ARIZONA WATER RESOURCES NEWS BULLETIN

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FY 1978 WATER RESEARCH PROJECTS FUNDED BY OWRT

Eleven new Arizona water resources research projects have been funded for Fiscal Year (FY) 1978 by the Office of Water Research and Technology (OWRT), U.S. Department of the Interior.

Three other projects funded during FY 1977 received continued support through FY 1978, according to University of Arizona Water Resources Research Center (WRRC) Director Sol Resnick.

Eight of the new projects and the three continuing investigations will be funded under the Annual Allotment Grant. Priorities for selecting these proposals from among the 21 submitted were set by representatives of the Arizona Water Resources Committee, U.S. Bureau of Reclamation and the following State of Arizona divisions: Water Commission; Water Quality Control Council; Land Department; Game and Fish Department; and Health Services Department.

"As in the past, many excellent proposals regretfully could not be funded," Resnick said. "Hopefully, in the future, more monies will be made available for funding Allotment Grant proposals. Although the yearly authorization for each center is $250,000, less than one-half that amount has been allocated per year," Resnick explained.

Three other projects were chosen from seven Matching Grant proposals submitted for review by OWRT, Washington, D.C.

Titles and descriptors of new and continuing projects, with principal investigators and their University of Arizona departmental affiliations, are listed below.

NEW MATCHING GRANTS

An Analysis of the Water Status of the Plant Soil Continuum Using Electrophytograms (B-061-ARIZ). W. Gensler, Electrical Engineering.

Simulation of Soil Water and Salt Regimes during Trickle Irrigation (B-064-ARIZ). A. Warrick, Soils, Water and Engineering; and D. Lomen, Mathematics.

Geologic Applications of LANDSAT Images in Northeastern Arizona to the Location of Water Supplies or Municipal and Industrial Uses (B-066-ARIZ). K. Foster, Office of Arid Lands Studies; and J. DeCook, WRRC.

New Projects

Guidelines for Integrating Geological and Archaeological Information into Water Resource Project Environmental Anaylsis (A-088-ARIZ). M. Bradley, Hydrology and Water Resources.

Organic Pollutants in Ground-Recharged Water (A-080-ARIZ). H. Bohn, Soils, Water and Engineering; and C. Steelink, Chemistry.

Applications of the Compartmented Reservoir Concept in Arizona (A-082-ARIZ). C. Cluff, WRRC.

Hydrologic Evaluation of Small Impoundments in Arid and Semiarid Regions (A-083-ARIZ). D. Evans, Hydrology and Water Resources.

Water Requirements for Urban Plants (A-084-ARIZ). D. Fangmeier, Soils, Water and Engineering; and L. Hogan, Plant Sciences.

The Political Feasibility of Alternative Mechanisms for Managing the Supply/Demand Gap for Water in Southern Arizona (A-085-ARIZ). H. Ingram and J. McCain, Institute of Government Research.

Developing a New Deconvolution Technique to Model Rainfall-Runoff in Arid Environments (A-086-ARIZ). S. Neuman, Hydrology and Water Resources; and S. Resnick, WRRC.

The Economic Consequences of Allocating Groundwater to Competing Interests in the Santa Cruz Basin, Pima County, Arizona (A-087-ARIZ). J. Wade, Agricultural Economics.

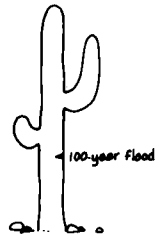
Continuing Projects

Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, Southcentral Arizona (A-073-ARIZ). S. Davis, Hydrology and Water Resources; and J. Sumner, Geosciences.

Developing Methods for On-Site Determination of Unsaturated and Saturated Hydraulic Conductivity above the Water Table (A-076-ARIZ). S. Neuman, Hydrology and Water Resources; and L. Wilson, WRRC.

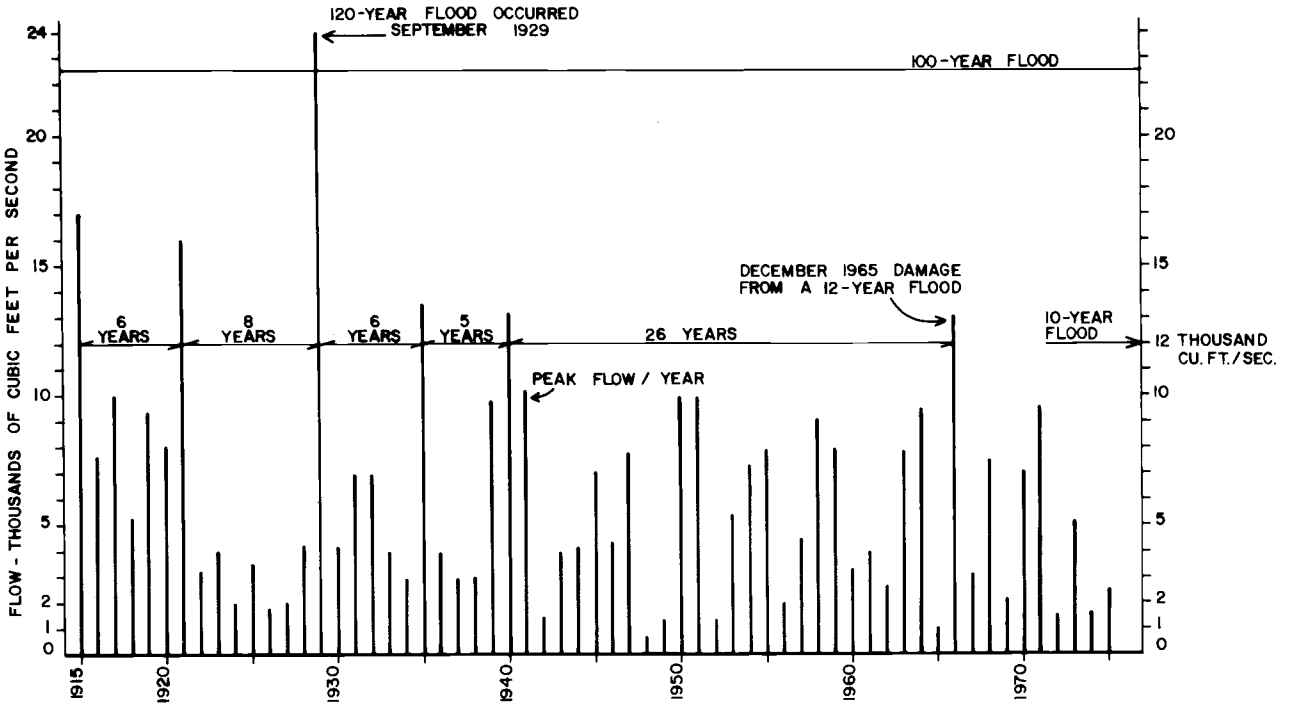
Predicting Discharge on Ungaged Streams from Rainfall Measurements in Southern Arizona (A-077-ARIZ). E. Simpson, Hydrology and Water Resources.

WAITING FOR THE 100-YEAR FLOOD



"The Flood Disaster Protection Act recently has drawn popular attention to the 100-year flood," said Brian M. Reich, Floodplain Engineer for the City of Tucson.

A common misconception is that a large flow of a specified rate will occur cyclically at 100-year intervals. But the randomness of nature is illustrated below by the 60-year chronological plot of the largest annual peak flows for a



60 YEARS Rillito Creek Near Tucson, Arizona. Drainage Area 915 Square Miles

Tucson drainage, Rillito Creek, Reich explained.

"Once, 26 years elapsed between floods exceeding the 10-year, statistically 'predicted' flow amount," Reich said. "But, then again, on three other occasions, larger floods were spaced as little as six years apart."

WHEN'S THE NEXT 100-YEAR FLOOD?

PERCENT CHANCE OF GETTING ONE OR MORE SUCH OR BIGGER FLOODS IN THIS MANY YEARS					RETURN PERIOD, YEARS
100 YEARS	50 YEARS	25 YEARS	10 YEARS	ANY ONE YEAR	
				50	2
				40	
				30	
				25	
				20	5
		99	80	15	
	99.9	94	65	10	10
	90.5	71	40	5	20
86	61	40	18	2	50
64	39	22	9.6	1	100
40	22	12	5	0.5	200
18	9.5	5	2	0.2	500
10	4.8	2.5	1	0.1	1000
5	2.3	1.2	0.5	.05	2000
2	1.0	0.5	0.2	.02	5000
1	0.5	.25	0.1	.01	10,000

For those readers who want to pursue the subject diligently but with ease, refer to the one-page article, "How Frequently Will Floods Occur?" by Brian M. Reich which appeared in 1973 in *Water Resources Bulletin* 9(1):187.

A more detailed but clear explanation of how computer analysis methodology can be applied to "predicting" flood frequencies is available in "Magnitude and Frequency of Floods" by B.M. Reich, published in 1976 in *CRC Critical Reviews in Environmental Control*, 6:297-348.

A statistical, flood "predictability" table prepared by Reich is at left. Instructions for interpreting it follow. If it is desired to determine the statistical probability of a 20-year flood occurring in any one year, for instance, refer to the "Return Period, Years" column. Find the number "20" in that column. Read across the table to the "Any One Year" column. The number is "5," meaning that there is a five percent chance of exceeding a 20-year flood in any year. Going left across to the other columns, there is a 40 percent chance of topping a 20-year flood in any ten-year period; a 71 percent chance of a larger than 20-year flood any 25 years; and a 90.5 percent chance that any 50-year period will include floods above the 20-year magnitude.

SOME PRELIMINARY USGS DATA ON OCTOBER FLOODS IN SOUTHERN ARIZONA

Near Nogales, at the upper end of the Santa Cruz River Basin, 533 square miles of watershed drain into the river. During early October, runoff from heavy rains in that area produced a peak water flow of 33,500 cubic feet per second (cfs) in the Santa Cruz River--larger than a 100-year flood.

Farther down drainage at Tumacacori, where the Santa Cruz River carries runoff from about 1,100 square miles of the basin watershed, a peak water flow of approximately 33,000 cfs was estimated.

In Tucson, at the West Congress Street bridge where the river carries runoff from some 2,200 square miles of watershed, the water flow peaked at about 22,000 cfs, about equivalent to a 50-year flood. Estimated peak flow to produce a 100-year flood is 30,000 cfs, according to Byron Aldridge, U.S. Geological Survey Tucson office.

"It does not take much imagination to envision how much worse it would have been in Tucson if the storm which produced the flood had been concentrated nearer the city rather than in the area of the border with Mexico," noted Brian M. Reich, City of Tucson Floodplain Engineer.

CONDENSATION

EPA Aquifer Regulations Proposed

The Environmental Protection Agency (EPA) will propose regulations to protect aquifers that are the only or principal sources of drinking water for communities. Included would be procedures to designate for special protection those aquifers which if contaminated would pose significant public health

hazards. Federally funded projects scheduled in areas where groundwater supplies all or most of the water to a community would be reviewed before being started.

"The new program is directed primarily toward the potential threat associated with large projects that receive federal funding," according to the EPA. "This includes highway construction, multiunit housing development, and municipal sewerage facilities built under EPA's construction grants program."

However, "small isolated commitments of federal assistance, such as individual home mortgage loans," including those from the Veterans Administration, Federal Housing Administration or Farmers Home Administration, would be exempted from EPA review.

Under the proposed regulations, the EPA administrator could designate an aquifer for protection, either on the administrator's own initiative or as the result of a public petition. Once an aquifer is ruled to be "protected" the EPA would notify federal agencies in the region of the aquifer that federally funded projects were subject to special review by the appropriate EPA regional office.

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Federal Water May Cost More

Water supplied by federally funded projects will cost more under the provisions of a bill introduced in the U.S. House of Representatives by Rep. George Miller, D-Calif., a member of the House Committee on Interior and Insular Affairs.

A graduated water price scale would be established under the "Water Resources Management and Pricing Reform Act" (HR 9592). Scale base price would be determined by the amount of water necessary to grow crops and would include the actual cost of delivering water to the contract user.

The proposed bill "would bring our water policies into line with reality, improve our planning and management techniques, encourage conservation, and assure a better return to the Federal treasury from the sale of our publicly owned natural resources," according to Miller.

Some current contracts between federal water users and the U.S. Bureau of Reclamation have a 40-year life span with no provisions for inflation escalation and no requirements for periodic water-rate cost reevaluation, according to Miller. His bill would require that the actual cost of delivering water to each customer be recalculated at least once every two years.

Las Vegas Land Subsidence

Land surface in Las Vegas, NV, has subsided four feet during the last 20 years as a result of pumping water from aquifers underlying the city. Streets, curbs and buildings show cracks up to three feet wide.

All of the 24 billion gallons of water pumped annually for Las Vegas use is from aquifers under the city, lowering water tables 150 to 200 feet and causing land surface to fall one-tenth foot each year.

In an effort to mitigate the problem, Las Vegas city officials have made arrangements to begin pumping water from the Colorado River.

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Drought problems and conjunctive use of multiple water supplies appear to be of wide-ranging interest currently.

Dr. Lucien Duckstein, who holds joint appointments in the University of Arizona Departments of Systems and Industrial Engineering, and Hydrology and Water Resources, is attending a conference on drought problems in Fort Collins, CO, December 12-14, 1977. In October Dr. Duckstein attended a Denver meeting aimed at defining problems related to the practical aspects of conjunctive use of various water resources. Both meetings, organized by Colorado State University, were user oriented.

Also considered were plans to organize a meeting on the same topics in cooperation with the University of Catania, Italy, during the spring of 1979.

For further information about these activities, contact Dr. Lucien Duckstein, Department of Systems and Industrial Engineering, University of Arizona, Tucson, AZ 85721, (602) 884-2274.

PUBLICATIONS

Impact of Groundwater Development in Arid Lands: A Literature Review and Annotated Bibliography, by Susan Jo Keith, and edited by Patricia Paylore, Assistant Director and Editor-in-Chief, University of Arizona Office of Arid Lands Studies (OALS), has been published by OALS as Arid Lands Resource Information Paper No. 10, 1977.

The 139-page publication reviews literature relevant to the impacts produced by developing groundwater resources in arid lands. Both ecosystem impacts and socioeconomic impacts are discussed.

"Two case studies are presented: one focuses on the impact of groundwater development on the Papago Indians, illustrating the cultural and subsequent environmental changes occurring when an assured groundwater supply is developed within an area of previous water scarcity inhabited by a (seminomadic) people; the second, through a discussion of groundwater development in Pakistan, demonstrates the role groundwater development can play in the economic development process in developing arid countries," Ms. Keith said.

The point is made in the publication that impacts produced by groundwater development are not created solely by withdrawing water from aquifers. Institutions and technology involved in groundwater development are major factors in characterizing the type and magnitude of impacts. Understanding the roles of institutions and technology can lead to promoting positive impacts and mitigating negative impacts, according to Ms. Keith.

The publication contains 34 figures, 13 tables and 318 annotated references. It costs $10 and can be ordered from Publications, Office of Arid Lands Studies, University of Arizona, 845 N. Park Ave., Tucson, AZ 85719.

Research for the publication was supported through a grant from the Office of Water Research and Technology, U.S. Department of the Interior.

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Water Conservation for Domestic Users with Special Reference to Warm Desert Climates is a short, informative book prepared by the University of Arizona for the City of Tucson Department of Water and Sewers.

"Depletion of a natural resource such as our groundwater supply (upon which the city is solely dependent) is a serious problem which concerns us all," according to the book. Tucson residents have been using three times as much water as is recharged into the city supply aquifers. If Tucsonans could reduce household water consumption by 10 percent, "more than a billion gallons of water would be saved annually for future use," the book states.

Several methods of saving water both in the dwelling and outside in the yard and garden are outlined. The book suggests installing water-saving devices and tells how to spot very small leaks in a water system by checking the household water meter.

Many of the most popular landscape plants used in the arid parts of Arizona are listed by landscape design function and general water requirement. The book does not rule out developing a "mini oasis" in the yard or garden for functional

or aesthetic purposes, but it suggests that "the highest return for each gallon of water invested" should be a household motto.

Also included are directions for determining the seasonal water requirements of plants, a number of conversion tables related to water and water use, swimming pool evaporation control methods, and numerous other tables, graphs and illustrations.

Faculty and staff from the University of Arizona Water Resources Research Center and Office of Arid Lands Studies, and the Departments of State and Community Programs, Horticulture, Landscape Architecture, Plant Sciences, Civil and Sanitary Engineering, and Soils, Water and Engineering served as contributors to and advisers for the publication.

The 32-page book is available for $1 from the City of Tucson Department of Water and Sewers, P.O. Box 27210, Tucson, AZ 85726, attention Mrs. Phyllis Stender.

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Maps showing ground-water conditions in the southern part of the Chinle area, Apache County, Arizona–1976, by G.W. Levings and C.D. Farrar, has been published as *U.S. Geological Survey (USGS) Water-Resources Investigations 77-50.* The publication was prepared by the USGS in cooperation with the Arizona Water Commission (AWC).

The maps show groundwater conditions in "C" aquifer and "D" aquifer, Bidahochi Formation, and alluvium. Information presented includes depth to water, altitude of water level and water chemical quality. The maps are part of a series that eventually will describe groundwater conditions throughout the state.

Computer printouts of the hydrologic data from which the maps were produced are available for perusal at AWC Offices, 722 N. Central Ave., Suite 800, Phoenix. Additional copies are available for reference and for copying at one's own expense at the following USGS offices: Federal Building, 301 W. Congress St., Tucson; Valley Center, Suite 1880, Phoenix; and 2255 N. Gemini Drive, Building 3, Flagstaff.

CALL FOR PAPERS

Detailed abstracts of papers to be given at a symposium during the Joint Session of the Arizona Section, American Water Resources Association, and the Hydrology Section, Arizona-Nevada Academy of Science, are due no later than January 2, 1978. Symposium topic is "Water for Cities in an Arid Environment: Demand Management."

The Joint Session will be held in conjunction with the 22nd Annual Meeting of the Arizona-Nevada Academy of Science, scheduled for April 14-15, 1978 at Northern Arizona University, Flagstaff.

"The State of Arizona has exhausted its supply of cheap water. This Joint Symposium is directed to better understanding the water problems Arizona's cities are facing and the development of alternatives to a continual emphasis on water supply expansion," according to Symposium coordinators.

"Papers dealing with hydrology, water quality, recycling, reuse, land use planning, recreation, energy generation, agriculture, mining, Indian water claims, socioeconomic, political and psychological research, and technology transfer which specifically relate to the Symposium topic are solicited along with general papers in hydrology," the coordinators said.

Abstracts should be submitted to Dr. Dwayne Fink, U.S. Water Conservation Laboratory, 4331 E. Broadway, Phoenix, AZ 85040, (602) 261-4356. Maximum length for abstracts is 200 words. Abstracts must be submitted in the format described below and must be camera-ready for reproduction.

TITLE

First Name of Author Last Name of Author (Affiliation)

Text of abstract. Type the abstract single spaced with a carbon ribbon. Use a type style that is simple, clear and distinct. Letter Gothic is recommended. Abstract, title and names of authors must fit within a 3½ x 7 inch box.

REMEMBER:

1) Indent first word of title 13 spaces.
2) Capitalize all letters of the title.
3) Double space between title and name of authors.
4) If joint authorship, underline author presenting paper.
5) In parentheses after names of authors list affiliation only to the extent of institution, city, and state.
6) Double space between author line and text of abstract.
7) Indent beginning of abstract 4 spaces.

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