



## Water on Legislative Back Burner

Water issues likely will take a back seat to tax cuts, education reform, and challenges to unfunded federal mandates in the 1995 session of Arizona's 42nd legislature. Among natural resource topics, air quality appears to be the top priority.

Some lawmakers speculated that the possibility of Democratic control of the governor's office following the November election caused Republicans to vigorously pursue their legislative agendas last year. Also, surprise over the Republican takeover of Congress has many re-evaluating their strategies regarding water quality and drinking water standards. As a result, there may be a dearth of major water legislation this year, as most legislators focus on other matters and take a breather to evaluate environmental and natural resource programs enacted in the last two years.

A legislative summary of water-related bills is found in the Legislation & Law section on page 6.

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*A Tucson plumber demonstrates some of the ways that incorrect installation of polybutylene pipes and fixtures can lead to leaks. (Photo by Kael Alford, WRRC.)*

## Leaks Plague Polybutylene Plumbing

A controversy regarding the use of polybutylene pipe (PB) raises concerns about its reliability and use. The problem is the pipes often sprout leaks, to the dismay of many Arizonans who have the pipes installed in their homes and now face unwelcomed plumbing bills.

To many homeowners the onslaught of the problem is sudden and unexpected. A plumber described the situation: "First you hear a bang, then there's a sudden drop in water pressure. Water then starts coming from pipes you didn't know existed, causing soggy floors or holes in ceilings that are destructive and expensive to repair."

Sufficient numbers of homeowners have shared this unnerving experience to provoke various lawsuits. Consumer complaints in Texas prompted the largest class action in U.S. history against the manufacturers of PB. This action resulted in a \$750 million settlement.

In Arizona, two lawsuits are pending in Maricopa County Superior Court to recover damages from PB manufacturers for Arizona homeowners with PB failure. One of the cases is a class action suit similar to the one filed in Texas.

Average costs for PB-related home repairs are about \$4,000, says Carl Triphahn of the Piping Industry Progress Education Trust, a contractor's organization in Phoenix. In some cases, homeowners are finding that homeowners insurance companies will either cancel their coverage when extensive damage is caused by PB or refuse coverage to homes piped with PB.

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*Polybutylene, continued from page 1*

PB is a flexible, easy-to-cut gray plastic that is put together with simple crimp connectors. Introduced in the late 1970s, PB has been used to pipe approximately six million homes in the U.S. While it is unclear how many homes in Arizona have PB, an estimated 80,000 Arizonans have had problems with PB. Homeowners often cannot determine what type of plumbing they have by inspection, as stubs to sinks and toilets generally use poly-to-copper connectors.

Despite the decidedly bad news associated with PB use, manufacturers and other defenders of PB piping insist the product on the market today doesn't deserve its bad reputation. Manufacturers of raw PB, including Shell Oil, Hoeschst Celanese Corp., and Dupont De Nemours, blame the bulk of leaks and ruptures on improper installation.

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*... another issue is whether chlorine deteriorates PB...*

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PB manufacturer spokesperson Carrie Chassin says, "The main problem has been at the joints. Some plumbers just took old brass fittings and used them for plastic — that's one piece of the puzzle." Chassin says the makers of PB piping have corrected problems with leaks.

PB manufacturers sponsor the Plumbing Claims Group (PCB) to replace plumbing for homeowners with leaking PB pipes. Despite manufacturers' assurances that PB is reliable, PCG uses only C-PVC, an indoor version of polyvinylchloride, a more rigid plastic piping with glued joints, in its repairs. Homeowners sign a binding agreement that releases the companies from further claims and requires repairs be done by plumbers chosen by PCG.

A contractor familiar with PB problems says ninety percent of all leaks are at joints in the piping. The contractor figures that about thirty percent of the problems at leaking joints are due to installation errors. Leaks occurring inside a line are almost always in hot water lines, sometimes in areas with no stress.

PB manufacturers have addressed joint problems with a new type of manifold design, which eliminates the use of T-joints and other traditional fittings used with copper and C-PVC pipes. Also known as the "manablock" system, the new design runs flexible 3/8 inch PB pipes from one common source to each fixture. Pipes are joined with a copper tube secured by two crimped copper bands to seal the connection.

Some contractors are not convinced that the copper bands are the solution to the problem. There have been complaints of leaking shutoff valves located at individual fixtures in the manifold system. Carl Triphahn says that the biggest failures in the new manifold design is that the PB tubing itself has been splitting.

Tom Sagau, Tucson City Council member and a plumbing contractor, disagrees. He claims the problems in the improved manifold system are the result of faulty fittings from improper installation. The new copper fittings are an

improvement over the old PB joints, said Sagau, but "crimpers need constant calibration to make sure [copper bands] are not too tight." If bands are crimped too snugly, excessive pressure on PB results and leaks are more likely to occur.

As debate continues about whether and to what extent faulty installation contributes to PB failure, another PB issue is getting attention — whether chlorine added to water supplies deteriorates PB causing weakness or holes in the pipes.

PB manufacturers contracted H.D.R. Engineering Inc., a Bellevue, Washington company, to study the effects of chlorine on PB joints. "There's been some evidence," says Steve Reiber of H.D.R., "that the acetal polymers that have been used to form some of the joint materials used with the plastic pipe, have a lack of resistance to some of the chlorine species common in distribution water systems."

Reiber found that "some forms of oxidants [e.g., chlorine] are more adverse than others and cause exfoliation that weakens the structure. Because [the joints] are under tension, it causes a leak." In other words, the pre-manifold PB joints, which were made from different plastics than the pipe itself, did deteriorate in the laboratory in the presence of chlorine.

Reiber says he has not looked at the susceptibility of the pipe to deterioration in the presence of chlorine. "To my knowledge, nobody has checked the pipe itself," he said.

Meanwhile, PB piping remains popular among many home builders because it offers savings of \$200 to \$600 per home compared to C-PVC and copper piping. PB piping is almost the exclusive material used in plumbing inexpensive tract houses and mobile homes. The piping itself is about half the cost of copper, but somewhat more expensive than C-PVC. Major cost savings come from lower installation costs — PB can be installed quickly by semi-skilled labor.

Some plumbers were attracted to PB because customers cannot do their own repairs. The crimping tool required to seal joints is difficult to find in stores or rental shops.

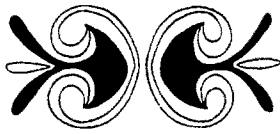
Several Arizona municipalities have become sufficiently wary of PB to ban its use in new construction. Glendale and Goodyear left PB out of their new 1994 plumbing codes, and Chandler has banned the piping.

"We have not used PB in our city system," said Tom Munding, a Tucson Water design supervisor, "because there were some settlements in California early on, and there have been other types of pipes we've been happy with." Polybutylene however was approved for private use in Tucson, and the City Council added it to the uniform plumbing code in 1991.

Caution seems to be the final word with regard to PB use. "When the stuff first came out in the 1970s, we had our doubts about it," said Wayne Bryant, a marketing representative for the Plumbers & Steamfitters Local 741 in Tucson. "It was a buyer beware type deal," Bryant says and he believes buyers still need to beware.

The following organizations can be contacted for more information about the PB piping issue:

Piping Industry Progress Education Trust	602-966-0377
Plumbing Claims Group	800-356-3496



## Water Vapors

Two readers wrote regarding stories in our last two issue. The article, "Replenishment Projects Moving Forward" states that "the Northwest Water Alliance, with cooperation from Tucson Water, is looking at recharge in the Santa Cruz River..."

Sharon Megdal, a consultant for Pima County, writes, "The article does not accurately report the situation. The project is not a Northwest Water Alliance Project. And noting Tucson Water the way you do overstates its role while giving short shrift to others."

The article is indeed misleading in that respect. The parties which initiated the cooperative effort are Pima County and the Metropolitan Domestic Water Improvement District.

John Korhonen, Manager of Environmental Restoration for Hughes Missile, took exception to our article, "Tucson Water Delivers TCE-Stripped Water." The article states that TCE was dumped down wells; Korhonen writes that the "industrial wastes were disposed of in trenches, unlined pits and drainage channels during the period from the early 1950s to the early 1970s. These methods were acceptable disposal practices during that time period. Many industries across the country used such practices during those years."

While we do not necessarily agree with the assertion that no TCE was put down wells, he is correct that these were acceptable disposal practices at the time. The article does not imply otherwise. Also, Korhonen wants it noted for the record that Hughes was not the only source of TCE contamination, and that Hughes Missile and the Air Force have been conducting a separate cleanup effort for the past decade.

Our article indicated that water entering the treatment plant had up to 5 parts per billion TCE, and that the

air-stripped water is delivered to some 25,000 persons. These numbers were from an erroneous summary of the project; actual TCE levels are around 22 parts per billion, with the water delivered to some 50,000 persons. We regret the errors.

### Water Crisis Redux Planned

Frank Walsh reportedly is working on an updated edition of his book, *How to Create a Water Crisis*. Apparently, Mr. Walsh believes some recent events support his thesis that western water shortages largely result from mismanagement, not aridity.

### Water Projects, Quakes Linked

The tragedy in Kobe, Japan illustrates the vulnerability of human-built structures to natural forces such as earthquakes and volcanoes. There is increasing evidence, however, that human activities, particularly large-scale water projects, can trigger earthquakes. Most induced earthquakes have been associated with the filling of reservoirs in previously quiet geological areas, but well injection also can trigger earth movements. A swarm of quakes in Colorado during the height of the Cold War apparently was triggered by injection of toxic waste from a defense plant into the ground. Whether groundwater overdraft can trigger ground movements more violent than subsidence is unclear; it also is difficult, if not impossible, to determine the additional impacts, if any, of reservoirs built in geologically active areas.

### Beau Rivage Update

An alert *AWR* reader on a junket to Vegas sent us more details and an artist's conception of the planned Beau Rivage Resort. As we reported last issue, the Beau Rivage is destined to be "the single most extravagant hotel" ever built on an artificial island in the middle of an artificial lake in the middle of a very real desert.

The lake is not merely incidental to the planned casino — it will define the resort experience. Visible from every room in the 46-story hotel, it will feature coves, beaches, waterfalls and lush tropical plants.

A 1,500-seat "water theater" will feature a show including precision water skiers, musically-scored pyrotechnics, and an underwater monster, all presented four times daily. And for a truly nautical experience, you'll be able to pilot a paddleboat out to the middle of the lake, where temperatures are projected to be 10 to 20 degrees cooler.

In an unrelated development, Nevada State Engineer Michael Turnipseed recently approved an application to divert water from the Virgin River for municipal and domestic purposes in Clark County. The water grant was based in part on a finding that "Las Vegas has made diligent efforts toward water conservation."

As always, your letters, faxes and e-mail on previous stories, new story ideas and calendar events are welcome.



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## News Briefs

### AHS Fines Water Testing Lab

The Arizona Department of Health Services (AHS) has fined Westech Laboratories of Phoenix \$282,900 for allegedly falsifying test results. The lab, which tests water quality for Flagstaff, Peoria, Scottsdale, and other Arizona municipalities, private water companies and school districts, was granted a provisional license to continue operating.

A spokesperson for AHS indicated that a two-month investigation revealed that contaminated samples sent to the lab were reported as safe, suggesting that Westech Labs either performed water quality tests improperly, or failed to perform them at all. Westech acknowledges it has had some record keeping problems, but denies that any tests were falsified. The company plans to appeal the fine at an administrative hearing on March 1.

AHS stressed that while a great deal of testing would have to be redone, there is no indication at this time that the drinking water provided by any of Westech's customers is seriously contaminated.

### Water Protection Fund Developing Guidelines

The Arizona Water Protection Fund Commission currently is developing guidelines for the Arizona Water Protection Fund grants program. The fund was established by the Arizona Legislature in 1994 to support projects that will enhance riparian areas (see Aug.-Sept. 1994 *AWR*, p. 1). The Commission administers a grants program of \$4 million this year, \$6 million next year, and \$5 million in subsequent years.

The statute establishing the Arizona Water Protection Fund requires the

solicitation of public comment regarding application guidelines. To fulfill this requirement the commission is distributing questionnaires to individuals, groups, and agencies requesting specific information concerning which areas of the state should receive project funding, what riparian habitat and associated natural resources should be protected, and what kinds of projects would be effective in protecting or restoring these resources.

In addition to questionnaires, public comments on these topics will be gathered at facilitated workshops tentatively scheduled for February and March. Written public comments also may be submitted directly to the commission for its consideration.

The commission will use information received from the public through the questionnaires, workshops, and written comments to develop draft application guidelines. Public hearings on the draft guidelines will be held prior to finalization.

For more information concerning the commission's activities and schedule contact Tricia McCraw of the Arizona Department of Water Resources at 602-417-2460.

### Tucson Sues CAP Treatment Plant Designer

The City of Tucson has filed suit against Carollo, Black & Veatch (CBV), a joint venture of engineering firms that designed and supervised construction of Tucson Water's CAP treatment plant. The lawsuit, filed November 8, alleges that "the plant, as designed and inspected by CBV, fails to comply with the intent of CBV's agreement with (the City) in almost every respect." The City further alleges that the contractors' negligence resulted in "substantial defects in the design and construction of the Plant," which has suffered from leaking concrete walls and other problems.

The treatment plant was shut down in October when flow through the CAP canal was temporarily halted for repair and replacement of siphons. It will remain shut down through 1995

pending the completion of studies to determine the best use for Tucson's CAP allocation. The City has maintained that the water produced by the plant meets all federal and state standards; however, corrosion and brown water had already caused the City to suspend deliveries of CAP water to most of its service area.

The lawsuit, which states that CBV has received over \$16 million from the City to design the plant and supervise its construction, does not specify damages. Negotiations with Carollo, Black & Veatch reportedly are continuing, with the City filing the lawsuit to stave off the statute of limitations.

### Committee Guides Wetlands Project

Tucson Water has appointed an Advisory Committee to help develop a constructed wetlands near its Roger Road Wastewater Treatment Plant. Backwash water from the treatment plant will be used to develop an experimental wetlands/recharge and wildlife habitat.

The project is a result of an out-of-court agreement with the Arizona Department of Environmental Quality, following alleged violations of state reporting and monitoring requirements (see June-July 1994 *AWR*, p. 6).

Committee members, which were chosen to represent organizations with interest in wildlife, recreation and education, are: Martin Karpiscak, UA Office of Arid Lands; Sarah Palmer, UA Life Sciences Department; Scott Richardson, Arizona Game and Fish; Jennifer Sprung, Pueblo High School; Lorna Taylor-Kreamer, Resource Center for Environmental Education; Barbara Tellman, UA Water Resources Research Center; Anne Warner, Society of Landscape Architects; and Richard Wise, the Larson Co.

Meetings to obtain public input will be scheduled in coming months. For additional information, contact Ralph Marra of Tucson Water, 791-2689; to be added to the mailing list for public participation, contact Rillito Consulting Group, 622-1933.

## 7-10 Group Faces Flow of Time and River

The Lower Colorado River Basin Technical Committee (aka the 7-10 Committee for its seven-state and 10-tribe membership) has agreed on a number of principles and needs, but may not be moving fast enough to stave off imposition of a federal solution. The group was formed to work out an alternative to the U.S. Bureau of Reclamation's draft plan for interstate leasing of Colorado River water (see June-July 1994 *AWR*, p. 1).

The committee has functioned as a forum to discuss problems and possible solutions to managing the Colorado River. Issues include interstate transfers, transfers including tribes, reservoir management, maintaining southern California's supply of Colorado River water, increasing supplies for southern Nevada, and reducing the vulnerability of Arizona's allocation to drought.

Seven meetings have been held since October, and Progress Report No. 2 has been issued. Nevertheless, some members feel that time may be running out. A BuRec official attending its most recent meeting on January 17 in Boulder City, Nevada, suggested that the federal government needs to see significant results soon.

## Reallocation an Exercise in Futility?

The Arizona Department of Water Resources' proposed reallocation of 66,000 a-f of M&I CAP water left many potential users disappointed (see October 1994 *AWR*, p. 1). But criticism voiced at a November 15th public meeting was restrained in part because, as Bill Chase of Phoenix said, "this water is virtually gone." The Central Arizona Project's proposed agreement with Interior would give the unclaimed M&I water to the U.S. as part of a settlement of CAP O&M costs. Even without that proposal it was speculated that Secretary Babbitt would take the water to settle Indian claims.

Despite this, there was general

agreement that the reallocation process was critical to establish the extent of demand and the value of the water. 51 applicants requested a total of 354,306 a-f. Based in part on those figures, ADWR estimates the value of the water to be \$1,080 per acre-foot. Beth Miller of Mesa (which "won" 13,765 a-f in the reallocation) noted it was important to "send a message to Washington" while a CAP spokesman asserted that the process would "show the strength of (CAP's) resolve."

The "losers" in ADWR's reallocation process were not silent, though. Ken Ritmer of Prescott Valley felt that ADWR was "ignoring rural areas," while Bill Chase argued for market mechanisms rather than ADWR's "command and control" allocation. Chase also noted that ADWR's decision to favor early demand overlooked the ability of users to put the water to immediate use.

In the end, ADWR Chief Rita Pearson wondered aloud whether the reallocation process would be put "on hold" while the CAP and the federal government finalized an agreement.

## CAP, Interior Move Closer to Settlement

Interior Secretary Babbitt's response to the Central Arizona Project's settlement proposal of November 3 appears to narrow the gap between the two parties over water allocation and debt obligations. Interior's counter-proposal seeks more water for settling Arizona tribal water claims and shifts some repayment obligations back to the CAP, while limiting CAP's capital obligation to \$2.047 billion.

The CAP had offered to allocate an additional 165,000 acre-feet of water, including 65,000 of M&I priority water, for federal purposes, which it claimed has a value of \$258 million. This would raise the total water reserved by the U.S. from 447,000 acre-feet to 612,000. Interior's position is that because the "water will be used within Arizona for the settlement of outstanding Indian water right claims, ultimately resolving the liability of

non-Indian interests within the State," the "concession is nonfinancial." The letter noted that the reallocation of water for federal purposes would relieve CAP of a portion of its capital and OM&R repayment obligations.

The counter-proposal seeks financial concessions from CAP that have a present value of \$56 million. These concessions include federal use of Hoover power through the year 2020 and payment of New Waddell interim costs as originally billed by the Bureau of Reclamation. In addition, CAP would forego all claims against the U.S. for siphon repairs and all other construction deficiencies.

Non-financial concessions sought by Interior include a first right of refusal to reallocate up to an additional 100,000 acre-feet of CAP water to resolve tribal claims, and the opportunity for tribes to participate fully in any interstate marketing agreements reached with regard to Colorado River water marketing.

## Initiative Seeks to Limit CAP Treatment Options

An initiative being circulated by a Tucson group calling itself Citizens Voice to Restore and Replenish Quality Water would ban direct chemical treatment and delivery of Central Arizona Project Water and groundwater recovered from a TCE cleanup plant to Tucson Water customers. The measure, which would be placed on Tucson's November 1995 city election ballot, would force the City to either recharge or use membrane filtration on Colorado River water.

The proposed Water Consumer Protection Act would limit the use of Colorado River water to sale, exchange, substitution for groundwater currently used for mining or agricultural purposes, landscape irrigation, or recharge. Direct municipal use would be allowed only after treatment which reduced salinity, hardness and dissolved organics to levels of groundwater from the City's Avra Valley well field.

Circulators must gather 11,000 valid signatures by July 6.



## Legislation & Law

*Key legislators, legislative aides, agency representatives and lobbyists were interviewed on possible water-related legislation in the upcoming session. The following summarizes their observations:*

### 1995 ADWR Omnibus Water Bill

The Arizona Department of Water Resources' annual bill contains numerous technical corrections to existing water laws. Nothing considered controversial or substantive is ever included. This year's bill is no exception.

### Water Rights Adjudication

#### Streamlining

Legislation to expedite the process of adjudicating 77,000 claims by 27,000 parties to the waters of the Little Colorado and Gila Rivers is being introduced. A Joint Select Committee on Arizona General Stream Adjudications has recommended statutory changes to hasten the settlement of water rights for the majority of claimants (see Aug.-Sept. AWR, p. 6).

The changes mainly would affect small or "de minimis" water users, which make up a majority of the total claimants, but involve a relatively small fraction of the waters of these rivers.

Two bills have been introduced. HB 2250 is a basic version; HB 2276, the version currently being pushed, contains what one legislator described as "bells and whistles" for mines, cattle growers, and the Salt River Project.

Other major amendments are possible. There has been discussion of allowing non-lawyers to represent claimants and doing away with the special master's position, both because some feel that the adjudication's main purpose has become to assure full employment for water lawyers.

### Colorado River Water Banking

A bill to establish an Arizona water bank to allow marketing of Arizona's unused Colorado River water alloca-

tion has been much-discussed (see June-July 1994 AWR, p. 1). Republican take-over of Congress appears to have temporarily slowed momentum.

### Son of Proposition 300

The governor and legislative leaders are discussing some form of a private property rights bill that could limit regulatory actions of the Departments of Water Resources and Environmental Quality. Voters soundly defeated Proposition 300 in the November election, so any bill likely would deviate significantly from the proposition. There is some discussion of merely codifying certain court decisions regarding regulatory "takings."

### State Primacy over Clean Water Act

Arizona reportedly may attempt to claim primacy over the federal government in enforcing the Clean Water Act. Right now, the Clean Air Act has a higher profile with legislators, but some lawmakers have noted that there are greater potential costs in meeting proposed Clean Water and Drinking Water standards.

### Water Company Costs Pass-through

The Water Utilities Association of Arizona (WUAA) is pushing HB 2137, which would force the Arizona Corporation Commission (ACC) to allow a surcharge pass-through to recover costs over which private water companies claim they have no control, including: energy costs; wholesale water costs; phone and postage rates; costs of compliance with EPA drinking water standards; and taxes and assessments. While opposed by the ACC, the bill reportedly is being supported by the Central Arizona Water Conservation District, the Arizona Department of Water Resources, and the Arizona Department of Environmental Quality.

### Definition of Small Water Provider

A second WUAA-supported bill would redefine small water providers, over which the Arizona Department of Water Resources has relatively limited regulatory powers, to those using 2,500 acre-feet of water per year or less. The definitional limit was raised last year

from 100 acre-feet to 250; 2,500 acre-feet is enough supply for the municipal needs of up to 20,000 persons. Such a definition would cover nearly all currently regulated municipal water providers. The Arizona Department of Water Resources is strongly opposed.

### San Pedro Water Management Bill

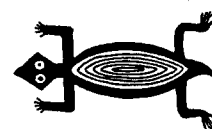
This bill would create a management entity with less regulatory power than an Active Management Area but more than an Irrigation Non-expansion Area to protect the San Pedro River while allowing economic growth. The proposal calls for a 9-member commission appointed by the governor.

The legislative effort, being championed by Senator Arzberger of Willcox, received a hostile reception at a public hearing in Sierra Vista. Many local and individual well owners are resisting any regulation, in part because they fear greater regulation in the future. Arzberger reportedly is considering letting local residents vote on creating a management district with an elected commission.

### Riparian Protection Legislation

The Riparian Area Advisory Committee (RAAC), which was created by the legislature last session, has issued a report to the Legislature making recommendations to: set a state policy of protecting riparian areas; establish a mechanism to promote local planning of prime riparian areas; establish a coordinating council of representatives of the departments of Water Resources, Environmental Quality, and Game and Fish to assist in these planning processes; and fund an economic analysis of additional RAAC recommendations and reconstitute RAAC to make final recommendations in January 1996 based on that analysis.

Other RAAC recommendations range from a new tax category for environmental preservation to powerful tools for conjunctive water management where local plans call for such tools. It is not clear whether anyone will be pushing for the legislation.





## Guest View

*Pity the competent, hard-working technocrat, struggling to serve society despite the interference of lawyers and politicians!*

*Such frustrations have moved Herman Bower, Chief Engineer of the U.S. Water Conservation Lab in Phoenix, to submit the following Guest View on Arizona's ongoing struggle to distinguish surface water from groundwater.*

### Surface Water, Groundwater, and Subflow — The Legal Nexus & the Hydrologic Connection

To the technical person, the distinction of "subflow" as a special part of groundwater (June/July 1994 *AWR*, p. 6) is mind boggling to say the least. Groundwater is one continuum that occurs in strata of different hydraulic conductivity underlain by bedrock or other impermeable formation. In dry climates, natural groundwater recharge from the land itself is very small (about one percent of precipitation, or on the order of 1 mm/year).

The main source of groundwater then is seepage from losing streams (ephemeral or perennial) in valleys or on alluvial fans (mountain front recharge). So, essentially all groundwater at one time was streamflow and became subflow. This raises the question of where does subflow end and "normal" groundwater begin? Or must subflow be legally divided into upper, middle, and lower subflow? And what about groundwater in buried valleys or ancestral streambeds? Is that "old" subflow? The subflow concept smacks like the legal distinction between percolating water and underground streams developed a number of years ago, which prompted Coogan<sup>1</sup> to state:

The law — a formal set of rules by which society is ordered — seems to the physical scientist a strangely confusing and confused tool with which to define, even in a social context, the parameters and limits of a physical continuum. For example, on the basis of attorneys' briefs bolstered even by expert testimony, judges have legally defined "subterranean streams" and erected criteria for recognizing such streams that sound more like the rhetoric of Humpty Dumpty than a description of a body of water one could scoop up in a bucket, or upon which one could float a rubber raft.

The main issue in surface water and groundwater adjudication is how groundwater pumping affects streamflow. Regardless of what the legal profession makes of it, this is a hydrologic issue that can be resolved by hydrologic analysis.

In general, groundwater pumping will diminish streamflow when groundwater levels are relatively high. For gaining streams to which groundwater is tributary, groundwater pumping will reduce streamflow by the proverbial cup of water for each cup pumped from the aquifer. For losing streams with clean bottoms (no clogging deposits), increased groundwater pumping will cause a linear increase in seepage losses from the stream because seepage flow will be primarily horizontal (if groundwater levels are fairly high) and controlled by the slope of the water table.

On the other hand, seepage losses will not significantly increase with increased pumping of groundwater if groundwater levels are so low that the seepage flow already is mostly vertical and controlled by gravity. In addition, if stream bottoms and banks are covered by a layer of fine sediment or other clogging material (including biofilms and other products of biological activity) that control seepage losses and produce downward unsaturated flow below the stream, seepage already is independent of depth to groundwater (assuming the water table is at least three feet below the stream bottom). Further lowering of groundwater levels then will not produce higher seepage losses from the stream.

These concepts are general and must be refined for specific situations. Hydraulic conductivity profiles and vertical as well as horizontal flow components need to be considered in determining effects of groundwater pumping on streamflow. Mathematical solutions based on horizontal-flow models like those by Jenkins<sup>2</sup> can be used only where underground flows are predominantly horizontal (e.g., shallow groundwater, thin aquifers, and streams that completely penetrate to bedrock or other impermeable boundary). These are not "typical" Arizona conditions. Groundwater models offer the best hope to rationally assess the effect of groundwater pumping on streamflow (Sobczak and Maddock<sup>3</sup>).

Surface water-groundwater relations and the effects of groundwater pumping on streamflow are hydrologic issues best left to the hydrologist or engineer. As Coad<sup>4</sup> wrote:

Engineers must take a leadership role. We shouldn't look to legislators, litigators, and economists to tell us what to do. They'll give us nontechnical solutions to technical problems. This will lead to chaos.

1. H.A. Coogan. Problems of groundwater rights in Ohio. *Akron Law Rev.* 9(1): 34-115, 1975.
2. C.T. Jenkins. Techniques for computing rate and volume of stream depletion by wells. *Ground Water* 6(2): 37-46, 1968.
3. R.V. Sobczak and T. Maddock III. Confusion where ground and surface waters meet: Gila River General Adjudication, Arizona and the search for subflow. HWR No. 94-030, Dept. of Hydrology and Water Resources, University of Arizona, Oct. 1994.
4. W. Coad. *Ground Water Market Trends*, Newsletter of the Association of Ground Water Scientists and Engineers. Oct.-Nov. 1994, 5(11), p. 9.



## Publications

### **Water Resources Administration in the United States: Policy, Practice & Emerging Issues**

Martin Reuss, editor. The essays in this book are based on selected papers presented at the National Forum on Water Management Policy held in Washington, DC, from June 28 to July 1, 1992, and organized by the American Water Resources Association. The essays, many revised and updated, offer the perspectives and expertise of leaders in the development and implementation of water policy. Representatives come from local, state, and federal institutions. The book costs \$32; \$40 for AWRA non-members. To order write: American Water Resources Association, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; phone: 301-493-8600; fax: 301-493-5844.

### **The High Country News Water Reader**

A comprehensive text available for classroom use. Chapters are HCN water articles and include such topics as: history and background; hydro-electric dams and the salmon crisis; Native American water issues; jurisdictional disputes; and innovations in water allocation and management. Water Readers are \$27 for the first copy and \$22 for each additional student copy, with discounts available for large classes. For more information call: 800-905-1155 or write: Water Readers, HCN, P.O. Box 1090, Paonia, CO 81428.

### **Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management**

This conference, sponsored by the School of Forestry at Northern Arizona University, brought together scientists and managers from federal, state and local agencies, along with private-sector interests, to examine key concepts of sustainable ecological systems, and their application. A plenary session established the philosophical and historical contexts for ecosystem management. Limited copies of the conference transcript are available from the U.S. Forest Service, 240 West Prospect Road, Fort Collins, CO 80526. Copies also available at U.S.F.S. offices and public document libraries.

### **Irrigation of Ineligible Lands, Bureau of Reclamation**

This July 1994, U.S. Department of the Interior audit states that farmers taking more water than they were entitled to between 1984 and 1992 cheated American taxpayers out of as much as \$46 million. The farmers depleted rivers by taking water to irrigate 154,000 acres, mostly in Washington and Oregon. The audit report No. 94-I-930 is available from the Assistant Inspector General for Administration, Office of Inspector General, U.S. Department of the Interior, Washington, D.C. 20240.

### **CAP Water Salinity Impacts on Water Resources of the Tucson Basin**

This October 1994 report prepared by the Pima Association of Governments evaluates the potential impacts of Central Arizona Project water total dissolved solids (TDS) levels on water resources in the Tucson basin. The report contains projections of TDS levels in Tucson's potable water and wastewater supplies, and evaluates potential impacts of the TDS levels on wastewater treatment facilities, wastewater reuse, and artificial recharge projects.

The report concludes that elevated TDS levels in CAP water will not significantly impact wastewater treatment facilities or recharge projects. Wastewater derived from CAP water will be suitable for irrigating most crops and landscape plants. Some plants, however, will not tolerate the higher salinities, and special management practices may be needed for others.

### **PAG Water Quality Documents: Summaries and Information Index**

Published annually by the Pima Association of Governments, this descriptive index covers all reports produced by or for PAG that contain water-quality, hydrogeologic, and land-use information useful for environmental assessments. The November 1994 edition contains an outline and brief summary for each of the 46 reports listed. The information also is contained in a DBASE III Plus database system, located in PAG's Water Quality section. For information on receiving a copy, or access to the database, contact Greg Hess at 602-792-1093.

*The following three items are from the U.S. Environmental Protection Agency's National Center for Environmental Publications and Information. To order, contact: National Center for Environmental Publications and Information, 11029 Kenwood Rd., Bldg. 5, Cincinnati, OH 45242; fax: 513-891-6685.*

### **Designing a Water Conservation Program**

An annotated bibliography of source materials. (USEPA document 832-B-93-003)

### **Combined Sewer Overflows in Your Community**

A full-color fold out poster showing the effects of combined sewer overflows. (USEPA document 832-F-93-003)

### **A State and Local Guide to Environmental Program Funding Alternatives**

This pamphlet provides an overview of traditional funding mechanisms and introduces innovative alternatives to traditional government funding. The focus is on nonpoint source pollution, but funding sources and mechanisms can be applied to environmental programs in general. (USEPA document 841-K-94-001)







## Transitions

**T.C. Richmond** has resigned as Chief Legal Counsel for the Arizona Department of Water Resources effective January 13. She and her family will be returning to Washington state, reportedly in May "before it hits 100" in Tucson.

Director **Rita Pearson** has appointed **Michael J. Pearce** as new Chief Legal Counsel. Pearce is a graduate of the University of Michigan and the University of Arizona College of Law and was a partner in the Phoenix firm of Carson, Messinger, Elliott, Laughlin & Ragan before joining ADWR's legal division five years ago.

Governor Symington has appointed the initial Ground Water Users Advisory Council for the newly created Santa Cruz Active Management Area. The five members are: **John Ellinwood**, attorney, of Tubac; **Ron Morriss**, Pima County Supervisor; **Bill Oliver**, project manager for Rio Rico Properties; **Duke Petty**, Nogales alderman; and **Sherry Sass** of Tubac, co-founder of the Friends of the Santa Cruz River.

The GUAC is charged with advising Placido Dos Santos, director of the Santa Cruz AMA, on groundwater management policies and issues.

**Kathy Jacobs**, Director of the Tucson Active Management Area, Arizona Department of Water Resources, has been named to a special National Research Council committee to study approaches to assessing the future economic value of groundwater and the economic impacts of polluting aquifers. The special 12-member committee, formed under the NRC's Water Science and Technology Board, will conduct a two-year study funded by the National Water Research Institute and the U.S. Environmental Protection Agency.

**Larry Linser**, Deputy Director of Engineering and Adjudication for ADWR, announced he will retire in March to assume the position of vice president and manager of the Phoenix office for Bookman Edmonston Engineering. The position recently was vacated by **Sid Wilson** (see below).

Linser joined ADWR in 1973 after working for the California Department of Water Resources for 14 years. No replacement has been named, and there is some speculation that the position may be redefined or eliminated.

**Sid Wilson** has been named general manager of the Central Arizona Project. Wilson succeeds **Tom Clark**, who retired in December.

Prior to his appointment, Wilson served for four years as vice president of Bookman Edmonston Engineering's Phoenix office. Prior to that, he worked for more than 20 years for the Salt River Project, most recently as associate general manager of the Water Group.

Four newcomers and one incumbent were elected to represent Maricopa County on the 15-member Central Arizona Project board of directors. Winners include: **William P. Mahoney, Jr.**, former U.S. ambassador to Ghana; **George Campbell**, former Maricopa County supervisor; **Rebekah Friend**, a student at Ottawa University; **William Perry**, a cotton farmer; and **George Renner**, former Glendale mayor.

Directors whose terms expire at the end of 1994 and who did not seek reelection are **Thomas N. Fannin**, **Marvin Andrews**, and **Webb Todd**.

Five CAP board members are elected every two years, to six-year terms. Members from Pima and Pinal counties will be elected in 1996.

**Grady Gammage, Jr.** was elected to a two-year term as president of the CAP board. Also elected were vice president **Marybeth Carlile** and secretary **George Renner**.

Voters elected three new members to the Metropolitan Domestic Water Improvement District board in November. **Martha Cramer** is a captain in the Pima County Sheriff's department; **James Doyle** is Assistant Superintendent, Pima County Wastewater; and **Barbara Johnson** is a civil engineer and technical support manager for Pima County Development Services.

**Susan R. Bolton** has been assigned acting judge for the Gila River adjudication, replacing **Stanley Z. Goodfarb**. The Arizona Supreme Court assigned Judge Bolton after soliciting recommendations from adjudication parties.

**American Rivers** has closed its Phoenix office, which had been run by **Gail Peters**. The not-for-profit organization opened a Tucson office last summer. That office, managed by **Dale Pontius**, will remain open.

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

**Arizona Department of Environmental Quality**

**Arizona Department of Water Resources**

**Arizona Hydrological Society**

**Arizona Municipal Water Users Association**

**Central Arizona Water Conservation District**

**Salt River Project**

**Tucson Water**

**USGS Water Resources Division**

**Water Utilities Association of Arizona**

Their contributions help make continued publication of this newsletter possible.



## Announcements

### AWWA Sponsoring Safe Drinking Water Teleconference

The American Water Works Association is sponsoring a national satellite teleconference March 9 on "Safe Drinking Water: Critical Choices for Utilities and Public Officials." Four downlink sites in Arizona are being hosted by the Arizona Water and Pollution Control Association at: Phoenix Fire Training Academy, 2430 S. 22nd, Phoenix, AZ 85009; Tucson Fire Academy, 797 E. Ajo Way, Tucson, AZ 85713; Yavapai College, 1100 E. Sheldon, Bldg. 3, Prescott, AZ 86307; and Yuma Fire Department Classroom, 298 4th St., Yuma AZ 85364. The \$25 conference registration fee includes refreshments and a participant manual. The conference is aimed at water utility owners and managers and public officials. For more information or to register by phone, call Heide Burbach, AWWA Training Program Coordinator, 800-559-2885. The registration deadline is February 23.

### Tucson AMA Seeks Conservation Assistance Project Proposals

The Department of Water Resources, Tucson Active Management Area, is accepting applications for funding for conservation assistance projects which will benefit the AMA. The Department will consider applications for funding in the following categories: information and education, agriculture, municipal and industrial. Funding available for 1995 is estimated at \$150,000. Applications must be received by April 28. For further information on the Program, to request a 1995 grant application packet, or for assistance in preparing an application, contact Christina Kuranz at 602-628-6758.

### Attention Elementary School Teachers

The International Office of Water Education in Logan, Utah sponsors an annual Water Education Poster Contest open to all K-6 students in various western states including Arizona. The theme of this year's competition is "The Power of Water." First, second, and third place winners will be selected from each state, with two then chosen to have their work featured in the 1995-96 Water Education Calendar. For more information and entry forms contact: Lin Stevens, Water Resources Research Center, The University of Arizona, 350 N. Campbell Ave. Tucson, AZ 85721; 602-792-9591.

### Arizona-Nevada Academy of Science Hydrology Section to Meet

The Annual Meeting of the Arizona-Nevada Academy of Science will be held on Saturday, April 22, 1995 on the campus of Northern Arizona University, Flagstaff, AZ, starting at 8:00 a.m. The Hydrology Section has issued a call for papers to be presented at the meeting. The Section is especially interested in encouraging the publication of new professionals in the broad area of hydrology and water resources and plans this year to devote a portion of the day-long event to papers submitted by university students and those who have completed their formal studies within the last five years.

Abstracts must be received by either session co-chair by February 17 to be accepted and published in the *Proceedings of the Academy*. Abstracts submitted after February 17 but before April 10 will not be published by the paper but will be considered for inclusion in the program. For further information, contact either Dr. Charles C. Avery at 602-523-6632, fax 523-1080, or Dr. Malchus B. Baker at 602-556-2001.

### Graduate Student Sought for Virgin River Study


The Southern Utah Wilderness Alliance seeks a master's level student or recent graduate interested in doing six months of focussed study on the Virgin River in southwestern Utah and northwestern Arizona. Applicants should have an understanding of hydrology/water resources and resource economics. The project involves research and analysis for determining \$/acre-foot costs of conservation, re-allocation, and new dam construction in the Washington County Water Conservancy District.

The successful applicant must reside in southwestern Utah (Cedar City or St. George) and will be paid about \$1,000 per month. A well-qualified student seeking a thesis topic or a recent graduate looking to get a foot in the environmental movement may find this offer attractive. Send resume and letter of interest to Southern Utah Wilderness Alliance, 1471 S. 1100 East, Salt Lake City, UT, 84105. For further information, contact Ken Rait at the above address or at 801-486-3161, fax 801-486-4233.


### Change of Address and a New Acronym Too

U.S. Fish and Wildlife Service Phoenix office has moved to 2321 W. Royal Palm Rd. #103, Phoenix, AZ 85021. Phone: 602-640-2720. fax: 602-640-2730.

The Soil Conservation Service (SCS) has changed its name to Natural Resource Conservation Service (NRCS).



## Calendar of Events



### RECURRING



**Arizona Hydrological Society (Phoenix).** Feb 14, 7:30 a.m. Salt River Project cafeteria, Phoenix. Contact: Rich Petrus 602-966-2337.

**Arizona Hydrological Society (Tucson).** 2nd Tuesday of the month, 7:30 p.m. WRRC, 350 N. Campbell Ave., Tucson. Contact: Laurie Wirt 602-670-6231.

**Arizona Water & Pollution Control Association.** Monthly luncheon series. Topic: An Overview of the Water Resources Research Center. Feb 21, 11:45 a.m. Reservation deadline: Feb 17. Ramada Downtown, 475 N. Granada, Tucson. Contact: Brad Jurkovic 602-791-2544.

**Arizona Water Protection Fund Commission.** Feb. 16, 10:00 a.m. Nogales. Contact: Trish McCraw 602-417-2400.

**Arizona Water Resources Advisory Board.** Feb. 10, 10:00 a.m. ADWR, 500 N. 3rd St., Phoenix. Contact: Beverly Beddow 602-417-2440.

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

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

**Maricopa Association of Governments / Water Quality Advisory Committee.** Next meeting to be announced. Contact: Ilene Miller 602-254-6308.

**Maricopa County Flood Control Advisory Board.** 4th Wednesday of the month, 2:00 p.m. 2801 W. Durango. Phoenix. Contact: 602-506-1601.

**Phoenix AMA, GUAC.** Feb. 2, 9:30 a.m. 500 N. 3rd Street, 3rd floor, Phoenix. Contact: Mark Frank 602-417-2465.

**Pima Association of Governments / Water Quality Subcommittee.** 3rd Thursday of the month, 9:30 a.m. 177 N. Church St., Suite 405, Tucson. Contact: Gail Kushner 602-792-1093.

**Pima County Flood Control District Advisory Committee.** 3rd Wed. of the month. Feb. 15, 7:30-9:30 a.m. 201 North Stone Street, Tucson. Contact: Carla Danforth 602-740-6350.

**Pinal AMA, GUAC.** Feb. 16, 1:30 p.m. 1000 E. Racine, Casa Grande. Contact: Dennis Kimberlin 602-836-4857.

**Prescott AMA, GUAC.** Feb. 13, 10:00 a.m. 2200 E. Hillsdale, Prescott. Contact: Phil Foster 602-778-7202.

**Santa Cruz AMA, GUAC.** Feb. 2, 9:00 a.m. 857 W. Bell Rd., Ste. 3, Nogales. Contact: Placido Dos Santos 602-761-1814.

**Tucson AMA, GUAC.** Feb. 17, 9:00 a.m. 400 W. Congress Ste. 518, Tucson. Contact: Kathy Jacobs 602-628-6758.

**Verde Watershed Association.** Feb. 6, 7:00 p.m., Clarkdale Memorial, ladies lounge. Contact: Tom Bonomo, VWA Newsletter Editor, c/o Verde R.D., P.O. Box 670, Camp Verde, 602-567-4121.

**Yavapai County Flood Control District Board of Directors** 2nd Monday of the month in Prescott, 255 E. Gurley St.; 4th Monday in Cottonwood, 575 E. Mingus. Contact: YCFCD, 255 East Gurley, Prescott, 602-771-3196.

### UPCOMING



**Feb. 16-18, Environmental and Natural Resources Law Conference.** Three half-day seminars at the Radisson Resort Scottsdale, 7171 N. Scottsdale Rd., Scottsdale, AZ. All programs run from 8:30 a.m. to noon. \$80 per seminar for members, \$100 for others. Contact State Bar of Arizona, 111 W. Monroe, Ste. 1800, Phoenix, AZ 85003-1742, 602-340-7322 (Phoenix) or 602-271-4930 (Tucson).

**February 21, Performing Phase I Environmental Inspections.** Sponsored by the Environmental Assessment Association. The Hilton Tucson East, Tucson Arizona. \$195 for members, \$225 non-members. Contact EAA, 8383 E. Evans Rd., Scottsdale, AZ 85260, 602-483-8100; fax 602-998-8022.

**March 2-5, 3rd Annual Celebration of Desert Cultures.** Hosted by the International Sonoran Desert Alliance. Caborca, Sonora. Conference will cover cultural preservation, sustainable development, and conservation along the U.S.-Mexico border. Contact Arizona Historical Society 602-628-5695 or Wendy Laird, Sonoran Institute 602-290-0828.

**March 9, Safe Drinking Water: Critical Choices for Utilities and Public Officials.** National satellite teleconference hosted by the Arizona Water and Pollution Control Association: Phoenix, Tucson, Prescott, and Yuma. \$25 fee includes refreshments and manual. Contact Heide Burbach, AWWA Training Program Coordinator, 800-559-2885.

*Announcements, continued from page 10*

## Calls for Papers, Abstracts

The Association of State Dam Safety Officials is calling for abstracts for its 12th annual conference. Single-spaced abstracts and biographical sketches of all authors should be submitted by March 1, 1995. ASDSO also seeks nominations for its Regional Merit Award given to individuals, companies, organizations, municipalities, or other entities working in the dam safety field that have made outstanding contributions to dam safety on a regional level. Nominations should be postmarked by June 15, 1995.

For more information contact: Association of Dam Safety Officials, 450 Old East Vine Street, 2nd Floor, Lexington, KY 40507; phone: 606-247-5140 or fax: 606-323-1958.

The "Interdisciplinary Conference on Animal Waste and the Land-Water Interface," July 16-19, announces an extension of its deadline for poster abstracts. Abstracts will be accepted and reviewed for approval in the order received until February 15, 1995, or until all poster slots are filled. Abstracts must not exceed 750 words and should include the authors' names, affiliations, addresses, phone numbers, and fax numbers, along with a title. Abstracts can be submitted by mail or fax to Arkansas Water Resources Center, University of Arkansas, 113 Ozark Hall, Fayetteville, AR 72701; Phone: 501-575-4403; Fax 501-575-3846.

## Rural Water Company Seeks Manager

Doney Park Water, a rural water cooperative in north-central Arizona, near Flagstaff, is seeking a general manager to supervise personnel and operations of the cooperative. DPW has a certificated area of 44 square miles and serves approximately 2,000 customers. Requirements are Water Treatment/Distribution Operator Certification of at least Level 3 from the Arizona Department of Environmental Quality and a degree in engineering and/or business administration, or equivalent. Deadline for applying is February 28. Qualified applicants should send resume or letter of inquiry to: GM Selection Committee, Doney Park Water, 7161 N. Highway 89, Flagstaff, AZ 86004.

## CSU Seeks Earth Resources Head

The Department of Earth Resources, College of Natural Resources, Colorado State University is seeking applications and nominations for a department head. Applicants should have a Ph.D., an acknowledged national and international reputation in research, and qualifications sufficient for tenure at the rank of professor in the Department of Earth Resources. Nominations and applications, including curriculum vitae, statement of academic philosophy, and names of five references, should be submitted by February 28, 1995, to: Dr. Charles Grier, Search Committee Chair, 102 Natural Resources, Colorado State University, Ft. Collins, CO 80523.

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