



# ARIZONA WATER RESOURCES NEWS BULLETIN

NEWSLETTER 79-2

APRIL-JUNE 1979

## SIGNIFICANT WATER PROBLEMS FORECAST IN LOWER COLORADO REGION\*

"The Nation's Water Outlook to the Year 2000" was published recently by the Library of Congress Congressional Research Service. Forecasts may include a general nationwide projection and regional projections.

### National

The 1976-77 drought amplified long-recognized, but frequently ignored, water problems in the United States. At issue is allocating scarce water resources for environmental enhancement; recreation; food, fiber and energy production; and municipal and industrial water supplies.

It has been estimated that 1980 demands on national water resources will nearly double those of 1954, and that by the year 2000 demands will triple those of 1954.

Thermal electric plant water withdrawals exceeded irrigation withdrawals for the first time in 1965, according to the U.S. Geological Survey (USGS). This shift was produced by rapid growth in demands for electric power and widespread use of once-through (non-recycling) power plant cooling systems. While it is expected that thermal electric facilities will increase in number, it is likely that closed (recycling) cooling systems will be used to reduce water withdrawals but increase water consumption. In terms of overall consumptive water use, however, irrigation agriculture is the frontrunner.

From a nationwide perspective, water supplies are sufficient to meet needs well beyond 1985. This optimism should be tempered, however, by realizing that national totals do not reflect geographic or temporal variations; some severe local and regional problems can be expected.

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\*Excerpted from "The Nation's Water Outlook to the Year 2000," 78-26 EP, by Warren Viessman Jr., Malcolm M. Simmons and Christine Demoncada, Congressional Research Service, Library of Congress, Washington, D.C., January 27, 1978.

Significant water supply problems exist or are anticipated in Southern California, the Great Basin, the *Lower Colorado Region*, the Rio Grande, the High Plains of Texas, and the south-central portion of the Missouri River Basin. In many of these regions irrigation agriculture consumes large amounts of water. Projected water demands to develop and process coal and oil-shale deposits in some of these regions will compound water supply problems. Unless water allocation priorities are shifted, water shortages already may be limiting growth in some of the more critical areas within the regions.

Many long-term alternatives have potential to ease the severity of national water supply problems. The difficult aspects of implementing these alternatives involve securing acceptance from the various regions that would be affected. Impediments to optimal water development and efficient use that merit attention include:

- The prevailing body of water law;
- Failure to recognize interrelationship of surface water and groundwater;
- The ingrained idea the per capita use of water must increase continually to maintain our standard of living;
- The artificial separation of water quality and quantity management; and
- The failure to establish a price for water that is commensurate with the value of its use.

Historic trends in American water resources development have been influenced strongly by regional interests and by an ardent belief in the sanctity of individual water rights. These traditions have fostered a generation of almost impregnable institutions that were appropriate at the time of their conception, but that now often constrain efficient allocation and management of limited national water supplies.

Most authorities on water use believe that unless a philosophy of total water management is adopted, it will be difficult to cope with tough contemporary issues. Institutional rather than technical constraints are the barriers to solving many regional water supply problems. Designing comprehensive water management policies is long overdue, according to these authorities.



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Finally, decision making based on studies of alternative futures seems to be worth pursuing. The complexity of factors that shape the Nation's destiny makes employing single planning projections, such as the Water Resources Council "Modified Central Case," more hazardous than ever. Analyses of a feasible mix of "tomorrows" probably would result in more rational and flexible policy decisions.

### Lower Colorado Region

*Water Quantity.* Water resources in the Lower Colorado Region are stressed by the competing demands of irrigation agriculture, municipal water systems, stream fisheries and wetlands, transfers to California, Indian water claims, and downstream commitments to Mexico. The Lower Colorado Region is using *all* of the available water supplies. Reordering priorities appears to be necessary to meet the demands of the future.

Present water use requirements have been met by mining aquifers, but declining water tables preclude continuation of this practice. Consumptive water use by irrigation agriculture is the main cause of large streamflow and groundwater depletions. Substantial reductions in irrigation agriculture must be contemplated if projected regional water shortages are to be avoided.

*Water Quality.* Water quality problems include high salinity in surface waters and groundwaters, and pollution of those waters by agricultural, mining, domestic, and manufacturing effluents.

High salinity concentrations, mostly from irrigation agriculture, are beginning to impact on agriculture itself. Salts leached into groundwaters and salts that occur naturally in some streams and aquifers have combined to degrade the primary sources of drinking waters in about half of the Lower Colorado Region. In some areas, groundwater has become even too saline to pump.

Effluents from mining activities have produced unacceptable concentrations of lead and other heavy metals in many water supplies including those in the Flagstaff and Kingman, Arizona, areas. Furthermore, there are indications of radioactive contamination of aquifers near Gallup, New Mexico, due to leachates from uranium ore processing.

## CONDENSATION

### Groundwater Heating-Cooling Pumps

More groundwater may be pumped for heating and cooling than for drinking by the end of this century, according to Dr. Jay Lehr, editor-in-chief, "Water Well Journal."

Groundwater stores energy in the form of heat that can be used for heating and cooling urban and suburban homes in those areas where adequate groundwater supplies exist, Lehr says.

Because groundwater is warmer during winter and cooler during summer than surface air, it can be used to provide low-cost heat energy. If groundwater is used in conjunction

with a water-to-air heat pump, heat can be extracted from the water for winter heating and expelled from the air to the groundwater during summer for cooling.

Using the groundwater heat pump would consume less energy than the conventional air-to-air heat pumps for heating and cooling, Lehr says, and could save the nation a significant amount of the energy it currently uses for space heating and cooling.

The system rapidly is becoming an attractive energy alternative as gas and oil costs rise, Lehr says. Initial investment in the groundwater heat pump system probably would pay for itself within two years if the well already exists, or in four to six years if a new well must be developed, according to Lehr.

Sufficient groundwater supplies to operate residential and commercial heat pump systems underlie about 70 percent of the United States, Lehr says. Only 3 gallons of water per minute are needed for each ton of air conditioning, or 12,000 Btu of heat. The non-polluting system recycles the groundwater after use as a continuously renewable source of energy, Lehr explained.

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### Mine Reclamation Center Begins Operation at University of Arizona

The Mine Reclamation Center (MRC) has been established by the State of Arizona Mining and Mineral Resources Research Institute to focus University of Arizona research, instruction and service competence on solving problems related to mined land rehabilitation.

National reclamation goals have been established and reclamation legislation has been enacted that demand increased mine reclamation knowledge, technology and skills, and communicating the knowledge, technology and skills to persons and organizations involved in mine reclamation.

MRC interest areas include:

1. Large-scale land disturbances related primarily to surface mining;
2. Economic impacts of mineral development;
3. Reclamation of range and forest land watersheds;
4. Reclamation of agricultural lands;
5. Urban environment land rehabilitation; and
6. Severely eroded lands.

The specific objective of the MRC is to provide a focal point for extensive ongoing University of Arizona Research in this field as well as achieving new applications of this expertise. To make the best use of this interdisciplinary approach, MRC seeks involvement with mine reclamation problems that require training, design, engineering and reclamation research.

The MRC offers the following expertise:

1. Prepare integrated land rehabilitation programs for mining operations;

2. Develop monitoring programs in watershed hydrology, meteorology and air quality;
3. Provide impact evaluation of proposed land disturbance;
4. Conduct research in techniques and methods of reclamation;
5. Plan alternative development strategies;
6. Initiate operational developmental programs;
7. Develop land management plans; and
8. Conduct demonstration projects of innovative land rehabilitation concepts.

MRC also offers the most up-to-date bibliographic information on mined land reclamation. SEAMINFO maintains a computerized data base of bibliographic information. Input to this file is from commercial information bases and from information developed by scanning more than 100 pertinent journals monthly.

For further information regarding the MRC and the benefits it can provide please contact Dr. Kenneth E. Foster, Director, Mine Reclamation Center, 845 N. Park Ave., Tucson, Ariz. 85719, (602) 626-2086.

#### GAO Calls For National Drought Plan

The problems encountered in providing emergency relief during the 1976-77 drought should be assessed by the Secretaries of Agriculture, Commerce and the Interior, and by the Administrator of the Small Business Administration to develop more effective responses to droughts in the future, according to the General Accounting Office (GAO).

Based on the assessment a national plan should be developed to provide drought assistance in the future in a more timely, consistent and equitable manner, the GAO advises.

Issues to be considered in developing the plan should include identifying the respective roles of the agencies involved to avoid overlap and duplication of efforts; generating legislation to define more clearly those roles; and formulating standby legislation to permit more timely responses to drought-related problems.

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#### AWRA Arizona Section Officers

Officers were elected during the April meeting of the American Water Resources Association (AWRA) Arizona Section. President is Don Young, Arizona Water Commission; Vice President is Kenneth Foster, University of Arizona Office of Arid Lands Studies Associate Director; and Executive Secretary is K. James DeCook, University of Arizona Water Resources Research Center Associate Hydrologist.

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#### PUBLICATIONS

"Maps showing water-level declines, land subsidence, and earth fissures in south-central Arizona" has been published as U.S. Geological Survey (USGS) Water-Resources Investigations 78-83. The USGS report was prepared in cooperation with the Arizona Water Commission (AWC) and the U.S. Bureau of Reclamation.

More than 109 million acre-feet of groundwater were withdrawn from beneath some 4,500 square miles of land in Pinal and Maricopa counties during the period 1915-1975. Groundwater pumped greatly exceeds natural recharge. As a result, water levels have declined to produce land surface subsidence, alluvial deposit stresses and earth fissures.

About 120 square miles of land subsided more than 7 feet in the Eloy and Stanfield areas between 1952 and 1977. Most noticeably near Picacho, the subsidence has increased greatly since 1952.

Land subsidence and earth fissures have damaged public and private properties and will continue to occur if groundwater is mined to lower water tables rapidly, according to the report.

USGS Water-Resources Investigations 78-83 was prepared by R.L. Laney, R.H. Raymond and C.C. Winikka. It is available from AWC, 222 N. Central Ave., Suite 800, Phoenix; and at USGS offices in Room 5-A, Federal Building, 301 W. Congress St., Tucson, and in Suite 1880, Valley Center, Phoenix.

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"Drainage Manual" is a publication designed to help engineers integrate plant, soil and water relationships to achieve proper drainage of irrigated farmlands. The manual discusses the engineering tools and concepts that have proven successful in planning, constructing and maintaining long-term irrigation projects.

The cloth-bound, 286-page publication is illustrated and is available for \$7.25 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, as Document Number 105Z8.

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"Sewage Treatment in Hot Climates" describes modern design procedures for developing sewage treatment processes suitable for use in hot climates. Included are discussions of waste stabilization ponds and their physical and biological bases.

The volume, by Duncan Mara, emphasizes the economic reuse of domestic wastes. Copies of the 168-page book cost \$19.50 and are available from Wiley Interscience, Division of John Wiley & Sons, Inc., 1 Wiley Drive, Somerset, N.J. 00873.

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"An Appraisal Study of the Geothermal Resources of Arizona and Adjacent Areas in New Mexico and Utah and Their Value for Desalination and Other Uses" contains data on temperatures, salinity and chemical geotemperatures for more than 10,000 water wells.

Temperature gradients, recent volcanics and seismicity also are discussed. Data are presented on U.S. Geological Survey Waterstore Programs maps.

Copies of the publication, by C.A. Swanberg, et al, are available at no cost from the New Mexico Energy Institute, Box 3E1, Las Cruces, N.M. 88003.

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"A Self-Study Handbook of Instruction on the Safe Drinking Water Act" is a publication prepared by the American Water Works Association (AWWA) under a grant from the Environmental Protection Agency (EPA) Office of Water Supply.

The handbook was prepared for persons who are responsible for community water supply systems in remote areas. Topics include an introduction to Primary Drinking Water Regulations; sampling, testing and reporting procedures; record keeping; other provisions of the Safe Drinking Water Act; and future considerations. A simplified drinking water regulation well chart also is included.

Copies of the handbook are available for \$6 as catalog number 1620 from the Publications Order Department, AWWA, 6666 W. Quincy Ave., Denver, Colo. 80235.

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"Groundwater and Well Efficiency" is a useful information source about water wells. General information addresses groundwater, water wells, irrigation, and dewatering wells.

Specific topics include well-screen design, well efficiency and water well service life. Also included are a glossary, filtering area charts and well-screen slot depths and their relationships to water flow.

Copies of the 61-page publication prepared by Carl E. Nuzman are available for \$3.95 from Doerr Metal Products, Larned, Kan. 67550.

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"Measurement of Non-Point Sources from a Coal-Fired Utility and Impact on Receiving Waters" contains information about measuring non-source pollutants at utility sites. Included are discussions about methodologies and equipment used to sample the sources.

Copies of 21-page booklet are available from The Research Corporation of New England, 125 Deane Highway, Wethersfield, Conn. 06109.

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"Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management" is the product of a conference held in Blacksburg, VA., July 26-28, 1978, and sponsored by the American Society of Civil Engineers (ASCE).

Subjects discussed in the proceedings are western water laws; eastern water law; water law, policy and the federal government; water law and technology; legal aspects of conjunctive use; water policy institutions; management institutions; water allocation and water-use efficiency; new irrigation and drainage constraints; "208" studies institutional and legal constraints; and water management in economically emergent countries.

The 895-page, soft-cover proceedings is available for \$40 from the ASCE, 345 E. 47th St., New York, N.Y. 10017.

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"Quality of Irrigation Water" summarizes use of brackish water for irrigation. Concise accounts are given of the basic properties of waters, soils and crops as they relate to salinity. Variables addressed include salt concentration, ionic composition and indices derived from them; the importance of clay mineral properties in the salt-soil interaction; and the nature of crop tolerance to salinity.

Also described in the book are irrigation management principles to control salinity. Topics include leaching, amendments, irrigation methods, and saline and sodic soils reclamation. A salt-tolerance table of many crops is included.

The 72-page, hard-cover book is available for \$10 from Maxwell House, Fairview Park, Elmsford, N.Y. 10523.

## CONFERENCES

"Water Resources in Arizona's Future" is the theme of the Arizona Governor's Commission on Arizona Environment 1979 summer conference scheduled for August 14-17 at the Little America Convention Center, 2515 E. Butler Ave., Flagstaff.

Gov. Bruce Babbitt will give the Conference keynote address August 15 between 8:30 and 9:30 a.m., during the Plenary Opening Session.

Concurrent workshops will begin at 9:40 a.m., August 15, on groundwater, flood control and riparian legislation. The workshops will continue August 16 from 9:45 to 11:45 a.m. A Plenary Review of Workshops' Progress will be held earlier from 8:30 to 9:30 a.m. Another Plenary Session will be held from 11:45 a.m. to 12:45 p.m. to hear reports of workshop recommendations.

Two special programs are scheduled to be held August 15 between 3 and 4:30 p.m. "Atlas of Arizona" will be presented from 3 to 3:45 p.m., and "Historical Buildings" will follow between 3:45 and 4:30 p.m.

Regular Commission resource committee meetings will be held August 17. For further information contact the Governor's Commission on Arizona Environment, 206 S. 17th Ave., Phoenix, Ariz. 85007, (602) 261-7803/7804.

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The 15th American Water Resources Association (AWRA) Conference will be held September 24-28, 1979, at the Aladdin Hotel, Las Vegas, Nev.

The Conference will focus on "Water Resources Management in a Changing Society." A national symposium also is scheduled that will address "The Use of Scientific Information in Planning for Environmental Quality Objectives."

Information about the Conference and registration procedures can be obtained from the AWRA, St. Anthony Falls Hydraulic Laboratory, Mississippi River at 3rd Ave. S.E., Minneapolis, Minn. 55414, (612) 376-5050.

A "Flood Monitoring and Management" Symposium will be held October 26, 1979, at the Sheraton Pueblo Inn, Tucson. The Symposium will be sponsored by the Arizona Section, American Water Resources Association.

Preliminary announcements and registration materials are available from Dr. K. James DeCook, Water Resources Research Center, University of Arizona, Old Psychology 104A, Tucson, Ariz. 85712.

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A "Waterpower '79 Conference" will be held in Washington, D.C., October 1-3, 1979. The Conference will be sponsored by the U.S. Army Corps of Engineers and the U.S. Department of Energy.

For further information contact International Science and Technology Institute, Inc., 1129 20th St. N.W., Suite 511, Washington, D.C.

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"Stormwater Management Alternatives" is a national conference scheduled to be held October 3-5, 1979, at Hotel Dupont, Wilmington, Del., that will focus on pollution caused by stormwater runoff.

Topics to be addressed include alternative approaches for handling stormwater, social and environmental factors, engineering design, and cost effectiveness. The conference is being sponsored by the University of Delaware Water Resources Research Center and the U.S. Office of Water Research and Technology.

For further information contact the University of Delaware Water Resources Research Center, 42 E. Delaware Ave., Newark, Del. 19711, (302) 738-2191.

"The International Congress on Desalination and Water Reuse" will be held October 22-27, 1979, at Nice, France. Conference theme will be "Water for Life." Sponsors will be the French Ministry of Industry and the International Desalination and Environmental Association (IDEA).

Manuel Morris, U.S. Office of Water Research and Technology (OWRT) Deputy Director, will be co-chairman of the session on "Desalination on the North American Continent." And Frank Carlson, OWRT Senior Research Staff member, will present a paper on "The Environmental Problems of Siting and Operating Desalination Plants in the United States."

For more information contact R. Bakish, President, IDEA, 1000 River Road, Teaneck, N.J. 07666, (201) 836-1594.

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Please address your news items or comments on the News Bulletin to any of the three editors:

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