



New Magma Files Bankruptcy

After five years of debt negotiations between officials of New Magma Irrigation and Drainage District and the U.S. Bureau of Reclamation, NMIDD filed for municipal bankruptcy in Federal District Court in mid-January.

NMIDD's action is a closely watched development since the financial health of the irrigation districts is viewed as an indicator of agriculture's viability as a Central Arizona Project water user. Other Arizona irrigation districts are financially stressed, with some observers speculating that future bankruptcies are a distinct possibility.

The irrigation districts were established to contract with the State of Arizona and the federal government for the delivery of CAP water. They now face the financial burden of paying off the debts they incurred financing the construction of their internal CAP distribution systems. The federal government financed approximately 80 percent of the costs, *continued on page 12*



Environmental and political issues combine to challenge Tohono O'odham officials. The appearance of sinkholes is a very obvious problem. Of uncertain origin, the 500+ sinkholes currently identified on the Tohono O'odham Nation dramatize the need to address reservation water problems. (Photo: B. Tellman, WRRC)

Problems Beset Reservation Seeking to Control Water Resources

A disturbing phenomenon has been occurring during the past few years in the San Xavier District of the Tohono O'odham Nation. Sinkholes are opening up on the land. Since 1988 over 500 sinkholes have appeared, ranging in size from one to forty feet across and up to twenty feet deep. The sinkholes are clustered along the Santa Cruz River, on land previously irrigated but now abandoned.

The sinkholes often occur suddenly. Farm Manager Clifford Pablo said one was discovered when a horse and rider toppled into it, another when a tractor plunged downward. Pablo warns visitors to avoid the sides of the holes. The cause of these sinkholes is uncertain, but they are a dramatic reminder of unresolved environmental and political issues affecting the San Xavier district. These issues are rooted in the early history of the area.

The ancestors of the present-day Indians on the San Xavier District of the Tohono O'odham Nation have inhabited the area near Tucson since time immemorial. The key to life was the then-perennial Santa Cruz River. Both groundwater dug from shallow hand-dug wells and surface water were available.

continued on page 2



C O N T E N T S

| | |
|-----------------------------|-----|
| Water Vapors | 3 |
| News Briefs | 4-5 |
| Transitions | 6 |
| Legislation & Law | 7 |
| Publications | 8 |
| Special Projects | 9 |
| Announcements | 10 |
| Calendar | 11 |

Problems Beset Reservation continued from page 1

Explorer J. Ross Browne traveled through the region in 1864 and described the valley as "one of the richest and most beautiful grazing and agricultural regions I have ever seen." The fresh flowing river supported many types of plants and wildlife near San Xavier. Wolves, quails, pronghorn antelope and wild turkeys inhabited an over 1,000-acre mesquite bosque, south of San Xavier.

Groundwater Pumping Reduces River Flow

Since the reservation was established in 1874, non-Indian water use has grown, with a dramatic increase when pumps were installed in the 1920s and 1930s. Groundwater withdrawals further increased in the 1940s to accommodate Tucson area growth, specifically the water demands of agricultural, mining, and municipal and industrial users.

The Santa Cruz River in the area now is dry except for flood events or effluent releases. The river flow has been depleted by groundwater pumpage, with much of the pumpage concentrated near the San Xavier area. Pumping in the Tucson Active Management Area increased from 29,000 acre-feet (af) in 1935 to a peak of 439,000 af in 1976, with 1990 pumpage estimated at 341,000 af. The groundwater table beneath the reservation has dropped significantly.

What Causes Sinkholes?

If the sinkholes are caused by groundwater pumping, it will be the first documented case of subsidence due to pumping in the Tucson valley. However, other possible causes have been proposed, all of them of human origin. Steve Slaff of the Arizona Geological Survey identified factors such as the loss of the mesquite bosques in the region. As the trees died from a falling water table, their roots rotted leaving cavities that formed tunnels.

Another possibility is alteration of the floodplain. The river seldom overflows its banks as it normally did when the course was shallow. Moreover, the placement of the Nogales freeway or I-19 between the riverbed and its floodplain further restricts the course of the river. Piping may also be occurring where water is traveling to a much lower water level beneath the river. A final possibility is soil compaction caused by alternative wetting and drying of the soils in farming operations. Alluvial soil often contains a mixture of clay and sand, with the clay forming tiny bridges between sand particles during dry periods. A combination of several of these factors may be contributing to the situation.

SAWRSA Offers Relief

The sinkholes are a recent occurrence in a long line of environmentally disruptive events. Obvious questions arise: What actions have been taken to mitigate the environmental problems, and how effective have they been? The primary action to date has been the passage of the Southern Arizona Water Rights Settlement Act (SAWRSA) by Congress in 1982. The intent of the act is to restore a water supply to the San Xavier District, to settle district water rights claims, and to ensure fair and equitable use of water on the reserva-

tion. The act includes an agreement among state and federal governments and several private water users to establish a \$15-million trust fund to develop district water resources.

The Tohono O'odham are to receive 76,000 af of water annually, from various sources, with 27,000 af of Central Arizona Project (CAP) water allotted to the San Xavier District. Further, groundwater pumping is limited to 10,000 af each year on San Xavier.

Controversy Continues

Designed to resolve an Indian vs. non-Indian water resource controversy, the settlement sparked conflict between the Tohono O'odham Nation and the San Xavier District. The nation agreed to the settlement, but allottees or private landowners within the San Xavier District have protested the terms of the settlement. The district believes that the settlement is inequitable and that individual allottees are not adequately compensated. In January 1993, 32 allottees filed suit against the City of Tucson and mining and agricultural interests protesting terms of SAWRSA.

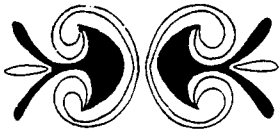
Controversy also has arisen over the expenditure of the trust fund for improving district farms. The nation spent \$8 million of the trust fund on planning for a large-scale irrigation project, a decision opposed by many district residents. The district claims the money was misspent and progress was minimal. Because of the dispute, implementation of the settlement has been delayed. Further complicating matters CAP water deliveries did not arrive until October 1992.

Meanwhile the ASARCO copper mine and the Farmers Investment Co. (FICO) continue to pump groundwater from nearby areas. In 1992, ASARCO pumped about 20,000 af just south of the district, and FICO used another 30,000 af further south along the Santa Cruz River. This pumping is occurring despite the fact that ASARCO and FICO promised to reduce groundwater pumpage and contract for CAP water as part of the SAWRSA settlement. Neither have yet signed CAP contracts. If groundwater pumping is a major cause of the sinkholes, the issue undoubtedly will need addressing as the terms of SAWRSA are renegotiated.

In contrast to their non-Indian neighbors, San Xavier residents are pumping minimal amounts of water. Austin Nuñez, chairman of the San Xavier District, reports that only one well is in operation, irrigating a few acres on the San Xavier Cooperative Farms.

In the midst of these various issues, the district also is considering options for using water it eventually will receive through SAWRSA. Agriculture will not be resumed until the sinkhole problem is resolved. Restoring riparian habitat has been proposed. The benefits of a recharge project located in the river south of the mission could include reestablishment of a cottonwood-willow forest along the river.

Other possibilities include creating an artificial wetland or recreational ponds or lakes, simulating previous conditions at sites where springs were located, and releasing small amounts of CAP water to various tributaries leading to the Santa Cruz River. Such plans, however, need to take into account the rapid erosion of the Santa Cruz River banks.



Water Vapors

We're baaaack! Like the subliminal salmon swimming across the centerfold of the last *AWR* published in the fall, we've fought our way back to the headwaters of the Rillito to spawn more issues.

Our first inclination was to blame our disrupted schedule on the Central Arizona Project. The focus of so many water management problems, from the demise of agriculture to endangered fish to skin rashes in Tucson, CAP is a convenient whipping boy whenever something goes wrong. So we would be treading very familiar ground if we were to blame CAP for the much delayed publication of the *Arizona Water Resource* newsletter. CAP made us do it—or not do it.

Committed as we are to the journalistic principles of honesty and fair play, we resisted the temptation to employ this self-serving strategy. We 'fess up. CAP was not to blame. It was the Yuma desalting plant.

In reality, the unplanned sabbatical of the *AWR* was the result of a condition plaguing many organizations both public and private—budget cuts, loss of personnel, and staff turnover (see box below and *Transitions*, p. 6 for details). These cuts coincided with new programs and project deadlines. The increased work load caused publication of the newsletter to fall behind. Way behind.

The temptation to fold our tent and concentrate on the *Arroyo*, our quarterly publication, was strong. Few of the 54 Water Centers across the United States put out a monthly newsletter and very few publish two periodicals. But a steady stream of inquiries about when the next issue would be forthcoming, and even a couple unsolicited offers of financial support convinced us that we were missed. It seems that the *AWR* fills a real need.

So we now are back on track and

determined to resume regular publication of the *AWR*. There will be a few changes as we continue to adjust to these lean and mean times. There will be few if any 16-page editions, and don't look for special four-page supplements in the future. There will be fewer guest articles (although as always, we welcome letters to the editor). And those organizations who do not notify us of their meetings may find we drop them from the calendar section, as we no longer have the staff to track down dates and times.

We look forward to continuing to serve the Arizona water community. Our sincere apologies for any inconvenience our absence might have caused.

This just in from the ivied halls of academia—researchers at Ohio State have determined that groundwater overdraft in Arizona is threatening the great coastal cities of the world. Sea levels have been rising slowly (0.07 inches per year) for decades. Initially, the most popular explanation was melting snowcaps and glaciers. Then, thermal expansion of the oceans, possibly linked to global warming, became a likely culprit.

Now it seems that groundwater mining in the great aquifer systems of the world, including the Midwest's Ogallala and the basin and range aquifers of the Southwest may be responsible for up to one-third of measured ocean rise. All that water no longer stored beneath the ground has to be

somewhere, and somewhere turns out to be the oceans, not backyard pools. So the next time you tarry in the shower or plant a few acres of alfalfa, consider this: your self-indulgence may be eroding the beaches of Maui.

Arizona's legislature stands adjourned, but it's never too early to begin drafting water-related bills for next year's session. One interesting trend that may be developing is a growing willingness to use "sin taxes" to finance new programs.

In some cases, it seems the wages of sin are enhanced natural resource management. Gamblers in Arizona provide lottery revenues used to purchase riparian habitat. The Nebraska legislature is considering a boost in state cigarette taxes to fund groundwater monitoring and testing.

The nexus between smoking and water quality is weak (although there must be billions of butts in unlined landfills); perhaps liquor taxes are a more logical revenue flow to tap. Personally, we think a dollar-a-bottle tax on lite beer to finance foreign travel for water resources researchers is an idea that merits serious consideration.

Next month—an Arizona legislative recap, an update on Nevada's continuing efforts to slake its thirst with someone else's Colorado River water, and outdoor misting systems exposed!



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News Briefs

Heritage Funds Buy Riparian Area

The Arizona State Parks Board, using Heritage Fund monies, purchased 4,914 acres to add to Patagonia State Park, near Nogales. The seven-square-mile area lies downstream of the state park along Sonoita Creek and extends north into Fresno Canyon. This area contains rugged wildlife habitat and is home to more than 150 bird species and many other kinds of wildlife.

Purchased for \$2.8 million from Rio Rico Properties, the land is a riparian area, a habitat now rare in southern Arizona. Rio Rico Properties had planned to build homes on the land. Once a trail is constructed, increased visitation to the area is expected to add about \$150,000 annually to the Nogales area.

This is the third major riparian Heritage Fund acquisition in less than a year. Arizona Game and Fish Department previously purchased the 205-acre Wenima Ranch along the Little Colorado River, north of Springerville for \$894,500. The agency also purchased the 1,362-acre White Mountain Hereford Ranch south of Springerville. The Heritage Fund provided \$2.9 million of the \$3.7 million purchase price.

State Lottery revenues provide funding for the \$20-million Heritage Fund which was established by a 1990 citizen initiative. Funds are to be used for such purposes as environmental education, research, land acquisition, recreation, and habitat preservation.

Study Says Global Warming is CAP Threat

Its viability questioned from many directions, the Central Arizona Project recently was found vulnerable from a new angle—global warming. A study

suggests that global warming could reduce flows through the CAP canal.

Global warming actually may cause an increase in rain and snow but surface runoff could decrease by 8 to 20 percent due to evaporation and the increased water needs of vegetation, the study reported. If Colorado River flows decrease, its salinity level, already a matter of concern, would increase, possibly by 15 to 20 percent.

The \$130,000 study, the first to link global warming and the CAP, was conducted by the Pacific Institute of Oakland with support from the U.S. Environmental Protection Agency.

CAP No Fishing Policy Catches Flack

As if overriding financial problems and the threat of climate change were not enough, the Central Arizona Project faces another controversy—fishing. To paraphrase a slogan from the Old West, "There's fish in them thar canals." Sportsmen want at them, but CAP policy says: "No Fishing."

Enforcing the regulation against persistent fishermen has been an ongoing problem. The stakes recently were raised when CAP security officers adopted a policy of calling local police to cite violators for trespassing. Since then about 20 people have been cited.

Among other arguments, the fairness of the CAP no-fishing policy has been contested by noting exceptions to the rule at other canal systems. For example, the California state aqueduct system is developed for recreational uses. Trails have been constructed, and fishing is allowed.

Closer to home fishing is permitted in the U.S. Bureau of Reclamation Salt River Project canals in the Phoenix area. John Schilling of the BuRec explains, however, that "these SRP canals were built before statehood, some dating from the 1880s and 1890s. They were built as part of the community and were always integral to the community."

Schilling explains that CAP was built much later historically and does not represent a community resource as

does the SRP canal. Also the CAP flow will be about four times greater and move three times faster than SRP water and therefore is more hazardous.

Schilling says the BuRec is studying CAP recreational possibilities. To be resolved are concerns about safety and liability, water quality, and protection of wildlife.

Border Conference Maps Grassroots Strategy

Representatives from U.S., Mexican and Tohono O'odham communities recently gathered at a conference to promote international cooperation in economic development, environmental research, health care, resource management and education. Conducted in Puerto Peñasco, Sonora January 13-15, the conference, "Bridging Borders: A Cross-Border Exchange," was organized by the International Sonoran Desert Alliance, a grassroots organization dedicated to preserving the Sonoran ecosystem and urging sustainable economic activities.

Unlike NAFTA, the much touted trade treaty promising improved international cooperation among business interests, the conference emphasized cooperation at the local level, to address problems immediately affecting residents of the border area. Participants met in roundtable workgroups to discuss issues and offer recommendations.

Broad issues as well as specific concerns were addressed. For example, a resident of Mexicali expressed concern that his children were getting sick from the drinking water when a short pipe from the United States could deliver clean water to the community. Mexican fisherman aired concerns about diminishing fish populations.

Along with Tucson's Sonoran Institute and Friends of PRONATURRA, the conference was supported by government agencies and various organizations, with a range of interests, from business to tourism to environmental. The University of Arizona's Water Resources Research Center also was a cosponsor.

Clinton Targets Water Institute Program

President Clinton has recommended eliminating the \$6 million Water Resources Research Institute Program in the 1995 federal budget. Administered by the U.S. Geological Survey, the program provides funding for a network of 54 institutes, located at land grant universities in each state and territory. The University of Arizona's Water Resources Research Center is a component of the institute program.

Originally established by the 1964 Water Resources Research Act, the institutes established a federal/state partnership in research, information transfer and education in water-related issues. Water centers were established in each state to respond to water research needs from a local or grassroots level and to build on these needs toward a national perspective.

The UA's WRRC mission includes the production of two newsletters, *Arroyo* and the *Arizona Water Resource*, an issue paper series, as well as providing support to university water researchers. During the past two years, WRRC has awarded \$115,299 of federal funds to researchers investigating state water issues.

Clinton's proposed action would have varied impacts on state water centers depending upon the extent to which they rely on federal funds for support. The UA's WRRC is supported by both federal and state funds, with federal funds making up about 12 percent of its budget.

HIV Virus in Wastewater Not Hazardous

Reacting to a University of Pittsburgh study indicating that the HIV virus is relatively stable in wastewater, treatment plant operators are asking whether there is a risk of transmission.

The study, "HIV Survivability in Wastewater," was published in the May/June 1992 issue of *Water Environment Research* and concluded, "HIV is fairly stable in wastewater for up to 12 hours

but experiences a 100- to 1,000-fold reduction in infectivity after 48 hours."

In response, the Center for Disease Control emphasizes that AIDS is a blood-borne disease and is not transmitted via a water-borne route. Further, CDC points out that the laboratory setting does not reflect conditions in a treatment plant. Laboratory studies use immense concentrations of HIV to study how the virus behaves. Concentrations in wastewater are very low. Also, the HIV virus is very fragile and is subject to hostile conditions in wastewater. Such conditions include disinfectants and other chemicals and changes in temperature and pH.

CDC concludes that the only way AIDS theoretically could be transmitted from wastewater is if a large quantity of the water was injected directly into the blood stream.

Tucson Water Tales

"May you live in interesting times" is a Chinese curse Tucson Water employees can appreciate. Recent months have seen numerous unexpected changes at the utility, many detrimental.

Central Arizona Project water treated in Tucson Water's state-of-the-art treatment plant corroded old water lines, damaged customer appliances and

fixtures and provoked widespread customer dissatisfaction. The City Council shelved plans to immediately deliver CAP water to the entire service area and implemented extensive programs of line flushing, filtering, and rebates. The resignation of Tucson Water's director followed and a national search for a replacement came up empty (see *Transitions*, p. 6).

A management study conducted by RW Beck faulted Tucson Water in many areas and recommended sweeping changes in organizational structure and operational policies. Meanwhile, the Arizona Department of Environmental Quality and EPA have accused Tucson Water of lapses in its water quality monitoring.

A controversial vote to kill the Santa Cruz Valley Water District and ongoing disputes with northwest area water providers have not endeared the utility to area water interests. A thrice-postponed water bond election scheduled for May 17 has attracted opposition from more than one source.

Implementation of the reorganization plan, eventual hiring of a new director and a new study to reevaluate uses of CAP water may put the beleaguered utility back on track. But absent capital improvement bonds or a stiff rate increase, "interesting times" may continue for Tucson Water.





Transitions

We report on a bumper crop of transitions this month. They are organized as follows: federal, state, and local agency positions.

Dr. Gordon P. Eaton is the new Director of the U.S. Geological Survey. Eaton is an earth scientist who comes to the USGS from the directorship of the Lamont-Doherty Earth Observatory at Columbia University. He previously served as president of Iowa State University and worked with the USGS for 16 years.

Jack Ward Thomas is the new chief of the U.S. Department of Agriculture, Forest Service. Formerly at the Pacific Northwest Forest and Range Experiment Station in La Grande, Oregon, Thomas produced numerous reports and studies on the spotted owl for Congress and the Forest Service. He recently headed the study team on timber harvesting that resulted from President Clinton's Timber Summit.

Mollie Beattie is the new director of the U.S. Fish and Wildlife Service. With a background in ecology and ecosystem management, she is considered a staunch defender of the Endangered Species Act and advocate for maintaining the integrity of wildlife refuges. Beattie's confirmation was delayed over the issue of low-level flights over the Cabeza Prieta Wildlife Refuge, when Arizona's Senator McCain objected to the USFWS stand against such flights. Her nomination went forward after the Department of Interior reversed the USFWS stand on this issue.

Matt Chew is the new Streams and Wetlands Coordinator for Arizona State Parks. Chew is an Arizona native who studied recreation management and ecology in Colorado, and worked on ecological assessment.

Robin Stinnett has left the Arizona Municipal Water Users Association where she served as Program Manager for Conservation to pursue private consulting opportunities and spend more time with her family. Her position has been filled by **Lisa Helms**, who left the Department of Water Resources' Tucson office in February.

Brent Cluff retired from the University of Arizona's Water Resources Research Center in January. Cluff had held the position of Associate Hydrologist since 1969 and has been associated with the Water Center since 1962. He now is concentrating on international consulting work involving nanofiltration in Third World Countries.

Susanna Eden resigned from the University of Arizona's Water Resources Research Center where she had served as a Senior Research Specialist since 1989. Eden joined her husband in Minneapolis, where he is attending law school. She is completing her PhD work while working part-time at the University of Minnesota's Water Resources Research Center.

Todd Sargent has left the University of Arizona's Water Resources Research Center where he had served as a Research Specialist since 1990. Sargent now is doing consulting work on water and related environmental issues.

Bob Mac Nish has retired from the U.S. Geological Survey's Tucson office where he served as District Chief. Mac Nish now is working with **Tom Maddock III** in the University of Arizona's Department of Hydrology and Water Resources on riparian hydrology. Specifically, Mac Nish is involved in establishing the Arizona Research Laboratory for Riparian Studies. **Mark Anderson** is the acting District Chief of the USGS.

Chuck Huckelberry has resigned as General Manager of the Metropolitan Domestic Water Improvement District on Tucson's northwest side to assume the position of Pima County

Manager. **Mark Stratton** has been promoted from Engineer to General Manager after serving as acting General Manager for several months. The search is on for a new engineer. **Mike Block** is the Districts' hydrologist, coming to MDWID last fall from a position as Water Quality Planner with the Pima Association of Governments.

Michael Tubbs resigned as Director of Tucson Water last November (see story, p. 5). A national search failed to land a new director. Meanwhile, **John Jones** remains on loan from the City's Development Services unit as acting Director while the search for Tubbs' successor resumes. Also departing Tucson Water is **Jane Burazer**, Plant Administrator for Tucson Water's CAP treatment plant. Burazer left for a similar position in Austin. **Dave Friess** is filling her position on an interim basis. **Trish Williamson**, Conservation Office Manager, has left Tucson Water to relocate in California. Under a proposed reorganizing plan for Tucson Water, that position will be eliminated.

Tom Whitmer has left the now-defunct Santa Cruz Valley Water District where he held the position of assistant director to become Water Planner for California's Imperial Irrigation District. SCVWD Director **Sharon Megdall** is wrapping up the District's activities and reactivating her utility consulting business.

Richard Silverman became the Salt River Project's fourth general manager in January. He is an attorney who has worked for Salt River Project since 1966 in a number of positions. Silverman succeeds **Dr. Carroll Perkins** who retired in November.

William Schrader has been elected president of Salt River Project, succeeding **John Lassen**. Schrader previously served as vice president. **John Williams, Jr.** was elected vice president. Both candidates ran unopposed in the election, which filled 66 board and council positions.



Legislation & Law

Supreme Court Rules on Groundwater-Surface Water Connection

A recent Arizona Supreme Court opinion represents the latest effort to legally interpret the hydrologic connection between groundwater and surface water. At issue was a determination whether a trial court erred when adopting a test to ascertain whether groundwater subflow is to be included in the Gila River adjudication. The State Supreme Court found that the trial court did, in fact, err.

The test adopted by the trial court was based on a 50%/90-day rule. If pumping for 90 days in the younger alluvium causes stream depletion of 50 percent or more, then those wells are presumed to be pumping appropriable water, which therefore would be included in the adjudication of surface water rights.

The Supreme Court's rejection of 50%/90-day rule relied on interpreting the 1931 *Southwest Cotton* case. The Court stated that "even though *Southwest Cotton* may be based on an understanding of hydrology less precise than current theories, it would be inappropriate to undo that which has been done in the past." The Court declared that the case "has been part of the constant backdrop for vast investments, the founding and growth of towns and cities, and the lives of our people."

The Court found that *Southwest Cotton* set forth a test for determining whether underground water is appropriable subflow: "The best test...is that there cannot be any abstraction of the water of the underflow without abstracting a corresponding amount from the surface stream."

The Court found that the trial court's 50%/90-day "volume-time test" does not accurately reflect the *Southwest Cotton* subflow rationale. *South-*

west Cotton did not purport to identify subflow in terms of an acceptable amount of stream depletion over an established time period. Further, the Court stated that the trial court's adoption of actual time and volume criteria was arbitrary. Regarding the time element, the Court asked, "Why not 75 or 100 days?"

Rejecting the "volume-time" criteria, the Court stated that a definition of appropriable subflow must "turn on whether the well is pumping water that is more closely associated with the stream than with the surrounding alluvium." The Court identified several potential variables for determining if pumping affects subflow: "Comparison of such characteristics as elevation, gradient, and perhaps chemical makeup can be made. Flow direction can be an indicator. If the water flows in the same general direction as the stream, it is more likely related to the stream. On the other hand, if it flows toward or away from the stream, it likely is related to the surrounding alluvium."



In its opinion the Court recognized in essence three classes of water, each with a specific status regarding appropriation and adjudication. Percolating groundwater is subject to neither appropriation nor adjudication. Stream flow is subject to appropriation and adjudication, and appropriable subflow is subject to appropriation and adjudication if meeting the prescribed test. The Court's interpretation of what is appropriable subflow did not include tributary underground flow in the younger alluvium.

The Court noted that a bifurcated groundwater-surface water system of water rights was typical of western states until the early part of this century. As the study of hydrology advanced and a hydraulic connection demonstrated, most western states adopted unitary management of underground and surface water. While recognizing arguments for Arizona's adoption of such a management plan, the Court called for such changes to

come from the Legislature.

Many officials agree that the legislative route is appropriate and ideally would provide an opportunity to adopt a timely and comprehensive plan through a democratic process. Given the divergence of involved interests, however, the legislative route may not be politically feasible. As a result, many officials believe that the courts eventually will have to resolve the groundwater-surface water dispute.

The Supreme Court ruling presents an immediate problem with regards to the Hydrographic Survey Reports already completed based on the 50%/90 day test, particularly in the San Pedro watershed. An adoption of a new test will necessitate that these HSRs be revised. If the new test is radically different, the completed HSRs may need to be scrapped. The Arizona Department of Water Resources will need to apply the new standard to all subsequent HSRs.

Some officials believe that the Supreme Court in rejecting the time-volume test rejected the most appropriate hydrological standard for determining surface water/groundwater. They admit that the 50%/90 day rule is, in fact, somewhat arbitrary. They argue, however, that any standard attempting to define the interrelationship between percolating groundwater and stream-flow could be similarly criticized. They say this differentiation does not exist in nature.

With the Supreme Court's rejection of the 50%/90-day test, a different standard needs to be worked out and reviewed by Judge Stanley Goodfarb, presiding judge of the Gila River adjudication. Judge Goodfarb then will decide on an appropriate rule, as he did initially in 1988 when he accepted the 50%/90 day standard.

The Supreme Court also ruled on burden of proof, stating that if DWR uses a proper test with appropriate criteria to determine whether a well is pumping appropriable subflow, it then is up to the well owner to prove that DWR is wrong. The Court also ruled that the trial court may adopt a rule to exclude from adjudication wells with a de minimis effect on the river system.



Publications

Abandoned Farmland Often is Troubled Land in Need of Restoration

Joe Gelt. The above is Volume 7 Number 2 (Fall 1993) of *Arroyo*, a quarterly publication of the Water Resources Research Center. Abandoned farmland has experienced at least two changeover, first when its natural vegetation was removed to create farmland, then again when agricultural crops no longer were cultivated. The newsletter discusses the issues involved in restoring abandoned farmland to some semblance of natural conditions.

Individual copies—also subscriptions of *Arroyo*—are available without charge from the Water Resources Research Center, University of Arizona, 350 N. Campbell Ave., Tucson, AZ 86721; 602-792-9591.

Indian Water Rights: Negotiating the Future

Elizabeth Checchio and Bonnie G. Colby. Water Resources Research Center. The authors discuss the context for litigated and negotiated settlements. They summarize the complex issues surrounding the resolution of Indian water rights claims by examining social, political, and economic questions. Case studies also are presented. Finally, the authors address some of the most difficult questions arising in the settlement process.

Cost is \$8 (\$7 each for orders of 10 copies or more) from: Tribal Water Publication Order, Department of Agricultural Economics, The University of Arizona, Tucson, AZ 85721; 602-621-4174.

Riparian Management: Common Threads and Shared Interests

This volume is the proceedings of a western regional conference on river management strategies. Sponsored by the Water Resources Research Center, the conference was conducted in Albuquerque, NM, February 4-6, 1993. Its purpose was to bring federal, state, and local agencies together with private sector interests to discuss strategies for an integrated approach to management of riparian areas that cross jurisdictional boundaries.

Free copies are available from the Rocky Mountain Forest and Range Experiment Station, 240 W. Prospect Road, Fort Collins, CO 80526 or from the Water Resources Research Center, The University of Arizona, 350 N. Campbell Ave, Tucson, AZ 85719; 602-792-9591.

Safe Drinking Water...Policy, Perceptions and Science

The above is Volume 2 Number 1 (Spring 1994) of the *Water Science Reporter*. This edition looks at the three "R's" of safe drinking water—regulations, risk and research along with their partners, the three "P's"—politics, price and public perception. The *Reporter* addresses a wide audience includ-

ing interested citizens, officials, and water education personnel. The first issue addressed groundwater remediation.

The National Institutes for Water Resources sponsors the *Water Science Reporter*. The NIWR is a coalition of the 54 institutes of the Water Resource Research program and includes the University of Arizona's Water Resources Research Center.

Limited free copies of the spring 1994 issue are available. For copies as well as information about the newsletter contact: Leslie Blair, New Mexico Water Resources Research Institute, Box 30001, Department 3167, Las Cruces, NM 88003; 505-646-4337.

Where to Find Water Expertise at State Universities in Arizona
Susanna Eden, Nicolle Lahr and Barbara Tellman. Where in Arizona can you find a German-speaking hydrologist who specializes in water harvesting in the Middle East, or a French-speaking ecologist knowledgeable about floods?

You might find what you are looking for in a new directory listing water experts at the three Arizona state universities. The directory provides information about areas of specialty, regions of geographic expertise and availability of the experts for various activities. The directory is fully cross-indexed and convenient to use. For either the free paperback version or the \$10 disk version, contact the Water Resources Research Center, University of Arizona, 350 N. Campbell Ave., Tucson, AZ 86721; 602-792-9591.

Arizona WET (Water Education for Teachers) Guide Liquid Treasure Water Artifacts Trunk

What was it like to live in Arizona during the 1800s? To explore and trap beaver along the San Pedro River as the early Mountain Men did? To fight the great 1885 and 1886 Phoenix fires as a member of The Bucket Brigade? Where did the early traders of Mesopotamia, India, and Egypt obtain the colors for their highly valued textiles of scarlet, gold, and blue? What do modern day Navajo weavers have in common with the Pilgrims of Plymouth Rock? How did ancient cultures call the rain?

The answers can be found in the *Arizona WET (Water Education for Teachers) Guide* and the *Liquid Treasure Water Artifacts Trunks*. The *Arizona WET Guide* is a collection of innovative water-related activities and lessons. Activities may span a single class or many days. All are hands-on, easy and fun to use. Through studies that focus on mathematics, social sciences, art, dance, drama, creative writing, storytelling, science, music and more, young people explore the importance of water. *Liquid Treasure Trunks* are packed with historic photographs, water artifacts and lesson plans. By studying Arizona's past, youth gain an appreciation and awareness of water's importance in today's society. The *Arizona WET Guide* is available for \$13.50, and *Liquid Treasure Trunks* are available on a loan basis. For information and/or materials contact Lin Stevens-Moore, WET Office, Water Resources Research Center, University of Arizona, 350 N. Campbell Ave., Tucson, AZ 86721; 602-792-9591.



Special Projects

Individuals and organizations involved in water-related studies, pilot projects and applied research are invited to submit information for this section.

Federal 104b Research Projects Funded

The University of Arizona's Water Resources Research Center announces recipients of grants supporting water-related research projects during FY 1993-94. WRRC receives approximately \$100,000 annually under the Water Resources Research Act, Section 104, a program administered nationally by the U.S. Geological Survey. Funds from the 104 project mainly are used to support water researchers at the state universities. Research topics are to focus on water issues of importance to Arizona. Following are brief descriptions of the funded projects.

Implications of Central Arizona Project Underutilization in Arizona and the Colorado River Basin

This project is in its second year of funding and is examining the legal, economic, and political implications of the decline in demand for CAP water, particularly by the agricultural sector, but also the lower than anticipated demand by the municipal and industrial sectors. The goal of the project is to identify strategies for mitigating the impacts of this underutilization and for repayment of CAP debt obligations. Possible strategies include the use of a linear programming model to develop options for agricultural use of CAP water, identifying the implications of CAP restructuring under various economic scenarios such as the conjunctive use of CAP and groundwater in irrigation districts, and to elaborate the legal issues raised by the underutilization of CAP water. Principal Investigators: Bonnie G. Colby and Paul N. Wilson, Department of Agricultural

Economics, and Robert J. Glennon, College of Law, University of Arizona.

Control of THM Precursors in Arizona's Canals and Reservoirs

Trihalomethanes (THMs) are formed when naturally occurring organic carbon compounds react with chlorine when used as a disinfectant in water treatment plants. THMs are carcinogenic and the Environmental Protection Agency has proposed to lower the standard for allowable levels of THMs. Surface waters generally have more THM levels than groundwater because of higher levels of organic compounds. The traditional method for lowering THMs is to modify the chlorination process in drinking water treatment plants. Alternatives range from halting the practice of prechlorination to adding carbon beds for adsorption of THM precursors, options which are often expensive. As an alternative, this project will examine the feasibility of modifying canal and reservoir management in Arizona to reduce the levels of THM precursors. Principal Investigator: Lawrence A. Baker, Department of Civil Engineering, Arizona State University.

Time Domain Reflectometry for Monitoring Water Use and Salinity in Turf

In Arizona, municipalities and other water users are turning to alternative sources of water for turf irrigation including Central Arizona Project water and treated effluent. There is a need to monitor the irrigation of these alternative water supplies to determine water-use efficiency and assess possible increases in salinity and decreases in groundwater quality. This project will utilize a new technique developed over the last ten years called Time Domain Reflectometry (TDR) to improve the measurement of water and salinity in soils. The basic TDR consists of a special oscilloscope, called a cable tester, connected to a soil probe consisting of three parallel stainless steel rods. An electromagnetic wave is sent down a coaxial transmission line to a soil probe. This technique can detect small changes in the water content of soil.

The project will compare vertical TDR measurements with both neutron probe readings and lysimetric readings at the Karsten Turfgrass Center, University of Arizona. Salt concentrations will also be monitored. Principal Investigators: Peter J. Wierenga and Michael H. Young, Department of Soil and Water Science, University of Arizona.

Water Resources Management of the Riparian Areas in the Upper Cienega Creek Basin, Arizona

The management of riparian areas is one of the most pressing water management issues facing the State of Arizona. By some estimates, over 90 percent of the free-flowing streams in the lower desert regions of Arizona have been lost in the last 100 years because of surface water diversions, damming, and groundwater pumping. The remaining habitats are important refuges for birds and wildlife and also perform important ecological functions. The Upper Cienega Creek Basin in southeastern Arizona contains prime riparian reaches as well as cienegas and marshes. This project, undertaken by a study team comprised of hydrology faculty members and students, will assess the surface water, hydrogeology, hydrochemistry and water policy relationships in this basin. Project objectives include developing groundwater flow and geochemistry models to determine the effects of various management policies on surface-groundwater interactions in the riparian reaches and developing appropriate water policy models to account for the various demands on these riparian reaches. Principal Investigators: L. Gray Wilson and Simon Ince. Other faculty participants are Nathan Buras, Don Davis, Martha Conklin, Thomas Maddock, Jr., Robert Mac Nish and Leo Leonhardt. All researchers are from the Department of Hydrology and Water Resources, University of Arizona.





Announcements

Water Information Network Up and Running

The Universities Council on Water Resources and the U.S. Geological Survey established the Universities Water Information Network. UWIN is a computer network to provide a forum for disseminating information within the water resources community. Services include: Expert directory, a listing of water resources experts that the user can search by name, areas of expertise, etc. (Water experts can request to be included by writing the UWIN office.); USGS WRSIC Database, a directory of abstracts of water resources research since 1967; and National Institutes for Water Resources Directory including NIWR publications directory and water resources information for the public directory.

If accessing UWIN through Internet using gopher client software, type "gopher gopher.c-wr.siu.edu" (regular version) or "xgopher gopher.c-wr.siu.edu" (Windows). Without gopher client software, type "telnet gopher.c-wr.siu.edu". Log in as "guest" and type "uwin" as a password. UWIN also can be accessed through a modem at 618-453-3324.

A brochure describing UWIN is available from Faye Anderson, UWIN, c/o OCOWR Headquarters, 4543 Faner Hall, Southern Illinois University, Carbondale, IL 62901; FAX 618-453-2671; email: Faye@uwin.c-wr.siu.edu

Arizona Riparian Council Sets Meeting

The Arizona Riparian Council Eighth Annual Meeting is to be held at the Phoenix Zoo, May 6-7. The Friday morning session will focus on riparian protection strategies, with technical papers presented in the afternoon.

Field trips to Arnett Creek and Pinto Creek will be offered Saturday, May 7. Contact Cindy Zisner, Arizona Riparian Council, Center for Environmental Studies, Arizona State University, Box 873211, Tempe, AZ 85287-3211; 602-965-2490.

Regulatory Takings is Boulder Conference Topic

Regulatory Takings and Resources: What are the Constitutional Limits? is the topic of the University of Colorado Natural Resources Law Center's June 13-15 conference. The conference will include an examination of the federal constitutional law of takings as defined by the U.S. Supreme Court. In particular, speakers will discuss takings cases

arising in the context of wetlands use, surface mining, public lands, water, and endangered species.

For additional information contact Kathy Taylor, Natural Resources Law Center, University of Colorado School of Law, Campus Box 401, Boulder, CO 80309-0401; 303-492-1288.

Arizona Hydrological Society Offers Scholarships

The Arizona Hydrological Society is awarding three \$500 scholarships to full-time students studying hydrology, hydrogeology or other water-related fields at any Arizona college or university. Juniors, seniors or graduate students are eligible. The award is based upon grade point average; letters of recommendation; application letter describing student's interest and career goals; financial need; and background in hydrology and water resource related activities. Application materials must be submitted by June 30 to Chairman of the Scholarship Committee, Dr. Aregai Tecle, Northern Arizona University, School of Forestry, P.O. Box 15018, Flagstaff, AZ 86001.

Public Involvement Report Available

A report titled *Public Involvement in Water Management* urges collaborative public involvement to create better, more durable water management and policy. Through such a strategy many water utilities, agencies and districts are bridging the gap between themselves and the public they serve. The 14-page report (publication #W94-15) is available for \$5 from Publications, Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO 81654-9199; 303-927-3851.

Arizona Water Resource is financed in part by sponsoring agencies, including:

Arizona Department of Environmental Quality

Arizona Department of Water Resources

Arizona Municipal Water Users Association

Central Arizona Water Conservation District

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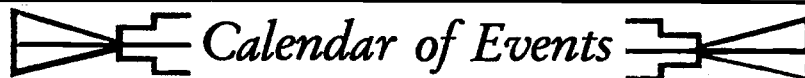
Tucson AMA Water Augmentation Authority

Tucson Water

USGS Water Resources Division

Water Utilities Association of Arizona

Their contributions help make continued publication of this newsletter possible.



Calendar of Events

RECURRING



Arizona Hydrological Society. 2nd Tuesday of the month, next meeting May 11. Meetings held at WRRC, 350 N. Campbell Ave., Tucson. Contact: Laurie Wirt 602-670-6231.

Arizona Water Resources Advisory Board. May meeting on the 2nd; June meeting not scheduled at this time. ADWR, BO44, 15 South 15th Ave., Phoenix. Contact: Beverly Beddow 602-542-1553.

Casa Del Agua. Hourly tours, Sundays noon to 4:00 p.m., 4366 North Stanley, Tucson. Contact: 602-791-4331.

Central Arizona Water Conservation District. 1st Thursday of the month, 12:30 p.m. CAP Board Room, 23636 N. 7th St., Phoenix. Contact: 602-870-2333.

City of Tucson Citizens Water Advisory Committee. 1st Tuesday of the month, 7:00 a.m. 310 W. Alameda, Tucson. Contact: Karen Alff 602-791-2666.

Phoenix AMA, GUAC. June 1, 9:00 a.m. ADWR, Phoenix AMA Conference Room, 15 S. 15th Ave., Phoenix. Contact: Mark Frank 602-542-1512.

Pima Association of Governments / Water Quality Subcommittee. 3rd Thursday of the month, 9:30 a.m. 177 North Church Avenue, Tucson. Contact: Gail Kushner 602-792-1093.

Pima County Flood Control District. 3rd Wednesday of the month, 7:30-9:30 a.m. Public Works Building, 201 North Stone, Tucson. Contact: Carla Danforth 602-740-6350.

Pinal AMA, GUAC. June meeting not scheduled. Pinal AMA Office, 1000 E. Racine, Conference Room, Casa Grande. Contact: Dennis Kimberlin 602-836-4857.

Prescott AMA, GUAC. May 23. Prescott City Council Chambers, 201 S. Cortez, Prescott. Contact: Phil Foster 602-778-7202.

Tucson AMA, GUAC. May 20. Tucson AMA offices, 400 West Congress, Suite 518, Tucson. Contact: Linda Stitzer 602-628-6758.

Yavapai County Flood Control District. 1st Monday of the month in Prescott; 4th Monday of the month in Camp Verde. Contact: YCFCD, 255 East Gurley, Prescott, 86301.

UPCOMING



May 11-13, **Drought Management in a Changing West—New Directions for Water Policy.** Portland OR. Contact International Drought Information Center, 236 Chase Hall, University of Nebraska, P.O. Box 830728, Lincoln, NE 68583-0728; 402-472-6707.

May 20, **Desert Horticulture 94.** Doubletree Hotel, 445 S. Alvernon, Tucson AZ. Annual conference for growers, suppliers, architects, and maintenance personnel. \$25 registration includes lunch. Contact Jimmy Tipton 602-621-1060.

June 6-17, **International Dam Safety, Operation and Maintenance Seminar and Study Tour.** American Water Foundation and others. Contact AWF, P.O. Box 480632, Denver, CO; 303-628-5516.

June 7-10, **The Fifth International Symposium on Society and Natural Resources Management.** Fort Collins, CO. Contact Jennifer Pate, College of Natural Resources, Colorado State University, Fort Collins, CO 80523; 303-491-6591.

July 17-22, **Second International Symposium on Artificial Recharge of Ground Water.** Orlando, Florida. Contact Ivan Johnson, SISAR Organizing Committee, 7474 Upham Ct., Arvada, CO 80003; 303-425-5610.

July 18-23, **Advanced Integrated Wastewater Pond Systems Workshop.** Designed for undergraduate instructors in civil and environmental engineering. No fee. Contact Dr. Albertson, Room 203 Weber Building, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523; 303-491-5753.

August 2-5, **The Universities Council on Water Resources Annual Conference.** Big Sky, Montana. Conference theme is "Environmental Restoration." Contact Larry W. Mays, Department of Civil Engineering, Arizona State University, Tempe, AZ 85287; 602-965-3589.

Sept. 11-14, **Conference of the Association of State Dam Safety Officials.** Boston, Massachusetts. Contact ASDSA, 450 Old East Vine St., 2nd Floor, Lexington, KY 40507; 606-247-5140.

Nov. 6-10, **American Water Resources Association Conference.** Chicago, Illinois. Featuring a National Symposium on Water Quality, a Symposium on the Future Quality of the Great Lakes, and a Symposium on the National Water Quality Assessment. Contact AWRA, 5410 Grosvenor lane, Suite 220, Bethesda, MD 20814-2192; 301-493-8600.

New Magma continued from page 1

with about 20 percent financed by private bonds.

Districts view meeting the private bond obligation as a repayment priority. The federal government is perceived to be a more accommodating creditor and more likely to negotiate flexible repayment terms. NMIDD has met its private bond obligations, but according to BuRec is in considerable arrears on its federal debt.

Arizona law defines an irrigation district as a political subdivision or a municipality. This municipal status affords the irrigation district special protection under federal bankruptcy law, relief that is unavailable in an "ordinary" bankruptcy. In general, in a municipal bankruptcy the debtor is permitted greater control over its affairs.

By declaring Chapter 9 bankruptcy the financially stressed NMIDD is seeking to restructure its debt to the federal government and possibly also its private bond debt. The intent is to protect its \$26 million investment. A likely strategy is to work out a payment plan that would reduce the debt without undermining the economic viability of the district and disrupting its operations.

Also, Chapter 9 entitles the district to the protection of a stay order which prevents creditors from taking any injurious actions against the debtor. In effect, this ensures that CAP water will continue to flow through NMIDD ditches. A significant alteration in the day-to-day operations of the district is not expected.

The larger issue, of which the NMIDD bankruptcy is part, is the ability of debt-burdened irrigation districts to purchase CAP water. Clearly Arizona's financial interest is served by agriculture's use of CAP water. The state pays less interest on its federal CAP debt if the system is serving agriculture.

The bankruptcy, however, demonstrates the precarious financial position of some of the irrigation districts. Important questions thus arise: To what extent should agricultural use of CAP water be encouraged? What, if any, actions should be implemented to support agriculture's purchase of CAP water? (Per a Governor's CAP Task Force recommendation, irrigation districts presently can purchase CAP water at a reduced rate.)

Another concern is that since an irrigation district is legally a municipality in Arizona, NMIDD's bankruptcy could hurt the credit rating of local government entities within Pinal County, possibly even in other areas of the state.

Also the bankruptcy of an irrigation district could lend support to those who claim that Arizona is unable to use its current allocation of CAP water. Nevada and California have argued that they could make better use of Colorado River water now allocated to Arizona.

Located within the Phoenix Active Management Area, NMIDD is northwest of Florence, near the boundary between Maricopa and Pinal Counties. The district includes some 27,000 acres, with 18,000 acres cropped in 1993.

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