



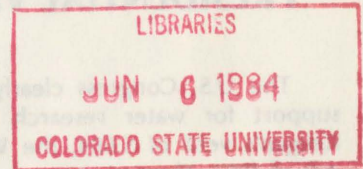
COLORADO WATER

Colorado Water Resources Research Institute

• Colorado State University

• Fort Collins, Colorado 80523

March - April 1984



WATER IN THE COLORADO

"If all goes well, and snowfall for the rest of the year is normal, the Colorado River Basin may squeeze through the summer and spring without too much flooding.

Last year, the Bureau of Reclamation was mousedrapped by heavy snow and rain in the spring, by inaccurate runoff predictions, and by a no-room-for-error policy which kept

the reservoirs as full as possible. As a result, the small amount of flood storage space in the reservoirs was overwhelmed by the gigantic runoff. Spilling water flooded out residents, chewed up waterways and destroyed habitats, and threatened the stability of dams" — High Country News, Feb. 20, 1984.

Thus goes the challenge to those who operate reservoirs on large river systems.

Extreme runoff events — both high and low — have never been adequately provided for in the rules which govern reservoir operation. The operator makes the decision guided by a set of "firm release" rules. The rules, in turn, are based upon long-term reliable water supplies and water demands, not extremes.

If precipitation this winter remains normal, the Bureau of Reclamation has estimated 12.4 million acre-feet will run off into Lake Powell in the four months April-July. The long-term average is 7.4 million acre-feet runoff.

Reservoir operators are given a set of "rule curves." When storage in a reservoir is above a certain level specified for each date during the year, water may be released for additional beneficial uses. A lower limit also specifies the level below which water releases for the firm demands must be curtailed (water rationing).

The trouble is, these rule curves tell the operator when deviations from target releases are justified, but they do not give any guidance regarding the magnitude of the releases. Neither do they indicate how fast the reservoir should be restored to the levels set by the rule curves.

Good progress has been made to develop new methods for the reservoir operator in making critical decisions to adjust to extreme events. CSU engineering professors Warren Hall, Jose Salas and Vujica Yevjevich have summarized the improved methods in CWRRRI Completion Report No. 111, titled "Investigation of Objective Functions and Operation Rules for Storage Reservoirs."

They used sophisticated probability analyses to estimate the risks of making bad release decisions. They tested the new method in case studies including reser-

voirs for power-generation, flood control, and both purposes.

They concluded that risk-formulated rules yield substantial improvement over standard methods for even small reservoirs, and improvements are magnified for large reservoirs. For example, Bonny Reservoir in eastern Colorado, a flood control reservoir, could be operated with 25,000 acre-feet less flood-storage space with no reduction in flood control benefits.

In many cases, the operation of flood-control space involves deliberate downstream flooding at a low level in order to minimize risk of severe flooding. There is a critical period of time during an extreme runoff event in which the deliberate flooding decision must be made and executed. If delayed, the space for flood storage will have diminished, perhaps to zero, before the flood peak arrives at the reservoir.

The result will be greater releases and higher flood damage than necessary. Thus, reservoir operators must be able to make continuous operational changes in long-range release strategy on short-range notice.

While the new products of high technology have been under development for the past several years, the extreme 1983 runoff in the Colorado River accelerated interest in their use. Fortunately, research anticipated the problem and the new technology is available.

This is precisely the mission of research and it justifies public investment in water research, says Dr. Norman A. Evans, director of the Colorado Water Resources Research Institute.

"Even the skeptic critical of university research ought to recognize that these scientific advances are essential for better water management," he said. "They stand to benefit the state, the region and the nation in billions of dollars annually from more power production and less flood damage in the Colorado River basin."

CONGRESS OVERRIDES PRESIDENTIAL VETO OF S.684

The U.S. Congress clearly demonstrated its strong support for water research by over-riding President Reagan's veto of S.684, the Water Resources Research Act of 1983. The vote to over-ride was 87-12 in the Senate and 309-81 in the House.

The five-year authorization provides \$10 million per year for cooperative research in the state water research institutes, provided the states share the cost.

The specified cost sharing in the first two years will be \$1 state:\$1 federal; for the next two years it will be \$1.5 state:\$1 federal; and for the fifth year (1989) it will be \$2 state:\$1 federal. The Congress intends that some of the state cost sharing be in "cash" rather than in-kind service. For this reason a state appropriation to the institute for 1984-85 is especially urgent.

Another \$20 million is authorized for matching grants, on a dollar-for-dollar basis, to be awarded through competitive proposals from any qualified research organization, including the state institutes.

Six million dollars is authorized for development of new technology with grant awards based on competitive proposals.

The new legislation directs the Secretary of the Interior to make periodic performance evaluations at each state institute. This is to monitor quality of research and its relevance to state water problems. The Colorado Institute depends upon an advisory committee of practitioners and state officials to select research priorities.

CSU WILL HOST INTERNATIONAL CONGRESS ON IRRIGATION AND DRAINAGE

For the first time since 1957, the United States will host the 12th triannual meeting of the International Commission on Irrigation and Drainage (ICID). Irrigation and drainage specialists from around the world will gather May 28-June 2, 1984, on the campus of Colorado State University in Fort Collins.

The ICID is a nongovernmental forum for water resource professionals from 78 countries committed to address one of mankind's biggest challenges — the efficient management of water. It is a nonprofit professional organization composed of engineers, scientists, economists, and others engaged in water resources management.

Concurrent with the meeting will be one of the largest irrigation, drainage and flood control exhibitions ever assembled. There will be numerous displays featuring a wide variety of products, such as heavy construction equipment and sprinkler and drip irrigation systems.

Consulting engineering firms and irrigation-oriented local, State and Federal Government agencies will exhibit their services and programs.

For more information contact:
Larry Stephens, Executive Secretary
U.S. Committee on Irrigation, Drainage
and Flood Control
P.O. Box 15326
Denver, CO 80215
Telephone: (303) 234-3006

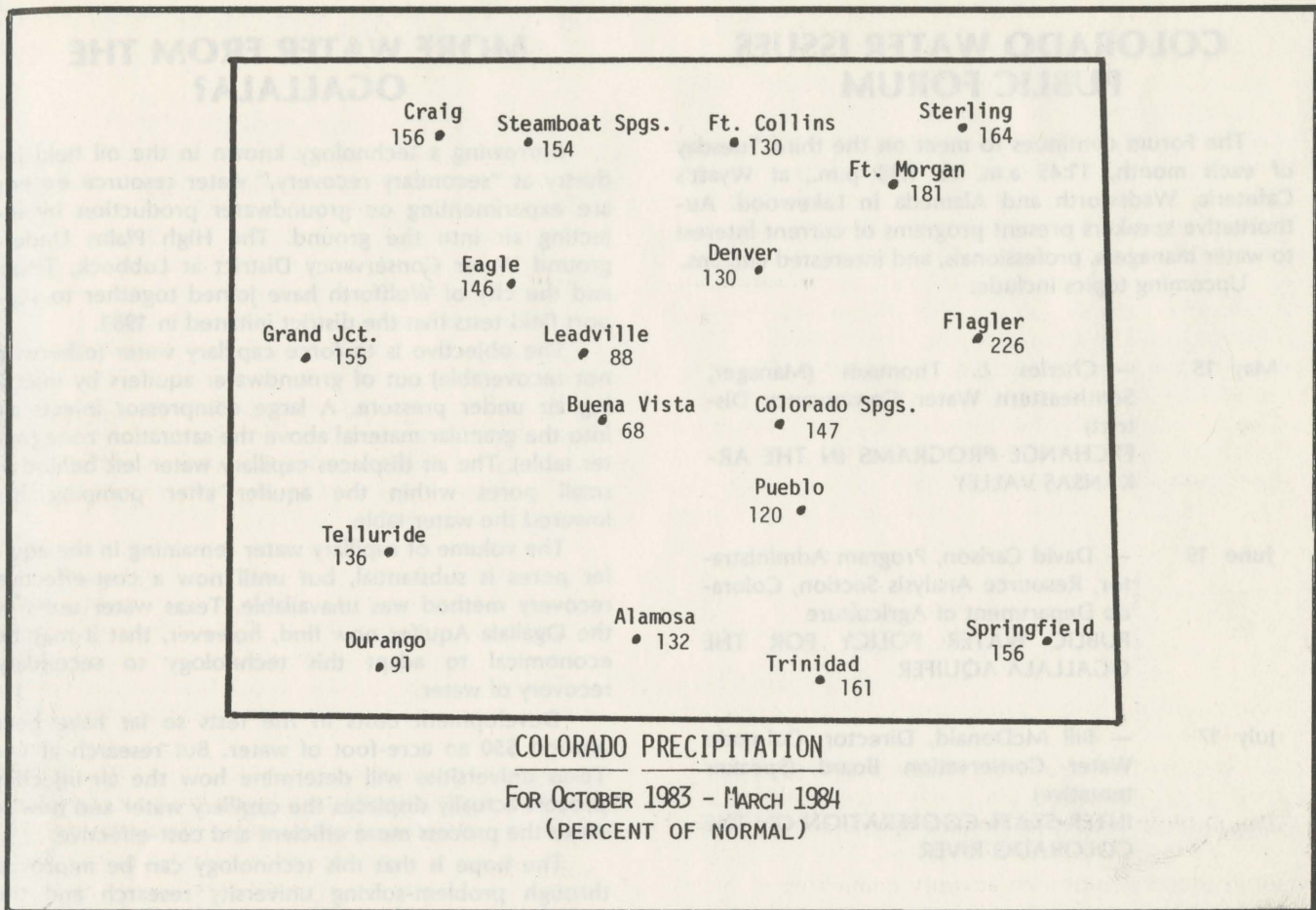
USBR PROVIDES CURRENT SNOWMELT FORECASTS, RESERVOIR CONDITIONS

Water Watch, a new publication of the Bureau of Reclamation, provides an update of conditions at major Reclamation reservoirs in Colorado and current snowmelt forecasts. The newsletter gives reservoir data, including: storage capacity, river inflow-outflow, present storage, percent capacity, and height below top of storage capacity.

The Bureau's March 1 forecasts for the April-July snowmelt runoff are summarized below.

River Basin	% of Normal
North Platte	
Seminole Reservoir inflow	128
Sweetwater River inflow to Pathfinder Reservoir	100
North Platte River gains between Alcova and Glendo Reservoirs	130
South Platte	
Big Thompson River inflow to Lake Estes	114
Big Thompson at canyon mouth	111
St. Vrain River	118
Cache la Poudre River	117
Colorado River	
Lake Granby inflow	128
Willow Creek Reservoir	143
Green Mountain Reservoir	138
Arkansas	
Fryingpan River below confluence with North Fork	114

Contact *Water Watch*, Bureau of Reclamation, Attention: LM-140, P.O. Box 25247, Denver, CO 80225 to subscribe.



COLORADO SKI COUNTRY USA CONDUCTS SNOWMAKING STUDY

A three-year, \$325,000 study will assess consumptive use of water related to snowmaking operations at Colorado ski areas.

Purpose of the study is to get factual information on how much water is actually consumed in ski area operations. If this study shows that a significant portion of the water returns to the river, ski areas will be able to purchase less water for a similar amount of snowmaking and stream augmentation plans will require less water.

Lake Eldora, Silver Creek and Vail ski areas are the primary research sites; peripheral sites for on-mountain research are Conquistador, Snowmass and Winter Park. Copper Mountain, Vail and Winter Park will participate in base facilities research in partnership with local water and sanitation districts.

The study by Wright Water Engineers of Denver will quantify the impacts of ski area operations, including

- net consumptive use of water for snowmaking purposes;
- impacts of clearing ski trails;
- effects of ski trail construction and ongoing operations on erosion from the watershed; and
- actual consumptive use of domestic water for base facilities and housing units.

The Colorado Ski Country USA Water Management Committee, composed of six Colorado ski operators, will direct the project. Eric Kuhn, Colorado River Water Conservation District, Gregg Campbell, Denver Water Department, and Jeris Danielson, Colorado State Engineer, will provide technical review of the study.

COLORADO WATER ISSUES PUBLIC FORUM

The Forum continues to meet on the third Tuesday of each month, 11:45 a.m. to 1:30 p.m., at Wyatt's Cafeteria, Wadsworth and Alameda in Lakewood. Authoritative speakers present programs of current interest to water managers, professionals, and interested citizens.

Upcoming topics include:

- May 15 — Charles L. Thomson (Manager, Southeastern Water Conservancy District)
EXCHANGE PROGRAMS IN THE ARKANSAS VALLEY
- June 19 — David Carlson, Program Administrator, Resource Analysis Section, Colorado Department of Agriculture
PUBLIC WATER POLICY FOR THE OGALLALA AQUIFER
- July 17 — Bill McDonald, Director, Colorado Water Conservation Board (Speaker tentative)
INTER-STATE COOPERATION ON THE COLORADO RIVER

THORNTON HOSTS 4TH ANNUAL WATER SYMPOSIUM

"Cooperative Solutions Regarding Front Range Water Development" is the theme of the fourth annual water symposium co-sponsored by the City of Thornton Utilities Department.

The primary emphasis this year is to update participants on the status of the Metropolitan Water Agreement. All aspects of the agreement will be addressed, including the concerns of Colorado citizens and special water interest groups.

The symposium is part of Thornton's "Better Water for People Week," sponsored by the American Water Works Association (Rocky Mountain Section). It features a keynote speech by the Honorable Richard D. Lamm, Governor of Colorado, and a panel of distinguished guests.

It will be held on April 27, 1984 at the Brittany Hill Restaurant, 9350 Grant Street, Thornton, Colorado, 11:30 a.m.

For further information contact: David P. Bata, Conference Coordinator, City of Thornton, 9500 Civic Center Drive, Thornton, CO 80229.

MORE WATER FROM THE OGALLALA?

Borrowing a technology known in the oil field industry as "secondary recovery," water resource experts are experimenting on groundwater production by injecting air into the ground. The High Plains Underground Water Conservancy District at Lubbock, Texas, and the city of Wolfforth have joined together to support field tests that the district initiated in 1981.

The objective is to force capillary water (otherwise not recoverable) out of groundwater aquifers by injecting air under pressure. A large compressor injects air into the granular material above the saturation zone (water table). The air displaces capillary water left behind in small pores within the aquifer after pumping has lowered the water table.

The volume of capillary water remaining in the aquifer pores is substantial, but until now a cost-effective recovery method was unavailable. Texas water users of the Ogallala Aquifer now find, however, that it may be economical to adapt this technology to secondary recovery of water.

Development costs in the tests so far have been around \$50 an acre-foot of water. But research at two Texas universities will determine how the air-injection process actually displaces the capillary water and how to make the process more efficient and cost-effective.

The hope is that this technology can be improved through problem-solving university research and the cost reduced to \$10-15 per acre-foot of water produced.

(Editor's note: If this new technology can be developed, it will have an important application in the Colorado High Plains region where the Ogallala Aquifer water supply is being depleted by pumping. Recovery of capillary water would promise an extension of time for the water-based economy of the region.)

Negotiations to conduct a survey of nonpoint source pollution control technologies and to improve the data base on nonpoint source pollution are underway between the EPA and the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA).

Using a detailed survey, ASIWPCA would gather technical information from all 50 states, from a collection strategy similar to and building upon data obtained by the ASIWPCA's soon to be released STEP (States' Evaluation of Progress) report, which evaluates major trends in water quality over the last 10 years.

*Water Information News Service
March 19, 1984, Vol. VIII, No. XXII*

FEDERAL WATER CLAIM

The Northern Colorado Water Conservancy District Board of Directors has been informed by its legal counsel that the U.S. Forest Service has filed an amendment to the Federal Reserved Right filings in Water Division 1 for the purpose of adding water requirements for scouring the river bed.

Purpose of this scouring would be to improve habitat conditions for aquatic life and for waterfowl.

This would be a federal claim for water in the South Platte River at certain times of the year to scour or flush the stream channel to remove certain sediment deposits and/or accumulations of debris or vegetative growth in the stream channel. The Board decided to oppose these Reserved Right filings on the ground that scouring the channel is not a legitimate purpose for the Federal Reserved Right.

The life story of a fish is etched into tiny bones in its ears. The bones are called otoliths, and they grow like tree trunks, in concentric rings, reports "Science Digest" in its February 1984 issue. At least one of these microscopic layers is added each day the fish grows — up to six years in some species.

By matching records of weather conditions with changes in the rings, scientists can learn when the fish was hatched, when it migrated, how it grew, how the water temperature varied from day to day, and when and how the fish changed its behavior . . . otoliths also contain evidence of pollution. The rings absorb heavy metals, and their growth is affected by temperature changes in the surrounding water — sometimes a sign of pollution.

Hydata, March 1984 Vol. 3, No. 2

American Water Resources Association

FOCUS ON LEADERSHIP

What makes a water leader? Some have a talent for administration. Others are gifted with a charisma which inspires confidence. A few have such a successful track record that others seek their counsel.

Mr. W.D. Farr of Greeley is a water leader having all these attributes. He is a successful businessman combining irrigated agriculture with livestock production, long-time director of the Northern Colorado Water Conservancy District, president of the Greeley Water Board, chairman of the Colorado Water Resources and Power Development Authority, member of everybody's blue-ribbon panel of water experts, and more.

It was Mr. Farr who, during the 1977 drought, stimulated thinking on better ways to manage the water resources of Colorado.

He said then, "What is needed is a total management plan for the total use of our water on a year-to-year basis. Our present water owners, ditch companies, cities, underground water users and individuals all do a fine job of managing their own water rights. The problem is the fragmentation of hundreds of owners trying to be sure that no one gets a drop of *their* water . . . water is finite in Colorado. The challenge is to develop new management to maximize the use of Colorado's water resources."

Recently Mr. Farr made a provocative analysis of the institutional aspect of water management in a talk to the Colorado Water Congress: "Are Water Conservancy Districts at the Crossroads?"

Mr. Farr believes that conservancy districts are in the ideal position to take leadership in improving basin-

wide water management. A public skeptical about the ability of government to solve problems challenges the districts to show just how good local government can be.

A new era of cooperation among districts has arrived. Districts should be agents of change. They should work toward new management strategies.

He says, ". . . water conservancy districts are the perfect tools to facilitate political agreements which provide an effective system of highly managed water supplies."

To fulfill the role of leadership, Mr. Farr suggests the following guidelines for conservancy district officials:

1. Work very hard to understand the basic needs and problems of local water users.
2. Stay out of water court whenever possible.
3. Communicate better — gain the trust of local water users.
4. Be a forum for objective analysis of local water disputes.
5. Develop agreements, not lawsuits.
6. Negotiate operating agreements that provide flexibility in basinwide water supply management.
7. Mediate disputes with objective, factual information.
8. Negotiate on behalf of your constituency, but remember that compromise will be needed.

The vision painted by Mr. Farr is of integrated, basinwide water management resulting from cooperation among conservancy districts with less reliance upon litigation and more on negotiation to resolve problems.

GLEN CANYON WATER STUDY

Glen Canyon National Recreation Area, comprising 1.2 million acres in Arizona and Utah, will be the focus of a study by the National Park Service Water Resources Field Support Laboratory (WRFSL) at CSU.

The project will provide Glen Canyon personnel with basic information needed to make decisions about long-range water resources management.

Glen Canyon is an important water-based recreational resource, with over 170,000 acres of lake surface and five major contributing rivers.

Energy projects in and around Glen Canyon could have significant impact on the environmental quality of the area. The WRFSL will analyze several tar sands development projects that are pending in the Colorado River system above the confluence with the San Juan River.

WRFSL and Glen Canyon NRA personnel will survey known point and nonpoint sources of contamination and identify contaminants at each source. A monitoring program will be initiated to evaluate potential hydrologic and water effects of tar sand developments.

The elevation of Great Salt Lake in northern Utah rose to 4,206.70 feet above sea level at the end of February 1984, the highest elevation in almost 100 years.

*National Water Conditions, February 1984
U.S. Geological Survey*

COST-CUTTING ON WASTE TREATMENT

Current methods of setting effluent limitations for municipal wastewater treatment plants in Colorado are based on safety margins that provide a risk-free environment for fish at great public expense, says Dr. John Hendrick.

Hendrick is Director of Water Resources Planning for the Jack G. Raub Company, a consulting firm in the Denver area.

These safety margins result from using rare, low-flow runoff conditions in the river as a basis. The 7-day, 10-year low streamflow employed in calculating effluent limitations and setting effluent permits is exceeded nearly 99 percent of the time, he says. A level of protection is thus established that provides aquatic life a virtually risk-free environment.

Hendrick says the goal of protecting the aquatic environment can be met by alternative means, and many professionals in the Colorado Division of Water Quality Control and the U.S. Environmental Protection Agency agree with him.

Many cities around the country have searched for a better way to set effluent limitations, but the established 7-day, 10-year low-flow criteria still govern for the most part.

Fort Collins, for example, has proposed a method based on daily monitoring of instream quality to establish daily assimilative stream capacity. Sewage discharge would then be adjusted daily to avoid exceeding the established standards for the receiving stream.

The unique feature of the Fort Collins proposal is that on any day when the stream cannot accept the full rate of effluent discharge, the excess would be diverted into an irrigation-water storage reservoir. City water department staff estimate a savings of \$140,000 per year if this method were accepted by the regulating agency.

The Georgia State Water Quality Agency has taken a different tactic — they propose to calculate the 7-day, 10-year low-flow event for each month rather than the traditional annual basis. This results in a higher streamflow rate as the limit-setting criteria and reduces the number of days when special advanced treatment must be applied.

Their studies showed about 16 percent reduced capital costs for waste treatment and about 19 percent reduced annual operating costs if the proposed strategy were applied statewide. EPA has given the Georgia proposal favorable consideration and encourages the state to accept it.

But, in a western state like Colorado the idea of a 7-day, 10-year low-flow as the basic criteria is inappropriate because irrigation withdrawals artificially change the streamflow daily, and often substantially. The minimum flow in many sections of Colorado rivers is often zero during the irrigation season.

So, the Water Research Institute is planning a research project on this problem in consultation with EPA staff in the Denver regional office, Colorado Water Quality Control Commission staff, and municipal waste dischargers. The planning group has met several times to discuss approaches and outline a research strategy. They hope that funds from EPA, the Colorado Division of Water Quality Control, municipalities and industry will be available for the project.

Participation of regulatory agencies in the planning phase insures that implementation of results, if feasible, will be seriously considered. Research sponsors will benefit from substantially reduced waste treatment costs, which will extend to every discharger of sewage effluent in the state. The Institute invites inquiries from potential sponsors.

INSTITUTE SLIDE SHOW DEVELOPED

An 8-minute slide-tape show has been developed which describes the Colorado Water Resources Research Institute — its mission, operation, how it's funded, and an example of the research results. It is designed for showing to general audiences. If you would like to have it shown to your group please contact Bill Raley at (303) 491-6308.

CONFERENCES

- May 23-25, 1984 **FOURTH NATIONAL SYMPOSIUM AND EXPOSITION ON AQUIFER RESTORATION AND GROUND-WATER MONITORING**, Columbus, Ohio. Contact: Aquifer Restoration Symposium IV, National Water Well Association, 500 West Wilson Bridge Road, Worthington, OH 43085.
- May 28-June 2, 1984 **12th INTERNATIONAL CONGRESS ON IRRIGATION AND DRAINAGE**, Fort Collins, Colorado. Contact: Mr. Larry D. Stephens, Executive Secretary, U.S. National Committee CID, P.O. Box 15326, Denver, CO.
- May 31-June 1, 1984 **CURRENT AND FUTURE NATIONAL WATER PROBLEMS AND ISSUES AS RELATED TO HYDROLOGY**, Washington, D.C. Contact: American Institute of Hydrology, P.O. Box 14251, St. Paul, MN 55114.
- June 11-13, 1984 **AWRA SYMPOSIUM: "A Critical Assessment of Forecasting in Western Water Resource Management,"** Seattle, Washington. Contact: Gary R. Minton, President, Resource Planning Associates, 113 Lynn Street, Seattle, WA 98109. Telephone: (206) 282-1681.
- June 18-21, 1984 **CONFERENCE ON DAM SAFETY ISSUES**, Denver, Colorado. Sponsored by the Council of State Governments. Contact: Leslie Cole, Council of State Governments, P.O. Box 11910, Iron Works Pike, Lexington, KY 40578. Telephone: (606) 252-2291.
- June 25, 1984 **INTERNATIONAL SYMPOSIUM ON IMPERMEABLE BARRIERS FOR SOIL AND ROCK**, Denver, Colorado. Contact: A. Ivan Johnson, Woodward-Clyde Consultants, Harlequin Plaza No., 7600 E. Orchard Road, Englewood, CO 80111. Telephone: (303) 694-2770; or R.K. Frobels, Bureau of Reclamation, MC 1521, P.O. Box 25007, Denver Federal Center, Denver, CO 80225. Telephone: (303) 234-3152.
- July 29-31, 1984 **EDUCATIONAL PREREQUISITES FOR WATER RESOURCES MANAGEMENT**, Universities Council on Water Resources 20th Annual Conference, Louisiana State University, Baton Rouge, in conjunction with The Louisiana World Exposition in New Orleans whose theme is: The World of Rivers: Fresh Water as a Source of Life. Contact: William Powers, Director, Water Resources Center, 310 Agriculture Hall, University of Nebraska, Lincoln, NE 68583. Telephone: (402) 472-3305.
- August 12-16, 1984 **20th ANNUAL AMERICAN WATER RESOURCES ASSOCIATION CONFERENCE AND SYMPOSIUM**, Washington, D.C. Conference: "Overcoming Institutional and Technical Constraints to Water Resources Management." Symposium: "Options for Reaching Water Quality Goals." Call for Papers. Contact: Arlene Dietz, Corps of Engineers, Institute for Water Resources, Casey Bldg., Fort Belvoir, VA 22060. Telephone: (202) 325-6768.

Sept. 26-28, 1984 7th NATIONAL GROUNDWATER QUALITY SYMPOSIUM, Las Vegas, Nevada. Theme: "Developing and Implementing Innovative Means of Dealing with Potential Sources of Groundwater Contamination." Contact: David M. Nielsen, Conference Coordinator, National Water Well Association, 500 West Wilson Bridge Road, Worthington, OH 43085. Telephone: (614) 846-9355.

SHORT COURSES

June 4-8, 1984 COMPUTER MODELING FOR WATERSHED HYDROLOGY, Colorado State University. Deterministic techniques for modeling hydrologic processes in watersheds; Conference Services, Colorado State University, Fort Collins, CO 80523. (303) 491-6222.

June 6-8, 1984 THE FEDERAL LAND POLICY AND MANAGEMENT ACT, Natural Resources Law Center, University of Colorado. Reviews the law, considers its implementation, and evaluates key issues; Natural Resources Law Center, School of Law, Campus Box 401, Boulder, CO 80309.

June 11-13, 1984 THE FEDERAL IMPACT ON STATE WATER RIGHTS, Natural Resources Law Center, University of Colorado. Natural Resources Law Center, School of Law, Campus Box 401, Boulder, CO 80309.

June 25-29, 1984 EROSION AND RIVER BEHAVIOR ANALYSIS, Colorado State University. Techniques to evaluate and solve practical erosion and river behavior problems; Conference Services, Colorado State University, Fort Collins, CO 80523. (303) 491-6222.

PUBLICATIONS

THE STATES' EVALUATION OF PROGRESS 1972-1982 REPORT, ASIWPCA, 444 N. Capitol St., NW, Washington, D.C. (202) 624-7782.

GROUNDWATER CONTAMINATION, National Academy Press, 2101 Constitution Avenue, NW, Washington, D.C. 20418. (202) 334-2665.

ROAD TO CRISIS: AN ANALYSIS OF WATER PROBLEMS AND INSTITUTIONAL RESPONSES, composed of two parts: Water Policy Search and Water Paper. Contact Michael Elliott, Technical Information Project, Inc., Resource Policy Institute, 1346 Connecticut Avenue, NW, #217, Washington, D.C. 20036. (202) 466-2954.

TOXIC SUBSTANCES: DECISIONS AND VALUES, a four-volume series: I. Decision Making; II. Information Flow; III. Compensation; and IV. Worldwide Problems. Contact Dr. Arthur Purcell, Technical Information Project, Inc., Resource Policy Institute, 1346 Connecticut Avenue, NW, #217, Washington, D.C. 20036. (202) 466-2954.

COLORADO WATER

Published by the

Colorado Water Resources Research Institute
Colorado State University
Fort Collins, CO 80523

Norman A. Evans	Director
William L. Raley	Extension Water Resources Specialist
Shirley Miller	Editorial Assistant
Cydney Conway	Secretary

Editorial comments and opinions expressed in COLORADO WATER do not necessarily reflect the views of Colorado State University, the U.S. Department of the Interior, or the Institute.

Colorado Water Resources Research Institute
Colorado State University
Fort Collins, Colorado 80523

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
Fort Collins, Colorado 80523
Permit Number 19