ARIZONA
WATER RESOURCE

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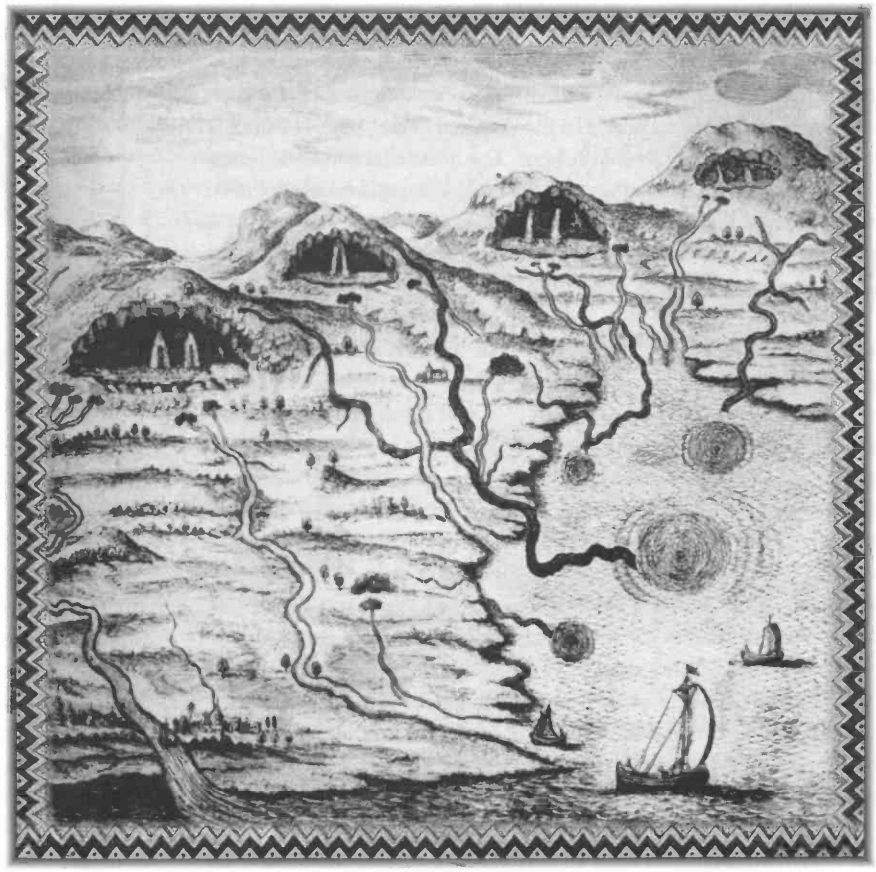
Understanding Groundwater: Ancient History and Today

The presence and movement of groundwater puzzled early scientists. Up to the Renaissance, many believed that holes on the ocean floor connected to underground brooks. The theory is deftly illustrated by Athanasius Kircher (1651-1680) in his book, "Mundus Subterraneus." His illustration (right) shows water seeping through the sea floor (resulting in whirlpools on the surface) and flowing through subterranean caverns to fiery underground chambers where the salt water is vaporized and condensed as freshwater within mountains. The desalinated water issues forth as springs and rivers, to return to the sea.

Nowadays groundwater hydrology is better understood, but managing groundwater still poses problems and challenges. The Governor's Water Management Commission has been meeting for over a year to develop recommendations for improving the way Arizona manages its groundwater resources.

The University of Arizona's Water Resources Research Center is sponsoring a Nov. 13 conference in Phoenix to discuss the work of the Governor's Commission. See side bar on the following page for conference information.



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Governor's Water Management Commission Ponders Replenishment

Can compromises plug holes in the bucket?

Early in the Governor's Water Management Commission's review of the Arizona Groundwater Management Act it was noted that the "bucket had holes in it." This was the metaphor of choice adopted by participants who believed that various legal exemptions in the GMA allowed unrestricted groundwater pumping. They said such exempted pumping undermined the GMA goals of the Active Management Areas, particularly safe yield in the Phoenix, Tucson and Prescott AMAs

Further, some participants perceived inequities within and among water use sectors—municipal, industrial and agriculture — with not all contributing equally to safe yield. Not only did the bucket leak, but to change the metaphor, the playing field was not level.

The GWMC had its work was cut out for it. Established to note the deficiencies and shortcomings of the GMA, the commission was to develop recommendations to improve the workings of the law. Clearly an issue of importance to the commission

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Groundwater Commission...continued from page 1

would be to ensure that all water use sectors of the state better share the burden of preserving the state's groundwater resources. Making sure that everyone plays by similar rules meant changing the rules.

GMA rules pertaining to replenishment stood out as possibly needing to be changed. The GMA stipulates replenishment as a strategy to help achieve safe yield. In other words, water users would replenish the groundwater supplies they use. Not all water users, however, are bound by the replenishment requirement. In fact, only the municipal sector, in response to the Assured Water Supply Rules, is subject to mandatory replenishment. The industrial and agricultural sectors can use groundwater without replenishing. And even within the municipal sector, the replenishment requirement is not evenly applied, as is evident from the operations of designated and undesignated water providers.

An undesignated water provider is without a designation of assured water supply. If the customer base of such a provider is not growing, the utility can continue to pump groundwater, without committing to renewable supplies. If a new subdivision is built in the provider's service area, the subdivision's landowners must pay to replenish groundwater, while the provider's existing customers continue to receive cheap groundwater with no replenishment obligations.

Customers of designated water providers are not so fortunate. Water providers with a designation of assured water supply are obliged to eventually substitute groundwater use with renewable supplies, either directly or indirectly through recharge. When water users served by a designated water provider pay their water bills they are contributing to the cost of reaching safe yield. Water users in areas built before 1995 and served by an undesignated water company are spared that cost.

Both prior to and concurrent with the GWMC review process, the Active Management Area Task Forces recognized the need to fill these holes. (The GWMC review process is a "ground up" operation, with the AMAs operating at the ground level. AMA recommendations are then passed on for further review and reworking to various committees, subcommittees, workgroups and sub-workgroups at the state level. The GWMC is the final decision-making body.) The Tucson SYTF was arguably the most strongly committed to broadly applying replenishment obligations across the board.

The Governor's Water Management Commission during its April retreat. Photo: Arizona Department of Water Resources

When forwarded to the Technical Advisory Committee, the Tucson SYTF recommendations moved from the local level to the state arena. At the state level, varied and diverse interests have more of a say, and political influences are more prominent. Incoming recommendations may shift focus or take on different colorations. Many of those close to the scene describe this process as winnowing. Recommendations and issues are winnowed at the state level to get at what is generally acceptable among all interests.

Initially an effort was made to ensure that major municipal and industrial groundwater pumpers would play by the same rules, with all committed to 100 percent replenishment by 2025, the year the GMA established for achieving safe yield. This would be accomplished over time, with pumpers either having to switch to a renewable supply or replenish a portion of the groundwater they mined in five percent annual increments. If begun about 2005 and continuing to 2025 the five percent increments would add up to 100 percent.

This proposal met with firm opposition from those who stood to lose established, long-running advantages. For example, water users benefitting from grandfathered groundwater rights objected to the proposed rules as depriving them of the value of those rights. Those relying on General Use Permits were similarly concerned about prohibitive costs. They were unimpressed that the rule would be equitably applied and phased in over 20 years.

The spurned proposal prompted a counter proposal, to apply a $20 tax per acre-foot of mined groundwater. When this also met with disapproval the proposal was further watered down, to apply the tax only to 50 percent of groundwater mined by municipal pumpers and 25 percent of water mined by industrial pumpers. To further sweeten the proposal the tax was to be phased in over ten years. The generous accommodations caused an official involved in the negotiations to state that the final result was "more symbolic than real."

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It Takes a Conference...

It takes conference to summarize and interpret the findings and conclusions of the Governor's Water Management Commission, and the Water Resources Research Center has taken on the challenge. (See "Guest View," page 8, for a discussion of the obstacles besetting the daily press when covering the GWMC.) The WRRC's annual conference will serve as a forum to inform legislators, the media and the public about major outcomes of the GWMC and how it arrived at its recommendations. The theme of the conference is "Water Planning for the Future," with a focus on the topic, "The Governor's Water Management Commission: Deliberations, Recommendations and Unfinished Business."

The conference will be conducted November 13 at the Heard Museum, Phoenix. A $50 fee includes registration, lunch and admission to the Heard Museum. For additional information contact: Rita Schindele, WRRC, 520-792-9591, x29 or email: ritas@ag.arizona.edu Or check the WRRC web site and click "announcement." (http://ag.arizona.edu/azwater/)

Water Vapors

Check out our new and improved web site

A reworked edition of a book is called a revised edition. No such term is available for the enhancement of a web site. A revised edition of a web site? "New and improved" is a term to shun since advertising has appropriated the phrase to apply to everything from cold medication to automobiles. Yet the Water Resources Research Center revised its web site, and it is now new and improved. Joel Spezeski, web master and office computer guru, has redesigned the WRRC web site to be more serviceable.

The site has been retooled to provide consistent, simple navigation, and improvements in the organization of the site provide better access to information. For example, the addition of pull-down menus provides greater ease in navigating the site. In the near future, users will be able to search the entire site for specific topics. Also, an alternative version has been created with the same information as the original site but optimized for low-bandwidth connections and accessibility.

The web site contains past editions of this newsletter in searchable format. Also available is the most recent edition of Barbara Tellman's "Arizona Water Information Directory," also in searchable format. This directory will help you find everything you wanted to know about water.

The new "Announcement" section of the web site includes WRRC news and information that will be periodically updated. Presently the section includes a job announcement for the WRRC associate director position, information about WRRC's upcoming conference and a description of Project WET workshops. The web site can be accessed at http://ag.arizona.edu/azwater/

Help Wanted

The Water Resource Research Center is seeking applicants for its associate director position. In its operations, services and its coverage of water issues, the WRRC covers a broad territory, and the best person for the position will need to have the flexibility and creativity to work within this multifaceted operation. The applicant will need to have knowledge of the many water issues of importance to Arizona and the West and be able to work with a wide range of people. The position includes working with the Arizona Cooperative Extension program, and the successful candidate will have a faculty appointment within a UA College of Agriculture and Life Sciences academic department. The position remains open until filled, although it will be filled subject to the position not being affected by a university hiring freeze. The job description is posted on the WRRC web site, as an "Announcement." (http://ag.arizona.edu/azwater/) For additional information contact WRRC Director Peter Wierenga. phone: 792-9591 x25; email: wierenga@ag.arizona.edu

Festival Celebrates Water Education

The Arizona Children's Water Festival was the occasion for about 850 fourth grade students and their teachers from the Mesa Public Schools to participate in water education activities at Hohokam Stadium in Mesa on Sept. 21. Students participated in various creative events to teach them about water. For example, they constructed papermâché watersheds and played water conservation charade. Even snacks were used to convey a water lesson. Students were served an "aquifer in a cup," made with granola, chocolate mix, crunched vanilla wafers, with milk added and served with a straw.

Main organizers of the event were the Water Resources Research Center's Project WET, the City of Mesa Water Conservation Office and the Mesa Public Schools. Also participating were about 126 volunteers from various organizations and agencies including the Salt River Project, Central Arizona Project, Arizona State Parks, Arizona Department of Water Resources, Intel Corporation and Greeley and Hansen. In honor of the occasion, Governor Jane Hull proclaimed Sept. 21 as Water Education Day in Arizona.

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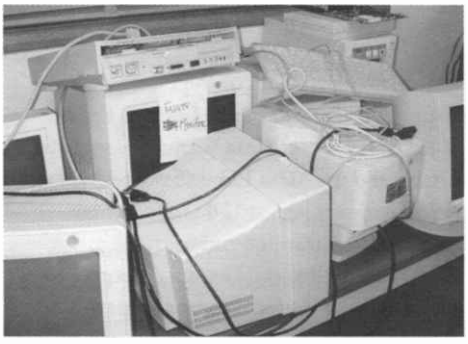
News Briefs

Discarded Computers Pose Risk to Groundwater

The digital age's promise to make life easier comes at a cost, with the road to the promise land littered with obsolete electronic equipment — dead monitors, obsolete PCs and printers, etc. No ordinary stuff, this is high-tech litter, with harmful chemicals that pose environmental hazards. The chemical and metal by-products of discarded computers can end up contaminating soil, groundwater and air.

This is a growing problem. Consider: Studies show that in the United States in 1998 about 21 million personal computers became obsolete, with only 2.3 million or 11 percent recycled. Experts predict that technological changes will likely result in another 315 million PCs becoming obsolete by 2004.



Computer junk at the Water Resources Research Center.

The component that is one of the worst offenders is the cathode ray tubes, or CRTs, the technical name for the glowing screens used in computer monitors and televisions. The average 14-inch monitor uses a tube containing about 5 to 8 pounds of lead. Dumped in a landfill this lead can seep into groundwater. Crushing or burning the tube can release pollutants into the air.

The Silicon Valley Toxics Coalition, a grassroots organization concerned about the environmental and human health problems caused by the electronic industry, provides a lengthy roster of computer pollutants. According to the coalition modern electronic computer equipment includes more than 1,000 different materials, including lead and cadmium in computer circuit boards, lead oxide and barium in computer monitors' cathode ray tubes, mercury in switches and flat screens, brominated flame retardants on printed circuit boards, cables and plastic casing, photo-active and biologically active materials and chromium in the PC's steel exterior.

"Electronic equipment is one of the largest known sources of heavy metals, toxic materials and organic pollutants in municipal trash waste," says Leslie Byster of SVTC.

Legal efforts are underway to control dumping of computer equipment. U.S. Environmental Protection Agency regulations prohibit business from dumping computers into the trash. The California Department of Toxic Substances Control considers monitors hazardous waste, and state law prohibits the dumping of computer monitors into land fills.

The European Parliament has taken more extreme measures. A recently passed law requires manufacturers of electrical and electronic equipment to reduce hazardous substances and to pay recycling costs of their products. Almost every electrical item, including personal computers, is included.

Cell phones also pose possible risks to groundwater when discarded in landfills since these devices contain many toxic materials including mercury, cadmium and lead. The increasing number of cell phones will likely cause the problem to become more severe.

Cell phone users tend to upgrade their units every 18 months, with an estimated 40 million cell phones in the United States last year replaced by new and improved versions. The number of cell phone users in the world is expanding rapidly, from about 600 million currently to an expected billion next year. Greater telephone access and convenience, however, comes with an environmental costs that needs to considered.

Dams Viewed as Possible Terrorist Targets

In response to the terrorist attack in New York City, officials took precautions to protect man-made structures along the Colorado River considered possible targets of terrorists assaults, Hoover and Glen Canyon dams.

Precaution against possible attack is nothing new at Hoover Dam, a structure holding back the nation's largest constructed reservoir. Still evident in proximity to the dam is a concrete-and-steel bunker that once housed guns installed to protect the structure against a possible Japanese, kamikaze-style attack. The "pill box" was constructed in 1942, after the attack on Pearl Harbor.

Following the recent terrorist attacks in New York City, officials closed Hoover Dam to all traffic and visitors. Passenger traffic was allowed on U.S. Highway 93 the next day, but commercial and trucks with trailers continued to be detoured.

At Glen Canyon Dam, upriver of Hoover Dam, various precautions were taken including the closing of the Carl Hayden Visitor Center, halting public tours of the dam and denying access to the tunnel serving the dam. Also raft trips from the dam to Lees Ferry were canceled. Concern about the dam prompted the closing of the Page public schools.

The attack in New York City has prompted officials to think about the unthinkable; i.e., the effect of a hijacked jet slamming into Hoover Dam. Jim Bayne, dam safety program manager for the Boulder City region, says it was not previously considered a possible scenario.

In now considering the effect of such an attack, he says the canyon walls and the transmission towers and lines would likely block any commercial jetliner from navigating through the area into the dam. But even if the dam did sustain a direct hit, Bayne doubts the structure would be substantially damaged. Unlike hollow, steel-and-concrete high-rise buildings, Hoover Dam is constructed of solid layers of concrete. 726-feet tall, 45-feet wide across the top, 660-feet wide at its base, and weighing 6.6 million tons, the dam is about as thick in places as it is tall.

Whatever damage the dam might sustain would not likely totally demolish the structure, to result in sudden and massive downstream flooding. The large chunks and fragments remaining amidst the dam's ruins along with the narrowness of the canyon would impede the flow of water to some extent. Further downstream dams also would

control flooding from a stricken Hoover Dam.

U.S. Bureau of Reclamation officials say contingency plans are in place in the very unlikely event Hoover Dam does fail. In such an event, a three- to five-hour window exists to evacuate Laughlin and downstream communities before they are inundated by an unleashed flood. The grace period is provided by a wide flood plain 12 miles downstream of the dam, which would slow the force of the rushing water.

Sahurita's Lake Officially Opens

Everybody loves a lake, and the town of Sahuarita now has one to love, a newly constructed 10-acre lake, about a mile around, 2,000 feet long, with a depth averaging 8 feet. Officially opened Labor Day weekend, the lake comes with varied amenities: a walkway surrounding the lake for biking and walking; landscaped areas with desert trees and grass; an amphitheater; benches and a gazebo.

Not everyone, however, loves a lake constructed in the desert, and the project has met with varied responses, from supporters, dissenters, and those willing to accept the lake as a guilty pleasure.

Supporters of the lake are glad for the increased aesthetic and recreational opportunities the lake promises to provide. Boating and lakeside strolls in the cool of the evening will be pleasures now available to Sahuarita residents. The Arizona Game and Fish Department expects to stock the lake with blue gill, catfish and Rocky Mountain bass in the fall. Estimates indicate that the lake will attract about 4,000 fisherman each year.

Opponents of the lake claim it is inappropriate for the desert. In a desert environment, where careful water use should be the rule, the lake is viewed as a needless extravagance. Groundwater evaporation each year from the lake could serve 950 residents. Aside from its direct water use, opponents say the lake symbolizes a disregard of a desert-wise way of life.

The lake is the pet project of developer Bob Sharpe. His Rancho Sahuarita is expected to include over 8,000 new homes, built within 10 to 15 years. Selling the new homes at the rate of 500 to 600 per year is expected to generate sufficient effluent to fill the lake in 12 months. Sharpe has constructed a 1.5 mile line to deliver effluent to the lake.

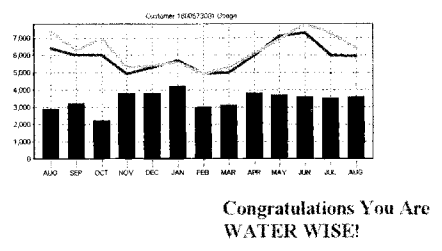
Sharpe surmounted legal restrictions against new private lakes by pledging to donate the lake to the town of Sahuarita, a bequest that helped prompt the Town Council's 5-0 vote in support of the lake.

Web Site Compares Water Use to Promote Conservation

A Green Valley water utility is testing the premise that its customers will be more efficient water users if they are able to compare their water use with that of their neighbors. Using their account number to log on to the utility's web site, customers can now compare their water use for each of the last 13 months with the average used by other single-family residences in the billing area and the average water use for the entire utility during the same time period.

After typing in an account number at the utility web site, customers view the headline "Your very own water consumption," followed by water use information. Depending upon their water use customers are greeted with the message, "Congratulations you are water wise," and "Thanks for being water aware," or "Did you know that your water consumption was high?" followed by "5 Basic Ways to Save Water."

Customers discover their ranking as water users, whether they earn high, top-of-the class scores, average scores, or low, bottom-of-the-class grades. The program's premise is that this knowledge makes a difference, with low-water users reinforced in their water-saving ways and high-water users encouraged to live up to the water-using standards of their neighbors. The web site provides only area averages, not the names of specific water users.



The project reinforces the message that we are not lone water consumers but part of a community of water users, with conservation a personal as well as community commitment.

The information also provides a more direct payoff. Customers noticing a sudden spike in water use not reflected in their background averages would be tipped off about a possible water leak. The source of the leak can then be investigated and fixed before too much water is lost.

Touted as the first such project in the country, the program is the result of a cooperative effort. With financial support from the U.S. Bureau of Reclamation, the Water Conservation Alliance of Southern Arizona assisted the Community Water Company of Green Valley in adopting this water conserving strategy.

Water CASA, a University of Arizona's Water Resources Research Center program, is a cooperative of small water utilities including the Community Water Company. Their membership within Water CASA enables these utilities to undertake water conservation strategies out of the reach of any single utility.

Water CASA manager Val Little hopes other member utilities also will eventually adopt the online program. She says, "Our goal is to establish and pilot this groundbreaking project at Community Water. We will be watching how and how extensively it is used as well as observing water use pattern changes attributable to the program. Following this review we will make "Water on the Web" available to all Water Casa members."

The Green Valley web site can be visited at communitywater.org. Sample account numbers are provided, one of a hypothetical customer with below average water use and another with above average, to enable browsers to view messages to customers.

Guest View

Reporter Treads Water in Covering Complex State Water Issue

Mitch Tobin contributed this Guest View. Mitch covers water and the environment for the Arizona Daily Star.

My editors' eyes tend to glaze over pretty quickly when they hear I'm writing about a bureaucratic commission discussing obscure water issues.

The Arizona Daily Star, like many newspapers nowadays, doesn't like covering government meetings. And for good reason – they're usually boring to sit through and boring to read about.

Our readers have split-second attention spans. If they don't see something in a story that intrigues them or affects their lives, there's little chance they'll read it.

Now, we all know the Governor's Water Management Commission has been discussing critical issues. We're talking about what type of water we drink, whether golf courses use effluent or groundwater, and how the state's remaining riparian habitat will fare.

So, given the commission's importance, how can the media cover its yearlong, mind-numbingly complex process so that it resonates with readers?

Reporters continually face this sort of dilemma. But with water issues it's an even taller order since the law, politics and science are so difficult to grasp and explain to people who lack much background in the subject.

I like to think of the challenge with the analogy of running a restaurant. Few people have the time or money to sit down for an expensive, three-course lunch every day. But they need food and shouldn't be forced to eat unhealthy, poorly-prepared grub.

The trick is to give people something nutritious and easy to digest. You tell readers what's the news and why they should care – and you do it quick, "up high" in the story, before readers flip to the comics section or throw your work in the bottom of the bird cage.

Studies show that about three-fourths of newspaper readers never follow a story's "jump" from a section front to the inside page. We write our stories with that in mind.

For other forms of media, such as television, there are different pressures. TV needs something visual, because no matter how beautiful the broadcasters are, viewers will flip the channel unless they *see* something compelling.

Another thing driving news coverage is the "news hook." News, dare I say, is about what's "new," so you'll usually see words like "today," "this week," "just-released" or "upcoming" to propel the story with a sense of urgency.

With the governor's commission that's a tough one since the process has been so drawn out. The two stories I've written so far were both pegged to milestones in the process – when the commission was in Tucson for a retreat midway through the process, and on the eve of the its final meeting before taking to the road for open houses.

I think the biggest challenge with something like the governor's water commission is finding focus. There's no way to write about everything the group is debating – and no one would read it anyway. So I simplify, I condense and I boil down hundreds of hours of meetings and thousands of pages of documents into something people will glance at in a minute or two.

Do I gloss over some subtleties? Yes. Do I leave out important aspects? You bet. But there's no other way. I might have a day or two to report and write the story. And I'll probably get far less space to do it than I have for this article.

With the governor's commission, I chose to focus on the riparian protection issue since it seemed to be what people in Tucson cared about the most. If I were writing, say, for the paper in Yuma, I probably would have focused more on agriculture.

One of the main gripes about the 1980 Groundwater Management Act is that it doesn't do enough to protect the environment and doesn't recognize what every hydrologist knows – that ground water pumping can affect nearby surface flows.

So, in both stories I've written I've focused on a proposal to prohibit some wells near certain riparian areas. It allowed me to give a bit of background on the 1980 act – what it does, what it doesn't do. It lets me explore something many Tucsonans care about and list 15 specific water courses in Pima County that might be affected. And it provided a window into some of the conflicts brewing on the commission.

Conflict is another thing that will flash on the media's radar screen. One of the first bits of advice an editor gave me about government coverage: "Figure out whose ox is getting gored." Do that and you have conflict, you have players, you have a skeleton on which to drape the rest of the story.

Critics might say we focus too much on conflict and turmoil, but those are the elements that drive *stories*, be they newspaper accounts or romance novels.

Besides making for a more interesting read, political cleavages on the commission will catch journalists' attention because one of our profession's basic principles is to be fair to all sides. To do that, we need to get a sense of the varying points of view on the panel.

So, with limited time and limited space, I tried to talk to people who might have different "spins" on the commission. I talked to people representing farmers, developers, municipal providers and environmental groups.

I asked very basic questions. What's wrong with the 1980 Act? What is the commission agreeing on? What is it fighting about? What's likely to be made into law? What do *you* think is important for readers to know?

In the end, both stories I've written on the commission were shortened in the editing process, which is hardly unusual. In one case, the cut was pretty severe and the story was demoted from page 1A to 1B. Why? Some kid went ballistic in Cochise County and shot up his family.

In the news business they say "If it bleeds, it leads." Water in the West may flow uphill to money and rival oil in importance, but it's still not thicker than blood.

Legislation and Law

Navajo Nation Gets Primacy of EPA Drinking Water Program

In what is a first for an Indian nation, the U.S. Environmental Protection Agency recently granted primacy to the Navajo Tribe to administer the Safe Drinking Water Act's Public Water Systems Supervision Program. USEPA acting regional administrator for Region 9 Laura Yoshii and Navajo Nation President Kelsey Begay signed the primacy document in February in ceremonies at the Navajo Nation Capitol, Window Rock, Arizona.

The Navajo Nation Environmental Protection Agency has sought primacy for the federal drinking water program since 1988 when USEPA first issued regulations enabling tribes to apply for primacy. Yolanda Barney, environmental specialists with the NNEPA's Public Water Systems Supervision Program, says, "We needed direct regulatory authority over drinking water systems. USEPA's staff from Region IX comes from San Francisco only once or twice a year."

Barney believes the NNEPA is in a better position to provide needed services. She says, "My staff is able to provide technical assistance daily to system operators who are required to comply with the federal Safe Drinking Water Act and the Navajo Nation's Safe Drinking Water Act."

In gaining primacy, the NNEPA will be regulating about 230 public water systems located within the Navajo Nation. Most of the systems belong to the tribally-owned Navajo Tribal Utility Authority, with other purveyors including the U.S. Bureau of Indian Affairs and various facilities and businesses.

Tribes take on the same responsibility to ensure public health as states when they administer drinking water programs. In applying for primacy the NNEPA had to develop and demonstrate its capability to administer the program, along with adopting appropriate regulations to ensure safe drinking water in public water systems.

The NNEPA, however, confronted complications not generally affecting states when it applied for drinking water primacy. For example, the NNEPA needed to demonstrate that the tribe had jurisdiction over the water systems to be regulated. This was a formidable task because of the complex legal status of various lands within the Navajo Nation. Some jurisdictional issues remain unresolved.

A large part of the Navajo Nation consists of trust lands, areas that are federally recognized and controlled by the tribe. Navajo authority over trust lands does not have to be demonstrated. Jurisdictional issues, however, arise over areas added later to the reservation by executive order. The eastern part of the Navajo Nation includes a checkerboard area, with various lands that are not trust lands, including fee lands, allotted lands, areas privately owned by Navajo and federal lands. Tribal jurisdiction of water systems in these areas had be demonstrated. Meanwhile the USEPA will retain jurisdictional over public water systems on federal lands within the checkerboard area.

Another obstacle confronting the Navajo Tribe when acquiring drinking water primacy is its lack of tax base. Funds are needed to administer the program with its various responsibilities, from water sampling to support of infrastructure upgrades. Also the Navajo Nation is required to provide a 25 percent match of federal monies granted to the tribe under the Safe Drinking Water Act. States can dip into tax monies to meet such obligations.

In at least one situation the Navajo Nation have chosen to comply with a provision that is voluntary to tribes but required of states. In granting primacy, USEPA requires that states certify their operators of water system, whereas for tribes such certification is voluntary. Barney emphasized the benefits of certification and convinced the Navajo Tribal Council to authorize a program to certify operators of tribal drinking water systems. She will be developing the program over the next year.

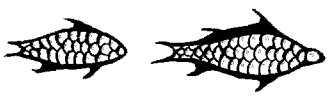
The NNEPA's effort at ensuring safe drinking water is complicated by the lack of public water systems on the Navajo Nation, especially in remote areas. The majority of Navajo people live in isolated settlements in outlying areas and rely on community watering points, including unregulated livestock tanks and wells. The U.S. Indian Health Service reports that 40 percent of the Navajo people haul water for domestic use, often from one of the 7,000 aforementioned water sources. NNEPA does not recommend using water from these sources for drinking.

The Navajo EPA confronts two options in dealing with the issue. The agency can either begin regulating these wells as public water systems or convince the Navajo people to only obtain water from wells that are regulated. Lacking the resources to regulate all wells used for drinking water over the vast Navajo Nation the agency must determine which wells to regulate.

Barney explains the strategy used to identify wells to regulate: "If we find through a survey that 25 or more people are using a well for sixty days or more out of the year, and it has 15 service connections, we will determine that source to be a public water system. We would then attempt to regulate it."

Public information efforts also are underway to encourage the Navajo people only to haul water from regulated wells. Many Navajo, however, have been relying on unregulated drinking water sources for a long time because they are readily available and free of charge. These people are reluctant to switch to regulated wells. A task force including representatives of federal and tribal agencies is working on the problem. In an effort to further understand Navajo drinking water needs, a study is planned to identify Navajos without water at their homes and to examine the feasibility of delivering water to them.

The Navajo EPA also is in the process of applying for authorization to administer two programs under the federal Clean Water Act, the Water Quality Standards Program and the Non-Point Discharge Elimination Systems Program.

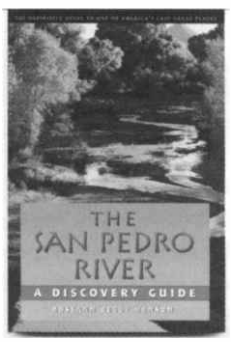


Publications & On-Line Resources

Guiding Principles for Constructed Treatment Wetland: Providing Water Quality and Wildlife Habitat.

In Arizona, various entities have established wetland treatment projects, including schools, museums and municipalities. This wide range of interests has another resource at hand to guide them in constructing treatment wetlands. Developed by an interagency workshop, this booklet provides information on the legal, technical, and policy issues associated with these systems. It serves as a guide to establishing projects to regain some of the natural functions of wetlands and offset some of the significant losses in wetlands acreage. The document is available by calling the Wetlands Helpline at 1-800-832-7828 (EPA 843-B-00-003)

Tucson Water's Sweetwater Wetlands. Photo: Tucson Water



The San Pedro River, A Discovery Guide
Roseann Beggy Hanson
This book is an introduction to the natural glories of the San Pedro River, with the author providing various suggestions for low-impact activities. Each chapter focuses on one segment of the river, with essays and activity guides for hiking, bird watching, biking, horse riding, and exploring historic sights. In writing the book, the author went far afield to gather information, reading explorer's journals and scientific findings and listening to ranch lore, fish stories and the river's own voice. The result is a compelling environmental history of the river. Every river deserves such a guide. $17.95 paper. University of Arizona Press, 355 S. Euclid, Ste. 103, Tucson, AZ 85719; phone, 520-621-1441; web site: www.uapresss.arizona.edu

U.S. Geological Survey Reports
The following USGS Arizona water reports were recently published:
"Water Quality in the Central Arizona Basins, Arizona, 1995-1998," by Gail E. Cordy, et al. USGS Circular 1213.
"Water Quality in the Upper Colorado River Basin, Colorado, 1996-98," by Norman E. Spahr et. al. USGS Circular 1214
"Daily and Seasonal Variabilility of pH, Dissolved Oxygen, Temperature, and Specific Conductance in the Colorado River Between the Forebay of Glen Canyon Dam and Lees Ferry, Northeastern Arizona, 1998-99," by M.E. Flynn, R.J. Hart, G.R. Marzolf and C.J. Bowser, USGS Open-File Report 01-222
For information about the above USGS publications contact: U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225-0046; or phone: 1-888-ASK-USGS.

Web Site Offers Updates of Global Water Developments
The Sustainability of semi-Arid Hydrology and Riparian Areas project has a web site that includes a new service featuring breaking news stories and scientific developments in various fields. Water News Watch monitors developments from around the world that impact water resources in arid and semi-arid areas. News items from over 150 web sites in English, French, Spanish and Italian are summarized in English, along with press releases and major scientific reports. Users can search for items of interest by topic, key word, date and geographic region. The web site highlights major breaking stories and offers shortcuts to the most recent stories in over a dozen topic areas, from climate change and conservation to technology and water supply. Links are provided to original source materials and reference sites. A geographic interface displays the location of news events, while a poll allows viewers to express their views on water policy issues of the day. Access the SAHRA web site at: www.sahra.arizona.edu

Pima County Sonoran Desert Conservation Plan Publications

The Pima County Sonoran Desert Conservation Plan proposes to save more than 250,000 acres for mountain parks, as well for preserving streams and washes and protecting ranch land along the county's urban edges. Various reports and documents have been prepared as part of the plan, written by Pima County staff and members of the local science community. Following are descriptions of two recently published works.

Water Resources in Pima County
Barbara Tellman
This report summarizes water information relevant to the Sonoran Desert Conservation Plan and the Pima County Comprehensive Plan. Topics covered include human water supply and demand and water needs for riparian and wetland habitat. Policy options also are examined for dealing with the challenge of meeting human water needs while protecting riparian areas and wetlands. $33

Climate Variability in Pima County and its Significance to the Sonoran Desert Conservation Plan
David Scalero et. al.
This report explores the range of climatic variability that might be experienced over the next 30 years and considers how these variations might affect plants, animals, humans and the ecosystem processes. $18

The above publications can be ordered from Pima County Graphic Services, 17 E. Pennington St., Tucson AZ 85701; phone:520-205-8300. A list of the complete publications prepared as part of the plan can be obtained from the same source. Some of the publications are available from the web site: www.sdcponline.org

Special Projects

Montezuma's Well Serves as Lab for Researcher Studying Arsenic

Montezuma's Well is located within Montezuma's Castle National Monument, in the Verde Valley of Northern Arizona. A significant feature of the well is its high arsenic level, about 100 parts per billion. The well with its high concentration of arsenic serves as a laboratory for Northern Arizona University graduate student Anne-Marie Compton as she studies the biogeochemical cycling of arsenic at the site.

As is implied by the term "biogeochemical," Compton's work has a broad, interdisciplinary focus. She is not just concerned with the chemical qualities of arsenic, but also its geological occurrence at the well and its biological effects on the plants and animals in the area. Further, her work also may help archaeologists better understand early human settlements at the well.

One component of her work is to study the arsenic cycling in the food chain, as she seeks a better understanding of the movement and effects of arsenic on the plants, animals and other organisms within the well environment. Compton's research is unique in focusing on a complete freshwater system since most such studies have examined marine conditions. Whatever freshwater studies have been done have usually focused on a single organism, not an entire food chain.

Previous studies of Montezuma's Well provided valuable background to Compton's research. Studies had already identified the well as has having the highest concentration of arsenic in the area. Also, Dr. Dean Blinn, one of Compton's NAU advisors, has spent several decades studying the biology of the area, and his work provides a wealth of data to characterize the food chain over time. Compton's research builds on this work.

Compton is analyzing samples of sediment, plants, animals and water collected at the well to determine total arsenic. At first she dried plant samples before measuring arsenic but found that volatile arsenic was lost in the drying process. She now examines the wet weight of the plant material to determine total arsenic. She also has worked out a new method for characterizing arsenic in her samples. The usual procedure relies on beaker digestion which involves heating the sample over a hot plate. This method, however, resulted in a loss of the volatile arsenic. To increase recovery, Compton developed a closed microwave digestion system that allows the sample to be heated to high temperatures without losing the arsenic.

One of her research objectives is to determine if arsenic bioaccummulates or biodiminishes as it moves up the food chain. Compton says a critical question is: Do leaches, a top predator, have more or less arsenic than what they eat? At issue is the effects of the water's toxicity on the life forms of the well. In a broader context, the issue is to determine if water with a high arsenic content is used for irrigation, will the vegetation absorb the arsenic and pose a risk if consumed by humans. A related concern is whether humans can safely consume fish and other organisms from such waters.

Another key aspect to her research is determining how various organisms endemic to the well process arsenic. Such organisms have presumably co-evolved with the high levels of arsenic at the well, and Compton is investigating the process these species have developed to detoxify arsenic. She believes an understanding of the process is likely to lead to an increased understanding of arsenic toxicity and tolerance. In pursuing this line of research, Compton must identify which organic arsenic compounds are found within organisms since arsenic exists in a myriad of forms, some more toxic than others.

Compton says the best tool for studying arsenic speciation in organisms is x-ray absorbance spectroscopy, a complicated procedure involving a synchrotron. Since NAU does not have such equipment, Compton sought funding to enable her to conduct summer research at Stanford University where she analyzed leeches, amphipods, water scorpions, sediment and plants taken from Montezuma's Well. She is now collaborating with Stanford scientists to identify which species of arsenic are present in various organisms and in what percentage.

Compton's research also is considering the phytoremediation potential of *Potomogeton illinoiensis*, a very prolific plant at Montezuma's Well. *P. illinoiensis*, which grows to about three inches in most locations, reaches over three feet at Montezuma's Well, considered one of the most biologically productive systems in the world in terms of biomass. Compton found that *P. illinoensis*, although accumulating arsenic at the well, does not hyperaccumulate, and therefore does not effectively remove arsenic from the system.

Compton also believes that Montezuma's Well, a relatively isolated and closed ecosystem, can serve as a model for understanding larger, more contaminated areas in other countries, such as China and Mexico. Information she has collected about the movement of arsenic, its inflow and outflow path, within the Montezuma' Well ecosystem can be used to develop environmental models of arsenic-contaminated sites in other geographic areas.

Compton's work also will likely promote a better understanding of the archaeology of the area. She has a minor in archaeology from Cornell University and has done field work in Turkey, Greece and Italy. This experience has lead her to speculate about the effects of arsenic on the Native Americans inhabiting the area, especially during the latest settlement phase, when well water was used for irrigation. After about 25 years of irrigation the area was abandoned. Did the arsenic enter the food chain through crop irrigation?

To answer that question, Compton is in the process of obtaining corn, bean, and squash samples from that era to determine total arsenic. She acknowledges that demonstrating that crops were the source of arsenic contamination of humans would be very difficult. She speculates that humans would more likely have been affected by drinking the well water than by irrigating with it.

The American Chemical Society's Division of Environmental Chemistry recently recognized Compton as one of the country's top environmental chemistry students. Also, she was awarded NAU's Merriam-Powell Center for Environmental Research Fellowship. Compton can be contacted at: ac23@dana.ucc.nau.edu

Announcements

ADEQ Funds Projects to Control Nonpoint Source Pollution

The Arizona Department of Environmental Quality requests grant applications for projects that implement on-the-ground water quality improvement projects to control nonpoint source pollution. Approximately $1 million is available for multiple awards during this grant cycle from the United States Environmental Protection Program, provided under the 319(h) portion of the Clean Water Act, and distributed through ADEQ's Water Quality Improvement Grant Program. The 2001 Water Quality Improvement Grant Manual, which details this ongoing grant program and includes the application forms can be downloaded from www.adeq.state.az.us/environ/water/mgmt/planning.html#improve The deadline to submit grant applications for this grant cycle is Nov. 28, with award announcements to be made in January 2002.

Call for Papers

The Fourth Conference on Research and Resource Management in the Southwestern Deserts has as its theme "Meeting Resource Management Information Needs," and will be conducted May 15-17, 2002 in Tucson. The purpose of the event is to improve the preservation of natural and cultural resources by increasing understanding of contemporary research and resource management challenges and to achieve more collaboration through discussion of active research and future research needs. Papers are sought for various topics including ecological restoration, regional conservation schemes and water and land-use planning. Papers are due January 14, 2002. For additional information check the web site: www.werc.usgs.gov/sdfs/meetings.html

EPA Seeks Environmental Education Proposals

The EPA solicits proposals for projects that design, demonstrate, or disseminate environmental education practices, methods, or techniques. Awards are up to $250,000, but smaller requests are encouraged. Priority areas for requests over $25,000 are: capacity building, education reform, and community issues. For funding requests of $25,000 or less, priority areas are: the areas listed above, health, teaching skills, career development, and environmental justice. Nonfederal matching funds of at least 25 percent of the total cost are required of all projects. The deadline is November 15. For requests over $25,000 contact Diane Berger, Environmental Education Grants, Office of Environmental Education (1704 A), 1200 Pennsylvania Ave. NW, Washington, DC 20460. phone: 202-260-8619; fax 202-564-2754; email: berger.diane@epa.gov For requests up to $25,000 contact Stacey Benfer, Environmental Education Grants, Community and Government Relations (CGR-3), EPA, Region IX, 75 Hawthorne St., San Francisco, CA 94105. email: benfer.stacey@epa.gov; phone: 415-744-2220; web site: http://www.epa.gov/enviroed/solnotice01.html

US FWS Offers Wetlands Conservation Small Grants

The Fish and Wildlife Service seeks proposals for matching funds for wetland and wetland-associated upland conservation projects. The awards provide up to $50,000, to be matched by at least a 1:1 contribution of nonfederal funds. The grants may be used only for wetlands acquisition, creation, enhancement, or restoration. Deadline for proposals is November 30. For additional information contact: Keith Morehouse, Div. of Bird Habitat Conservation, U.S. Fish and Wildlife Service, 4401 N. Fairfax Dr., Suite 110, Arlington, VA 22203. phone: 703-358-1784; fax: 703-358-2282; web site: http://northamerican.fws.gov/NAWCA/grants.htm; email: keith_morehouse@fws.gov

Indian Agriculture Conference Scheduled

The Southwest Indian Agricultural Association' s 14th annual conference, "Tribal Nations in Unity: Striving Towards the Next Generation of Indian Farming and Ranching," will be conducted Jan. 15-17, 2002 at Laughlin, Nevada. The conference includes a full-day water marketing seminar. For additional information contact Gary Parker. phone: 480-759-1273; email glp.etc@worldnet.att.net

Call for Papers

A call for papers is issued for the conference, "Allocating and Managing Water for a Sustainable Future: Lessons from Around the World." Papers are sought that address one of the three major themes of the conference: the role of markets and policy: lessons in water allocation and use; integrating environmental, cultural and other values; and transboundary water conflicts and cooperation. A one-page abstract and a biographical note should be sent to: nrlc@spot.colorado.edu or to the Natural Resources Law Center, 401 UCB, University of Colorado School of Law, Boulder CO 80309-0401. Deadline for abstracts is Nov. 30.

Consortium Offers Support of Arid Lands Research Projects

The International Arid Lands Consortium supports research and training on the development, management, restoration and reclamation of arid and semiarid lands through its Research and Development Project grants and Demonstration Project grants. Research and development that lead to the improved management of soil and water resources in agronomic systems are supported. IALC will provide up to $75,000 for 12-30 month demonstration projects and up to $100,000 for research and development project of up to 30 months. Deadline for applications is Nov. 15. For additional information contact Jim Chamie. phone: 520-621-3024; fax: 520-621-7834; email: chamie@ag.arizona.edu; web site: http://ialcworld.org/About/rfp2002.html.

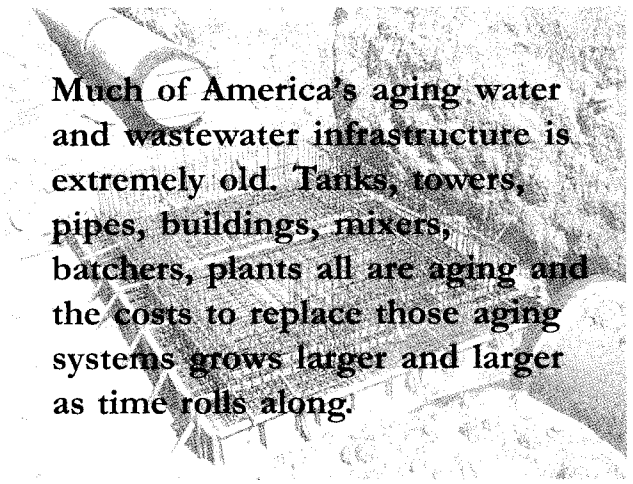
Outside Readings

America's Free Water Ride May be Coming to an End

"Outside Readings" includes reprints or abstracts of editorials, features, articles or other published materials that appeared in various publications. Following is the lead editorial in the August edition of the U.S. Water News.

The rubber is about to meet the road for the cost of water in America. The day of cheap water is fast leaving us behind and the day of paying the true cost of water is about to dawn on this country. And what will bring about these changes in the pricing structure of water? It will be the collapse of America's aging water infrastructure, pure and simple.

We have all for most of our lives, had a free ride on this pleasure boat called cheap water. We have enjoyed the cruise with little or no expense out of our own pockets. But the sound of water crashing over the ever-approaching waterfall located just downstream is getting louder and louder as our cruise ship heads for certain disaster when we top the falls.



Much of America's aging water and wastewater infrastructure is extremely old. Tanks, towers, pipes, buildings, mixers, batchers, plants all are aging and the costs to replace those aging systems grows larger and larger as time rolls along.

Photo: Tucson Water

Much of America's aging water and wastewater infrastructure is extremely old, a great deal of it over 100 years old. Tanks, towers, pipes, buildings, mixers, batchers, plants all are aging and the costs to replace those aging systems grows larger and larger as time rolls along. Of course a lot of the hardware is out of sight and out of mind because there are millions of miles of buried water lines, pipe lines, and sewer lines that are rusting, crackling and crumbling, away from seeing eyes.

So what are we to do? What solutions have been offered to raise the monumental amounts of money it will take to replace our water and wastewater systems? Of course the first place everyone turns is to the federal government, and not without reason. When the Clean Water Act and Safe Drinking Water Act were first passed, the federal government bore a great deal of the cost of improvements in our water and wastewater systems in order to upgrade plants and clean up our lakes, streams, and waterways. And because the federal government was handing down decrees for improved water quality, it was only right and fair they should bear some good portion of the cost.

Today, however, we are in a different economic climate, The federal government is pulling back on freely funding many programs. And it may be no less so with water. In spite of the fact that the federal government is requiring evermore costly and stringent water quality requirements, it may be the local taxpayer who will wind up providing the bulk of the funds necessary to revamp and restore our aging cruise vessel, Our Sugar Daddy from the past, or Uncle as it were, just may not have as much sugar as he once did.

What will all this resurrection of our water systems cost? The figures are so large as to be meaningless to the average person. The Water Infrastructure Network (WIN), a coalition of 29 organizations representing local government officials, municipal professionals, engineers, environmentalists, and labor unions, recently testified before Congress that it will require $23 billion annually to finance the capital needs of renewing our municipal drinking water and wastewater infrastructure. That, they say is on top of the $60 billion now spent annually by local ratepayers in investing in their local water and wastewater systems. Who can fathom these kinds of costs?

WIN explained to Congress that the "gap" in funding is due to a confluence of circumstances -- the exhaustion of the useful life of existing infrastructure, much of which is over 100 years old; population growth; new and ever more complex and costly federal mandates that divert local funds from local to federal priorities; and the substantial decline in federal participation in helping local governments meet their needs and comply with federal mandates. WIN says specific and substantial increases in local user fees are already costing "real people, real money."

The free ride on our pleasure craft may be over. Everyone is looking for a handout these days from the federal government. Whether Congress will create additional funds from your money to help rehabilitate our aging water and wastewater infrastructure remains to be seen. But chances are, the ticket prices for future cruises will see a substantial increase.

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Groundwater Commission...continued from page 2

The tax would be collected and used for projects within the AMAs. It is unlikely such funds would go far in paying the real costs of renewable supplies, but they could subsidize infrastructure costs or support studies related to renewable water supply use.

Mining interests wanted out even from these modest obligations. They argued that mining, unlike the municipal sector, was unable to pass on additional costs to consumers and therefore should not be required to contribute to the costs of renewable supplies. Mining won its exemption. The agricultural sector was previously exempted.

The above proposal applies only to existing groundwater pumpers. Future municipal and industrial pumpers would confront the stricter obligations initially proposed for current pumpers, with 100 percent replenishment phased in over a 20 year period.

The proposed changes are considered to be relatively unassuming. Present groundwater pumpers get off lightly, with major increases passed on to future pumpers. This is a tried-and-true strategy, with obvious political appeal. A GWMC member stated, "It is a step in the right direction, although those of us already committed to an assured water supply don't consider it much."

Expressing similar sentiments the Tucson AMA Task Force formally voiced its support, but with an obvious sense of disenchantment. Its letter of support stated, "The Tucson Safe Yield Task Force is supportive of the Replenishment for M&I Users Proposal. It is the one proposal that attempts to address equity between and within the municipal and industrial sectors. The Task Force is, however, disappointed in the proposal's limited scope and strongly believes the proposal should not be further weakened by additional exemptions."

After public review the GWMC's recommendations will be forwarded to the Legislature for consideration during the 2002 session.

Arizona Water Resource

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