury homes constructed in the area. The town later discovered that the development is not in Gilbert and therefore cannot be annexed.

The oversight boded well for owners of the 19 houses surrounding the lake. They faced the prospect of buying millions of gallons of Gilbert water without paying construction sales taxes, impact fees or municipal property taxes.

The town water department had worked with the developer for over a year on the plan, not realizing the full implications of the annexation law. The deal was negotiated and settled without public discussion or vote.

The action caught the some Town Council members by surprise. Councilman Mike Evans said, "I don't even like lakes in communities. This is outlandish ... and it is the first I've heard about it.

Remedial efforts to ensure annexation face difficulties. According to state law parcels to be annexed must be no longer than twice the footage that touches town borders. This disqualifies the development which is about 10 times longer than wide. The cooperation of neighboring landowners would be required for annexation.

With the lake full and luxury lots for

sale, the Town Council has now approved an annual allotment of 48.9 million gallons of municipal water for the lake. In exchange, buyers of estate homes must promise to annex into Gilbert at the first opportunity or risk losing their water. Also the agreement includes paying town impact fees on the new homes and restrictions on boating and skiing after dark.

The developer meanwhile is taking action that could facilitate annexation. He is working with the owner of a 40-acre parcel adjacent to the development to join in an annexation request.

Phoenix Voters OK Habitat Restoration Funds

Phoenix voters recently did their part to promote the restoration of environmental conditions of Arizona rivers by approving Proposition 3. The Rio Salado Habitat Restoration Project is the prime beneficiary of the proposition, receiving \$16 million of its \$24.8 million or about two thirds of the total.

The project site is a five-mile stretch of the Salt River, between 24th Street and 19th Avenue, an area now blighted by landfills and trash. Present conditions are a stark contrast to river conditions of the past, when water flowed along banks lined with trees. Dam building of the early 1900s dried the Salt River in the area. The regular river flow in the area now mostly consists of effluent and Salt River Project tail water.

The Rio Salado project is an U.S. Army Corps of Engineers project involving the City of Phoenix and the Maricopa County Flood Control District. The Corps and the city are working on the habitat restoration components. The flood control district is building low-flow channels within the river bottom to confine flood flows below the terraces and banks where habitat restoration will occur.

The total cost of the restoration is estimated at about \$85 million, with the Corps contributing about \$66 million. The Corps funding is contingent upon local government matching a third of that. The Maricopa County Flood Control District came up with \$11 million for the project.

The goal of the project is to create a rich riparian area, with streams and ponds sup-

porting varied wildlife amidst cottonwoods and desert grasses. Human amenities will include trails for biking and walking. The plan is to eventually restore river conditions beyond 24th Street, to connect with Tempe's Town Lake.

In another river restoration project, the City of Tucson is considering using CAP water to restore flows to stretches of the Santa Cruz River as part of its Rio Nuevo project. The plan has met with objections that such restored river areas would cause the spread of exotic species.



The National Water Resources Association has recently elected a new slate of officers, with **John Sullivan** of the Salt River Project elected vice-president. NWRA officers serve two-year terms.

George A. Schade, Jr. is the new Special Master in Arizona's general state stream adjudication replacing John Thorson. Mr. Schade served five years as an Administrative Law Judge in the Arizona Office of Administrative Hearings. From 1986 to 1992, he was Chief of the Litigation Support Section in the Adjudication Division of the Arizona Department of Water Resources. In this position he established much of the framework for the general stream adjudication. Schade is a graduate of the American University Washington College of Law.

The **Old Pueblo Chapter of Trout Unlimited** is being awarded a \$10,000 Embrace-A-Stream Grant from its national parent organization, Trout Unlimited. The funding will support recovery work of the threatened Apache trout on the Apache-Sitgreaves National Forests. An aggressive three-year plan is underway to delist the threatened Apache trout from the Endangered Species List. The Old Pueblo Chapter is providing matching contributions of \$5,000 in cash, in-kind denotations, and volunteer labor.



Guest View

Historians, Archeologists, SRP Work Out Plan to Preserve Cultural Value of Active Canals

Dave Gifford, archaeologist with the U.S. Bureau of Reclamation, contributed this Guest View. His piece is especially appropriate since March was Arizona Archaeology Awareness Month. Archaeologists and historians have an important, albeit often overlooked role in water affairs.

Water and growth go hand in hand in the Salt River Valley where growth has exploded over the past 30 years. Organized in 1903, Salt River Project has been conveying water to this ever expanding area for almost 100 years. In the beginning it delivered water to farmers, but today urban and industrial users are requiring more and more water resources of the Salt and Verde rivers.

The history of the modern system originated in the 1860s, but irrigation in the valley is much older. Prehistoric Native Americans were irrigating there as early as A.D. 300 and continued to do so until the 1400s. They built hundreds of miles of canals using stone hoes and irrigated many types of crops that included cotton, beans, and corn. The American and European pioneers that came some 400 years later used many of those ancient Hohokam ditches. These canals were re-excavated in the late 1800s by pioneer entrepreneurs, and many became part of our modern-day system.

During the drought of the late 19th and early 20th century, Valley residents began looking for a way to develop a reliable water delivery and storage system. Under the Reclamation Act of 1902, arid lands throughout the West could be developed by the federal government. SRP was one of the earliest of these reclamation projects with the construction of Roosevelt Dam in 1911, and subsequent valley canals throughout the rest of the decade. By 1917, most of the private canal companies and irrigation districts in the valley were incorporated into the federal system under the Salt River Valley Water Users Association (known today as SRP). The seven main canals and hundreds of miles of lateral ditches are owned by the federal government. They are overseen by the U.S. Bureau of Reclamation but operated and maintained by SRP.

These historic canals are part of a modern infrastructure that delivers water to the Phoenix metropolitan area as well as to surrounding farms and orchards. It is a state-of-the-art system with computerized networks, innovative engineering, and ongoing operation and maintenance. Because the system is federal property, it is subject to federal cultural resource laws, particularly Section 106 of the National Historic Preservation Act. Structural changes and

upgrades to the system are subject to archaeological and historical review under those regulations. The problem faced by Reclamation was how to ensure appropriate historical review while allowing SRP to continue operating and modernizing its system with efficiency and cost-effectiveness.

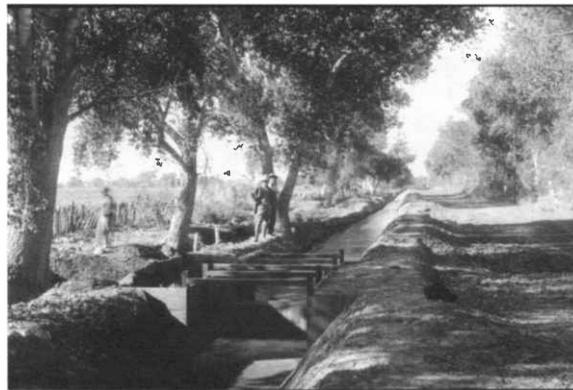
Reclamation, in conjunction with SRP, the Arizona State Historic Preservation Office, and the Advisory Council for Historic Preservation developed a solution. Under our 2001 Programmatic Agreement (PA) the four agencies agreed to certain criteria as to when cultural resource review is required and when it is not appropriate. In exchange for streamlining the review process and allowing specific O&M with reduced oversight, a cost-shared mitigation program will be implemented by SRP and Reclamation. Under the PA a historic context study will be prepared and made available to the public.

This study will assess the historic system, examining the social and developmental contributions SRP has made to the Valley. Interpretive signs will be installed in conjunction with the report

along canal banks and at other locations explaining the Valley's water history. These signs will be developed in coordination with local towns and cities illustrating the role canals have played in their community history and development. Runners, walkers, bicyclists, and others will have the opportunity to learn the importance of canals, irrigation districts, water conservation, and engineering in an arid climate.

Additionally, SRP has agreed to locate and recommend for preservation certain portions of the system that maintains its historic character. These areas will be preserved, allowing the public to visit segments of the historic agricultural valley that is quickly disappearing. Finally, Reclamation will continue to complete required archaeological surveys when and where they are necessary.

It is the goal of Reclamation to allow efficient use of the canal system while adhering to federal historic preservation laws. We have tried to streamline the process through the PA and believe we have achieved this goal. Under the PA, SRP can continue to upgrade, maintain, and operate its water delivery system so important to the Salt River Valley. Reclamation will reduce time and costs spent on regulatory oversight while ensuring federal cultural resources are protected, and the public will gain a more efficient process that saves tax dollars, reduces bureaucratic oversight and informs valley residents of their common history.



Salt River Valley lateral at the turn of the 20th Century



Legislation and Law

NAFTA, WTO Govern International Water Marketing

Water marketing is usually thought of as an intrastate or interstate issue, but with the worldwide expansion of markets, water is subject to international and even global reallocation. In an article in the fall issue of the Institute Report of the Pacific Institute for Studies in Development, Environment, and Security research associate Beth Chalecki discusses the possible legal and equity issues of bulk water exports with reference to the North American Free Trade Agreement and the World Trade Organization.

She writes that because of fears of water shortages and the prospects of global reallocation of water resources water-rich countries such as Canada have reason to be concerned they will be viewed as international water sources. If water were a commodity on the world market its allocation would be determined by international commodity trading obligations. As a common resource in the market place water faces the danger of being over exploited without any national control.

NAFTA governs trade in goods between Canada and the United States. Goods are defined as "domestic products, as these are understood in the General Agreement on Tariffs and Trade or such goods as the Parties may agree..." The definition covers most commercial goods and natural resource commodities such as lumber or food, but whether it includes fresh water *in situ* is unclear.

If fresh water is in fact a commodity as defined by NAFTA the treaty includes three conditions impacting international trade in water. One condition would require that signatory countries accord businesses and investors from the other signatory countries the same preferential treatment they accord their own businesses and investors for both goods and services. For example, Canada cannot favor Canadian water exporters over water exporters from other NAFTA member states.

Also, Chapter II of NAFTA allows corporations of a signatory country to sue the government of either of the other two signatories if that government takes an action to "expropriate" that company's profits. This has already occurred, with Sun Belt Water, a Santa Barbara company, suing the Canadian government when it lost a contract to export water to California as the result of the British Columbia provincial government banning bulk water exports in 1995. NAFTA cannot be used to overturn BC law, but it could make the Canadian government liable for Sun Belt's lost profits.

Further, Article 309 of NAFTA states that, if shortages occur, exports of any good are to be reduced proportionally across signatory countries. For example if Canada were exporting water in bulk and experienced drought or other water shortages, it could not then reduce the amount of its water exports and continue undiminished deliveries to its domestic customers. Instead both domestic and foreign customers would have to proportionally share reduced deliveries.

The above conditions in effect establish the principle that water once traded as a good must continue to be traded if valid contracts exist. This violates a belief held by many environmentalists who believe that domestic legislation best protects natural resources on a watershed scale.

Water exports governed by the World Trade Organization are subject to even less environmental considerations. Whereas NAFTA provides some environmental protection WTO assumes that any trade restriction is illegal, even if its intent is to protect the environment. According to WTO economic development trumps environmental protection.

Concerned about the possible exploitation of Canadian water resources the Council of Canadians, an anti-NAFTA public interest organization, is attempting to halt the emerging bulk water export industry. In response to such sentiments Canadian lawmakers are considering legislation to ban bulk water withdrawals from Canadian basins. The legislation is being carefully crafted to avoid authorizing an outright export ban, thus enabling Canada to continue to maintain its NAFTA and WTO commitments.

Riverbed Giveaway Illegal, Court Says

Arizona lawmakers overstepped legal bounds when they gave away thousands of acres of riverbed land that in fact may be public property, the Arizona Court of Appeals recently ruled. This is the latest setback in legislative efforts to give some riverbed lands to sand and gravel operators and other interests that have been using the land for years.

The issue has historical roots. Upon becoming a state in 1912 Arizona was given title by the federal government to all navigable streams within its boundaries. The issue lie dormant until 1985 when a lawsuit forced the Legislature to address the issue. The result was a 1987 law that relinquished the state's interest in stream bottoms. The law was subsequently ruled unconstitutional.

The recent court decision was in response to a 1998 law disclaiming the state's rights to the beds of six rivers including the Agua Fria, New River and the lower Salt River on the grounds they were not navigable when Arizona achieved statehood. The Defenders of Wildlife, an environmental organization, and three individuals challenged the law, with Timothy Hogan of the Arizona Center for Law in the Public Interest arguing the case. Hogan said, "The standard the Legislature used was rigged so you couldn't do anything but determine them non-navigable."

The Appeals Court agreed and stated that the "potential forfeiture of the water course bedlands" violates both the public trust doctrine and the constitution's gift clause.

The implications of the ruling extend beyond the six rivers to affect other rivers throughout the state where the state is giving up its title.



Publications

Arizona Water Information Directory

Barbara Tellman

This publication consists of revised information from two volumes previously published separately – “Where to Get Free (Or Almost Free) Information About Water in Arizona” and “Where to Find Water Expertise at State Universities in Arizona.” Including the information within a single volume provides readers with a convenient “one-stop” reference work when seeking answers to water questions. The publication documents the extensive and broad range of available resources for water information as well as the many and varied water topics of interest. The directory is number 23 in a series of issue papers published by The University of Arizona’s Water Resources Research Center. Publication date is mid-May. For free copies contact WRRC, University of Arizona, 350 N. Campbell, Tucson, AZ 85721; Phone: 520-792-9502; email: wrrc@ag.arizona.edu A searchable version of the directory will be posted on the WRRC web page (<http://ag.arizona.edu/AZWATER/>) in the fall.

Toward Understanding New Watershed Initiatives

Stephen M. Born and Kenneth D. Genskow

A report from the Madison Watershed Workshop, this publication discusses the “new watershed approach,” with its distinguishing features: decentralized and shared decision-making, collaboration, engagement of a wide array of stakeholders, and goals that reflect concern for the ecosystem. The intent of the report is to compile an informed status report on key elements related to the “new watershed approach” that captures the current state of knowledge, advances the broader critical dialogue within the large watershed-management community, and proposes a focus for additional research. The report is available for downloading at <http://www.tu.org/library/conservation/watershed.pdf>

America’s Water Resources Challenges for the 21st Century: Summary Report on Identified Water Resources Challenges and Water Challenge Areas

U.S. Corps of Engineers

Last year the Corps and its Institute for Water Resources conducted “listening sessions” to obtain information and feedback from stakeholders and concerned citizens regarding U.S. water re-

sources. The report describes the identified challenges and their assigned rank of importance. Also included are participants’s suggestions regarding the roles of federal, state and local governments in addressing the challenges. Copies of the report, along with information about the sessions, is available on-line: www.wrsc.usace.mil/iwr/waterchallenges

Visit On-line Versions of Colorado Plateau and San Pedro River

The sites and sounds of the San Pedro River are yours at the click of a mouse, thanks to the Nature Conservancy and microchip maker, Intel. The two organization, one environmental and the other industrial, have teamed up to create a website, “Explore the Last Great Places,” that is intended to inform and educate students and public about Earth’s biological treasures and how to protect them. Information is variously presented, including film clips, pop-ups and 360-degree panoramas. Materials include maps, lesson plans and accounts of the history and hydrology of the area and is available in both Spanish and English to benefit viewers on both sides of the border. The site can be reached through www.lastgreatplaces.org. This website is the first in a planned series that will also feature other prominent natural areas.

After taking in scenes along the San Pedro River another click of the mouse will set up a visit to the Colorado Plateau. Two Northern Arizona University researchers, Tom Sisk, professor of an environmental science, and John Grahame, a science outreach coordinator, teamed up to create the website that contains extensive land-use history of the Colorado Plateau, including information about water resources. This effort is a local application of a national USGS project that aimed at a better understanding of the rate and direction of change in the Earth’s ecosystem. A click on www.cpluhna.nau.edu will enable a person to identify a topic, with follow-up and related information also provided. For example, a person who identifies Mesa Verde National Park also will have access to such information as the lifestyles of the Anazazi people, local geology and the history of climate change in the area.

Power plants...continued from page 2

California is now taking belated action to construct power plants to serve its critical energy needs. If California significantly reduces its purchase of out-of-state power Arizona might find itself with a surplus of energy for in-state use. Such a surplus could benefit energy intensive industries like mining. It also might have implications for water resources. If an energy surplus reduced power costs the cost of pumping groundwater would decrease, with the result that more groundwater might be used.

The full implications of a dramatic increase in the number of power plants in the state is not known, although a broad range of areas will likely feel the effects, including water resources. Any analysis of water in this context will once again show water to be a very complex issue.



Special Projects

Center Studies Ultra-Pure Water Needs of Semiconductor Industry

Special Projects reports on projects and centers devoted to water research.

Citizens-as-water-users are generally aware of a water quality range from graywater to drinking water. They may not be aware that certain industrial applications broaden the water quality range far beyond drinking water standards, into a realm of ultra-pure water.

Ultra-pure water is a major research topic at the University of Arizona's Engineering Center for Environmentally Benign Semiconductor Manufacturing. A cooperative venture among industry interests, government and various universities, the center studies the specialized water needs of the semiconductor industry, its supply, use and reuse of ultra-pure water.

Farhang Shadman, director of the center, says, "We need to purify water to an unprecedented level. Contaminants cannot be tolerated, whether organic, inorganic, or even dissolved gases. In ultra-pure water, contaminants are measured in very low parts per billion and even parts per trillion. This may be two or three orders of magnitude purer than drinking water quality."

The original source water is city water that is then purified through various processes including softening, ionization exchange, reverse osmosis, ozonization, various radiation treatments, carbon beds and chemical disinfection. In the early stages of purification the techniques are similar to those used by utilities treating drinking water.

Shadman says ultra-purification, however, is a specialized branch of water, a science unto itself. To reach higher levels of water purity center researchers developed new methods for achieving extremely low concentration ranges of contaminants.

Ultra-purification requires precise measuring methods to record very low concentration of contaminants. As a result the center is engaged in metrological studies, to develop unique methods for measuring and characterizing water quality. This technology enables researchers to track water quality during the purification process.

Not only does the semiconductor industry require extremely high water quality but a high volume of water also is needed. A modern fabrication plant uses about three million gallons of ultra-pure water per day. Considering that many such plants are located in the semi-arid Southwest the efficient use of water is an industry priority. The center studies ways for the industry to conserve water.

The chemical mechanical process (CMP) involves polishing microchips to ensure flatness before the next manufacturing process and is the largest user of water in the operation. Semiconductor manufacturing is a 40- to 50-step procedure, with materials layered on a silicon wafer to create microchips. Center research has focused on CMP to develop new methods for cleaning microchips that optimize water use.

The industry could tap into a potential source of water by recycling some of the large volume used in the manufacturing operation. The water such facilities discharge however is highly contaminated with various process chemicals. Furthermore, the industry is reluctant

to recycle this discharge since a system recycling ultra-pure water is very sensitive to upset. If a very small amount of impurities enters the system, the entire operation would be seriously disrupted, even shut down. To deal with this problem the center is considering various strategies for treating discharge for reuse in operations.

Shadman explains that the sensitivity of the recycle system requires very sophisticated control and measurement throughout the entire process. Water rapidly flows through the pipes at the rate of 300 or 400 gallons per minute. A disturbance at one point is quickly distributed throughout the fabrication plant. Very sophisticated sensors are needed to accurately detect disturbances and trigger control measures. Such sensors are not presently available.

Shadman says center researchers are making progress in this area, and the results need to be demonstrated to the industry which is being very cautious about using its recycled water.

Shadman considers recycling as a key to the industry's survival in Arizona. Water options are limited. Since abundant water supplies are not available, a plant must recycle for additional water resources for its operations.

The center seeks environmentally benign solutions to industry concerns. Some industry activities, such as the high energy and/or chemical use in some of the current recycling strategies, are not particularly environmentally friendly. Adopting a holistic view, the center is working to develop a neopurification processes, with extensive reduction of energy use and very limited chemical application. Not appropriate to municipal water treatment, the process is suitable for wastewater generated by the microchip industry, with its particular type of contaminants.

Center researchers rely on a pilot plant to simulate operations within an actual industrial plant. The pilot plant is a physical model, larger than lab-scale but not industrial-scale. Also called test beds, the pilot plants enable researchers to conduct studies, then apply and test their results under simulated industrial conditions. The center has two pilot plants, both located on the UA campus.

The research project began in 1996 when the National Science Foundation and the Semiconductor Research Corporation each donated \$2 million annually for five years. Stanford, the Massachusetts Institute of Technology and the University of California at Berkeley were original partners in the project, with three other universities, including Arizona State University, joining later. The research project also includes 35 industry members.

Although the semiconductor industry drives much of the research devoted to ultra-pure water other fields also stand to benefit from the results. Work in certain pharmaceutical and medical specialties require ultra-pure water. Also the field of biotechnology, an increasingly important activity in Arizona, also will benefit from some of the techniques and technologies developed at the center.

For additional information contact Farhang Shadman, phone: 520-621-6052; email: shadman@erc.arizona.edu



Announcements

ADEQ Seeks Water Quality Improvement Grant Proposals

The Arizona Department of Environmental Quality will be accepting grant applications for projects that implement water quality improvement projects to control non-point source pollution. Approximately \$1 million is available for multiple awards during this grant cycle from EPA, under the 319(h) portion of the Clean Water Act. ADEQ administers the program in Arizona.

The deadline for submitting grant applications to ADEQ for this cycle is 3 p.m., May 23. Award announcements are expected to be made in July. A 2001 Water Quality Improvement Grant Manual has been developed which details this ongoing grant program and includes the application forms. For more information or to obtain a grant manual, contact Susan Ward, Phone: 602-207-4635; email: swl@ev.state.az.us. The manual can be downloaded at www.adeq.state.az.us/environ/water/mgmt/planning.html#improve

Call for Papers on Artificial Recharge

A call for papers is issued for the 4th International Symposium on Artificial Recharge of Groundwater, to be held in Adelaide, Australia Sept. 22-26, 2002. The symposium is in response to the huge increase in the number and variety of artificial recharge schemes, monitoring methods, and a growing understanding of subsurface physical and biogeochemical processes. Up to 250 word abstracts are due Oct. 15, with notification of acceptance Dec. 7. For abstract submission, general inquiries and to be placed on the symposium mailing list email Louise Carnell, isar4@hartleymgt.com.au

Symposium Targets In Situ & On-Site Bioremediation

The Sixth International In Situ & On-Site Bioremediation Symposium will be conducted in San Diego from June 4-7 and will focus on the use of biological processes to remediate soil, groundwater, and sediment contamination and to treat industrial waste. Sponsored by Battelle, the symposium provides a forum to facilitate technology transfer and integrate recent developments in fundamental research with innovative engineering applications. The symposium speakers and registrants will be environmental professionals from government agencies, universities, and the private sector. For more information, contact Carol Young, phone: 614-424-7604; email: youngc@battelle.org/ or check www.battelle.org/biosymp/

UC Law Center Hosts Summer Conference

The University of Colorado Natural Resources Law Center will hold its annual summer conference June 13-15 in Boulder. The theme of the conference is "Two Decades of Water Law and Policy Reform: A Retrospective and Agenda for the Future." The conference will examine the agenda for reforming and improving water law that

has developed during the past two decades, assess what has and has not been accomplished and explore lessons and implications for future water law and policy. For additional conference information call the NRLC at 303-492-1272 or email NRLC@spot.Colorado.edu

Summer River Conference Scheduled

American Rivers, The Nature Conservancy and other non-profit organizations and federal agencies announce "Managing River Flows for Biodiversity: A Conference on Science, Policy and Conservation Action" July 30-August 2 in Ft. Collins, Colorado. Built around case-study symposia and field trips, the conference will build understanding of the conflict between meeting ecosystem needs and human demands for water; showcase the latest science concerning the in-stream flows required to protect biodiversity; provide a look at current policy concerning regulation and management of water quality, quantity and use; and involve participants in reviewing case studies that address inherent conflicts and potential solutions.

Billed as a conference for river activists, scientists and water managers, the event is open to 350 attendees from diverse professional and academic backgrounds. Travel assistance may be available. For more information about travel stipends, please contact jmierau@amrivers.org. To register for this conference, please visit www.freshwaters.org/conference.

Colorado Plateau Research Conference

This conference will provide a scientific forum for research results and land-management issues related to the biological, paleontological, geological, cultural, physical, and social sciences on the Colorado Plateau. Persons interested in submitting a talk or poster abstracts should do so by August 12 to receive priority consideration and reduced registration fees. Special sessions will include biological inventory and monitoring, sustainable ecosystems during times of environmental change, and factors influencing regional identities and culture. Persons interested in organizing other special sessions or symposia should contact Kenneth Cole (520-556-7466 X 230; email: Kenneth_Cole@usgs.gov). The conference is from November 5-9 at Northern Arizona University and is sponsored by NAU and the U.S. Geological Survey. Conference details are posted at: http://www.usgs.nau.edu/6th_biennial_conf/

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Outside Readings

Get Comfortable With Uncertainty In Resource Management Decisions

by Sandy (Alex K.) Williamson, email: akwill@usgs.gov; phone: 253-428-3600, X 2683 U.S. Geological Survey, Tacoma WA

This section, "Outside Readings," includes reprints or abstracts of editorials, features, articles or other published materials that appeared in various publications and would likely interest readers of the "Arizona Water Resource" newsletter. The following piece was published in the Washington Water Research Center newsletter, "E-Water News."

Science-based management seems to have become an accepted buzzword as of the late 90s. Most seem to agree that it is something we should do. But what does it really mean in the important resource management decisions facing us today? Decisions facing us today are usually complex. Most of the science that can be applied to those decisions is based on questions that can only be answered in a statistical sense, because few relevant problems are simple enough that science can tell us categorically yes or no. Most scientists were trained in statistics where the allowable confidence level for a valid result was either 95 or 99 percent confidence. We were trained that a relationship only certain at the 80 or 90 percent confidence level was technically unsupportable – so nearly all results at that level have never been published.

So what usually happens? The scientists, uncomfortable with presenting results at those lower confidence levels, tell the managers that that question cannot be answered, so the scientists search for a simpler question that is answerable with higher confidence. Scientists are generally very adverse to risk taking, especially when the risk in question is the risk of being wrong. However, the difficult question **MUST STILL** be answered by the resource manager, or even in some cases by the public through a referendum. So managers or politicians, or citizens, who are generally not trained in the scientific disciplines relevant to the question, are forced to translate the scientifically confident answer to the more complex question at hand. Is this the best way to make science-based decisions?

I suggest that we demand that the relevant, although complex, questions are studied and answered, even if the uncertainty is only 80 percent confidence. Some may say that 80 percent confidence is not enough, and for questions where much is at stake, that is likely true. However, we usually do not consider the uncertainty associated with the do-nothing alternative, which is probably what happens when we reject an answer because it is not certain enough. Most people are comfortable, (though not pleased) with uncertainty in some areas of life. Many weather forecasts as little as one or two days out are probably no more confident than 60-70 percent. We have come to accept and appreciate getting the forecast even if it has an unknown uncertainty.

Some, as potentially affected land owners or industries, say they want nearly complete certainty in the outcome before they are asked to make changes in their practices that would cost them

money or time. This makes sense except that often the do-nothing alternative has serious (and often costly) outcomes as well. And if the science-based decision was handled correctly including all factors as well as economic ones, it can sometimes be used to answer the appropriate question with the optimum benefit for all.

Examples where relevant, although complex questions are replaced with easier questions:

1. In the Northwest today, many environmental questions revolve around salmon. A relevant question would be how many salmon are likely to be restored by taking this or that action (dam removal, banning some type of fishing, etc.). If we could answer some of those questions, then we could compare alternatives in a much more sensible manner. In the dam removal case, the scientists have translated that question to a simpler one like, "sediment loading in the stream will increase or decrease," or dam removal will increase the velocity of water movement in the downstream reservoir, which should help the smolts. Recently in Washington State, the voters were asked to answer the question of whether commercial fishing should be severely limited in order to save salmon. Very little science was offered by either campaign's advertising and so it became mostly an emotional decision about what to value more.

2. Choosing which best management practices (BMPs) to encourage and support. Many BMPs have been identified and limited resources need to be used for the BMPs that are most beneficial. Most often this decision is based on judgment alone. If this decision were aided with a statistical approach, it would usually involve some kind of multiple regression where many factors are correlated against a result. Many multiple regressions involving several factors do not satisfy the 95 percent confidence level, yet it still might be helpful to know which factors are most likely to help, if even only at the 80 percent confidence level. This known uncertainty might make some people uncomfortable, yet the judgment decision might have had even less confidence, though it was unknown.

We scientists must be willing to answer the more difficult, but more relevant questions even though the uncertainty is more than we like or are accustomed to. We must be willing and allowed to publish results at lower confidence levels. For this change to be effective, we must clearly communicate our findings as well as the confidence level estimates, but also our own judgments about how certain we are about the answer and the estimate of the confidence. We must help people understand all the good and bad about particular question-answering efforts so that they can properly make their own conclusions about our results. Resource managers, who generally fund scientists, should demand that relevant, though complex questions are investigated.

Urban ecology...continued from page 1

The times seemingly are ripe for urban ecology. William Shaw, University of Arizona professor in the Department of Renewable Natural Resources, says, "There has been a growing movement to bring ecology and natural resource science out of the bush and into the urban and suburban environments. This is where most people spend most of their time. Instead of treating these areas as sacrifice zones and doing all our conservation in national parks and elsewhere there is a growing appreciation of the need to incorporate conservation into urban planning."

Urban ecology acknowledges the obvious, that humans are not only part of the environment but they profoundly affect it. Shaw says, "Metropolitan areas are the ultimate in terms of human manipulative environments." Dense populations, clusters of buildings and structures, social, cultural and political institutions, along with whatever natural features exist in an urbanized space create a complex and varied environment.

Pima County has undertaken a project to ensure compatibility between urban planning and the natural environment. Shaw says the Pima County Sonoran Desert Conservation Plan epitomizes the use of urban ecology as a planning strategy. He says, "Pima County is spending millions to put together a comprehensive land use plan with the primary focus of conservation in the metropolitan environment." Water is a critical element in the plan.

In fact water is an important issue in urban ecology. Shaw says that within metropolitan regions the riparian areas have a prime biological importance and are logical places to focus attention. Such areas are likely to have aesthetic and recreational value. Fortunately these areas are also less likely to be developed in the Southwest because of flood hazards, their importance for groundwater recharge and the need to keep drainage systems open.

Arizona's universities are involved in urban ecology studies. The University of Arizona's Department of Renewable Natural Resources demonstrated an early interest in the 1980s when it studied

the effects of urban development on the natural resources of the then Saguaro National Monument. More recent studies range from bats' use of bridges to urban hawks and coyotes.

Arizona State University also has an interest in urban ecology, and its efforts in this area got a recent boost from several grants. In 1998, the National Science Foundation identified Phoenix as a Long Term Ecological Research site, with ASU funded to conduct project research. Baltimore also was included as a LTER site. LTER's relatively recent interest in urban areas represents a program shift as well as an acknowledgment of the emerging interest in urban ecology. Established in 1980, LTER had previously supported sites of traditional ecological interests, focusing on ecosystems such as lakes, forests, and prairies. The LTER goal of observing ecological process occurring over long periods of time now will also apply to the urban areas of Phoenix and Baltimore.

ASU also received a \$2.7 million National Science Foundation's Integrative Graduation Education and Research Training grant that further promotes ASU's involvement with urban ecology. The NSF money, along with ASU matching funds, is to be used to develop a multi-disciplinary graduate program in urban ecology. IGERT will support student involvement in LTER's research activities.

UA and ASU differ in their approaches to urban ecology. The UA has mainly worked with communities in solving problems that result when elements of the natural and human environments interact. The LTER grant enabled ASU to establish a center and work on the theoretical implications of urban ecology, along with conducting research and field work. ASU takes a broad view and considers cities as ecosystems unto themselves. Whereas UA's interest might be described as ecology within cities ASU's approach focuses on the ecology of cities.

Whatever its emphasis urban ecology relies on a multi-disciplinary approach as befitting a discipline dedicated to studying the complex workings of an urban environment. An ecologist, sociologist, geographer, economist, biologist and hydrologist might collaborate on a single project.



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