

# COLORADO WATER

Newsletter of the Colorado Water Resources Research Institute, Fort Collins, Colorado 80523

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## WATER ITEMS AND ISSUES . . .

March 1990

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**COLORADO GROUNDWATER ENGINEERING AND MANAGEMENT CONFERENCE**  
**FEBRUARY 28-MARCH 1, 1990**  
*Registration Form on page 5*

**FLASH!** "WATER FOR THE WILDERNESS" is the topic for the next WATER ISSUES FORUM -- Speakers are Gregg Hobbs of Davis, Graham and Stubbs and Lori Potter of the Sierra Club Legal Defense Fund. Moderator: Chips Barry, Colorado Department of Natural Resources. Thursday, MARCH 29 -- Be sure not to miss it! Details on page 23.

## ADAPTING TO FEDERALISM IN WATER MANAGEMENT

Editorial by Neil S. Grigg

Water managers sense that it is becoming more difficult to solve problems that have to do with water rights, water allocation and gaining new supplies through development projects. One source of the difficulty is ambiguity in state-federal relations as they relate to authority over water matters. Actions are needed by both the federal government and state governments if this situation is to improve.

In the 1970s it became clear that the federal government was backing out of its lead role in building water projects, and both the Corps of Engineers and the Bureau of Reclamation began searches for new missions. These searches continue. It was said that state governments would take primacy in water resources management, and some states have strengthened their capabilities with new agencies, staff and programs.

Meanwhile, a new intergovernmental factor has become apparent in water management, certainly in the West, but also in other parts of the country. This new factor is the emergence of federal authorities and programs that compete with and weaken state government's supposed "primacy" in water resources management.

You can see this drama unfold clearly in Colorado; you might say we are a laboratory for the rest of the nation. Examples:

The Corps carries out an expensive EIS (the authority for which is NEPA) for Two Forks, finally works up to a decision on the 404 permit (the authority for which is the Clean Water Act), only to be vetoed by a new EPA Administrator who did not participate in the planning and EIS process.

The Forest Service (under its federal authorities) claims instream flow rights for federal lands, threatening to overturn many vested state water rights. This promises a long and expensive court battle.

The Park Service (under its federal authorities) decides it needs more water flowing in the Gunnison through federal lands, and threatens to overturn state water rights to provide the flow.

Other examples would include use of the Endangered Species Act, as on the Colorado River, Fish and Wildlife Service authorities to comment on project proposals and other federal actions such as designation of wilderness or wild and scenic rivers.

Federal agencies are obviously important actors in water management in Colorado and in other states, and clearly

state governments do not exercise overall primacy, nor are they able to coordinate federal agencies. In spite of the importance of federal agencies, they are often left out of state government planning and problem-solving exercises. There is little overall recognition of federal agency roles in some, but not all, state government forums. The resulting disorder is expensive and disruptive. Providing the intergovernmental coordination needed for local-state-federal water management actions is one of the principal challenges facing the nation today in water resources management.

The Water Resources Planning Act of 1965 offered mechanisms, such as a federal Water Resources Council, to resolve some of these problems, but these didn't meet some political tests, and most of the Act's programs have been discontinued. Now there really isn't any federal initiative around to aid in these problems; local and state governments are left to fend with different federal agencies using their own means.

What to do? Actions seem needed on both the state and federal fronts. State government is the logical place to take initiatives to solve water problems within states, and to coordinate actions of different parties. This requires strong agencies and effective political leadership. At the federal level the problem is more difficult: how to coordinate federal agency actions as they affect local and state matters and how to coordinate regional water actions? Often environmental or other interest groups are looking to the federal agencies to provide them a place at the decisionmaking table when they cannot gain satisfaction from the state or local water agencies. The Water Resources Council concept was not fully satisfactory, and it didn't address operating and water allocation issues anyway. What federal program, for example, could have prevented the Corps-EPA difference on Two Forks? What federal program might coordinate the Fish and Wildlife Service and the Corps of Engineers on instream flow issues? What federal program could bring harmony to a dispute with environmental groups over water development?

At the federal level the issues often have strong scientific components: how to stop pollution of Chesapeake Bay or how much instream water is needed to protect an endangered species. The expense of a state or local government providing the evidence and arguments can be excessive (\$40 million spent by Denver ratepayers for the Two Forks EIS, for example), and one approach would be to organize a scientific court at the federal level to take on issues such as these. This, at least, might resolve some of the factual issues, but the concept, if it had merit, would need a lot of work.

At the state level, the needs are: effective water agencies, good scientific information, and the right policies. Each state must seek these in its own way.

## WATER ISSUES TO BE EXPLORED AT DENVER COMPANION CONFERENCES

Three water conferences will be held back-to-back in Denver, Colorado during the week of February 26-March 3, 1990. They offer an unusual opportunity to study rural water, groundwater issues and water-well contracting.

The Colorado Rural Water Association offers a technical program related to drinking water issues on February 26-27, 1990. Extensive exhibits will be available and the Operator's Exam will be administered. Contact: Herman Wooten at 719-545-6748.

The Colorado Water Resources Research Institute at Colorado State University and the Office of the State Engineer plan a program to evaluate technical and management methods necessary to solve groundwater problems on February 28-March 1, 1990. Contact: Janet Montera at 303-491-7425.

The Colorado Water Well Contractors Association will offer the NWWA Certification Exam followed by a technical program dealing with well regulations and the presentation on how to run a prosperous business on March 2-3, 1990. Contact: Carol Engleberg at 303-759-1756.

### PROGRAM

#### COLORADO GROUNDWATER ENGINEERING AND MANAGEMENT CONFERENCE Denver Marriott Southeast, Interstate 25 at Hampden Avenue Wednesday, February 28, 1990

See page 5 for conference registration form

8:30 - 10:00 AM Registration and Coffee

10:00 - 10:15 Opening Session: Neil Grigg and Jeris Danielson

10:15 - 12:00 N Session 1 (Plenary): National and State Groundwater Issues

"National Groundwater Agenda":

"State's Groundwater Agenda":

"Colorado Groundwater Management Issues":

"Groundwater as an Environmental Issue" :

Marian Malay

D. Craig Bell

Jeris Danielson

Dan Luecke

12:00 - 1:30 PM Luncheon "Colorado's Water Agenda": Governor Roy Romer (Invited)

1:30 - 3:00 Session 2A: Groundwater Quality Remediation 1 (Concurrent)

"Groundwater Remediation Near the Lincoln Park Superfund Site, Canon City, Colorado": A. Brown and T.C. Smith

"Hydrogeologic Characterization Leading to a No Action Alternative With Monitoring for Groundwater Contamination at Air Force Plant PJKS, Waterton, Colorado": T.M. Murphy, J.R. Hicks, L.A. Korner, T.C. Shangraw and J.K. Yu

"Operational Model of North Boundary Barrier System at the Rocky Mountain Arsenal": J.W. Warner

1:30 - 3:00 Session 2B: Application of Groundwater Models (Concurrent)

"The Anticipation of Augmentation Needs for Allocation Operations": H.J. Morel-Seytoux and C-M. Zhang

"HELM: An Integrated Model Applied to the South Platte Stream-Aquifer System": J.F. Booker, R.A. Young, C-M. Zhang and H.J. Morel-Seytoux

"Finite Difference Model Application to a 3-Dimensional Aquifer System in the San Luis Valley: Model Adjustments to Compensate for Dewatered Cells": I.R. McGowan, R.E. Brogden and D.H. Koch

"A Solute Transport Model for Conjunctive Use Studies with Water Quality Considerations": T.H. Illangasekare and J.H. Zou

3:00 - 3:30 Break

**3:30 - 5:00 Session 3A: Groundwater Quality Assessment (Concurrent)**

- "Assessment of Relative Vulnerability of Shallow Groundwater Resources in the Greater Denver Area": M. Wireman  
 "Nitrate Pollution of Shallow Groundwaters in the West": J. Silverstein and N. Cook  
 "The High Plain's Ogallala Aquifer System vs. the Northern Plain's Spiritwood Aquifer System: Water Quality Comparison": R.F. Meyer  
 "Complementary Investigative Techniques for Accurate Site Assessment with Low-Level Contaminants": M.E. Byrnes, R.W. Nelson, R.G. La Poe, D.E. Lundquist, W. McNeill and S.E. Hulse

**3:30 - 5:00 Session 3B: Groundwater Model Refinements (Concurrent)**

- "Simulation of Stream Boundaries in Groundwater Models: An Historical Overview": C. Kraeger-Rovey  
 "Improved Methods for Modeling of Surface and Groundwater Interactions": J. Schenk, E. Poeter and C. Kraeger-Rovey  
 "Solution Refinement of a Finite Difference Groundwater Model": D. Zachmann, J.W. Warner and S. Choi  
 "How Aquifer Heterogeneities Affect Numerical Groundwater Models": M.B. Allen and R.E. Ewing

**5:00 - 6:30 PM Reception**

Thursday, March 1, 1990

**8:30 - 9:45 AM Session 4 (Plenary): Groundwater Issues**

- "Comparing Groundwater Quality Protection in the Western States": L. MacDonnell  
 "Dependability of Groundwater Supplies: County Perspective"  
 "Role of Bedrock Groundwater in a Municipal Supply": J. Hendrick

**9:45 - 10:15 Break****10:15 - 12:00 N Session 5A: Groundwater Quality Remediation 2 (Concurrent)**

- "Aquifer Protection in a Changing Regulatory Environment for Above Ground Storage Tanks": P.C. Sorensen and J.M. Kerr, Jr.  
 "Soil Venting: An Aquifer Remediation Technique for Volatile Organic Compounds": J.M. Davidson  
 "Soil Vapor Surveys and Soil Venting as an Aquifer Restoration Technique: A Case History": J.M. Kerr, Jr., B. Steadman and J.A. Adams

**10:15 - 12:00 Session 5B: Test Results from Castle Pines Hole Study (Concurrent)**

- "Comparison of Specific-Storage and Storage-Coefficient Values Measured by Aquifer-Test, Barometric-Efficiency and Aquifer-Compression Techniques in Deep, Closely Spaced Wells": S.G. Robson and E.R. Banta  
 "The Concept of Specific Yield and Its Evaluation by Laboratory Measurements": D.B. McWhorter and A.J. Garcia  
 "Preliminary Results from the Coring of the Denver Basin Aquifers": R.L. Raforth and J.L. Jehn

**10:15 - 12:00 Session 5C: Artificial Recharge (Concurrent)**

- "Determination of Aquifer Recharge from Pond (or Trench) Operations": H.J. Morel-Seytoux, C. Miracapillo, H. Khadr and C-M. Zhang  
 "Artificial Recharge: Willows Experience, Willows Water District, Arapahoe Aquifer Recharge Project": J.C. Halepaska, K.T. Le and B. Lytle  
 "Recharge: Is it the Answer to Future Storage Needs in Northeastern Colorado": T. Cech  
 "Status of Bureau of Reclamation Artificial Recharge Demonstration Projects": B. Glenn

**12:00 - 1:30 PM Luncheon "National Groundwater Perspective": Congressman Dan Schaefer (Invited)****1:30 - 3:00 Session 6A: Groundwater Contamination Issues (Concurrent)**

- "Contamination of Groundwater by Chlorinated Solvents": D.B. McWhorter

"Investigation of the Movement and Location of Immiscible Organic Fluids in Groundwater Systems": D. Durnford, D. Hansen and J. Billica

"Adsorption/Partitioning/Biodegradation/Bioconcentration - The Impact on Hydrophobic Organic Mobility in Contaminated Aquifers": T.C. Peterson and K.G. Doxtader

1:30 - 3:00 **Session 6B: Aquifer Management (Concurrent)**

"Evaluation of Groundwater for Municipal Supplies Using a PC-Based Spreadsheet Analysis": W.F. Hahn, J. Slattery and D. Little

"The Widefield Aquifer Management Program": G.B. Thompson

"Hidden Costs of Farm-to-City Water Rights Transfers": J.E. Flack

"Hydrologic Impacts of Groundwater Development in the Denver Basin": T. Hatton

1:30 - 3:00 **Session 6C: Well Construction and Management (Concurrent)**

"Optimal Well Field Design for Reducing Phreatophyte Uptake Losses": G.A. Nelson, R.W. Ritz, Jr., S. Sorooshian and H. Bouwer

"Well Treatment Techniques for Restoring Yield and Reducing Sand Pumping": B.E. Kroeker and C.E. Nuzman

"Use of Bentonite in Well Field Management": F. Ogden and J. Ruff

3:00 - 3:30 **Break**

3:30 - 5:00 **Session 7A: Data Management and Mapping (Concurrent)**

"Geographic Information Systems (GIS) Technology Applied to Hydrologic Mapping": S.B. Urban and D.W. Gallaher

"Use of the Colorado Water Well Data File": W. Burt

"Determining Sampling Frequency in Water Quality Monitoring": M.L. Brogden and M.G. Richard

"Gradient Analysis of the Groundwater Fauna of the South Platte River": J.V. Ward and N.J. Voelz

3:30 - 5:00 **Session 7B: Aquifer Characterization (Concurrent)**

"Aquifer Characterization in the Northern San Juan Basin, Colorado Using Borehole Geophysical Logs": K.G. Witherbee

"Stratigraphic Nomenclature Inconsistencies in Laramide Orogenic Sediments: Denver Basin, Colorado": R.R. Crifasi

"Structure and Outcrop Mapping of the Laramie-Fox Hills Aquifer in Colorado Springs": J.M. Kaufman

CO-SPONSORS: Agricultural Experiment Station; Colorado Ground-Water Association; Cooperative Extension; Colorado State University: Colorado Institute for Irrigation Management, Dept of Agricultural and Chemical Engineering, Dept of Civil Engineering, Groundwater Program, Dept of Civil Engineering; League of Women Voters of Colorado, Groundwater Institute, Colorado School of Mines, Natural Resources Law Center, University of Colorado, U.S. Geological Survey, Colorado District; Wyoming Water Research Center, University of Wyoming

Registration Form

Please print or type:

Name(s) \_\_\_\_\_

Organization \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone \_\_\_\_\_

Registration Fee:

Postmarked by 2/9/90 # \_\_\_\_\_ @\$175 = \$ \_\_\_\_\_

Postmarked after 2/9/90 # \_\_\_\_\_ @\$200 = \$ \_\_\_\_\_

One-Day Registration Fee # \_\_\_\_\_ @\$100 = \$ \_\_\_\_\_

Total Enclosed \$ \_\_\_\_\_

Method of Payment  Check (payable to Colorado State University)

Purchase Order/Training Form (attached)

Mastercard Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_

Visa Card # \_\_\_\_\_ Exp. Date \_\_\_\_\_

Mail completed form with payment to Conference Services, Rockwell Hall, Colorado State University, Fort Collins, CO 80523.

### LINDSAY NAMED CSU DISTINGUISHED PROFESSOR

Willard L. Lindsay, Professor of Agronomy, was inducted as a University Distinguished Professor at Colorado State's Graduate School commencement ceremony on December 15. Lindsay joined the University in 1960, and has devoted much of his career to the study of phosphate minerals in soil. He developed, with the assistance of W.A. Norvell, the DTPA micronutrient soil test, which has become the standard micronutrient soil test around the world. Lindsay's textbook, *Chemical Equilibria in Soils*, is also used in research laboratories worldwide.

Lindsay received the 1980 Soil Science Award from the Soil Science Society of America for his creativity in research and teaching, and in 1987 he received the Superior Service Award from the U.S. Department of Agriculture for outstanding research. He was a member of the Governor's Scientific Council for four years and also served on the Governor's Acid Rain Deposition Panel. Lindsay is well-known in Colorado for his work with farmers and through Cooperative Extension Workshops. His appointment as a University Distinguished Professor is the highest title awarded to a faculty member by the University.

### CSU EXPERIMENT STATION DIRECTOR NEW DEAN OF AGRICULTURE AT WYOMING

Robert Heil, Director of the Agricultural Experiment Station at Colorado State University, has been named Dean of Wyoming's College of Agriculture. He will oversee six departments including home economics, veterinary medicine and range science. The appointment, effective in May, must be approved by the University of Wyoming's trustees. Heil coordinated soil testing for Colorado State from 1964 to 1970. He then went into research and teaching in the Department of Agronomy. He was named Associate Director of the Experiment Station in 1982, Interim Director in 1983, and permanent Director in 1984. Heil was active in promoting new resources and directions for the Agricultural Experiment Station, which has a number of projects related to improving agricultural use of water in Colorado.

### USGS APPOINTS NEW CHIEF OF OFFICE OF EXTERNAL RESEARCH

John Schefter was appointed Chief of the Geological Survey's Office of External Research in mid-November. Schefter has been with USGS for about 12 years. His research interests have been in the area of the economics of water transfers. Schefter replaces Frank Carlson, who retired in 1989, and will oversee administration of the State Water Institute Program.

### TWO COLORADO STATE STUDENTS AWARDED AWF RESEARCH FELLOWSHIPS

Hamid Jalali-Farahani and Edward A. Optiz have each received \$2,000 Research Fellowships from the American Water Foundation. The two Colorado State students were

among 18 Fellowship winners for 1989 announced by AWF. Optiz, a native Coloradan, is a graduate student in Water Resources Planning and Management. He spent last year as a Boettcher Scholar at Moscow State University and has worked as an Engineering Technician for Wright Water Engineers, Denver. Hamid Jalali-Farahani, a graduate student in the Department of Agricultural and Chemical Engineering, is from Iran. His Ph.D study concerns the effects of consolidation on the change of infiltration as it relates to surge irrigation. He received his Masters from the University of Arizona in Tucson.

### COLORADO WATER SUPPLY: GENERAL OUTLOOK

*Released by Sheldon G. Boone  
State Conservationist  
Soil Conservation Service*

- **Summary** - Dry conditions have prevailed across the state during the 1989 water year. Precipitation during October and November was well below normal. Significant accumulations of snowpack in the mountains did not occur until mid-December. This storm completely missed southern Colorado, making this one of the driest October through December periods in that portion of the state. The dry fall season has reduced the soil moisture across the state, making even less water available for runoff next spring.

- **Snowpack** - With the exception of the northern mountains of Colorado, the snowpack readings on January 1 are much below normal. Percentages decrease to only the single digits in some portions of southwestern Colorado. The snowpack in the Rio Grande and southwestern basins is only 10 percent of average for January 1. Snowpack figures in this part of the state are near the record low readings of 1977. Above normal readings were measured in the North Platte, Yampa, Elk, Boulder, and St. Vrain River watersheds. The statewide snowpack is only 64 percent of average, and is only 60 percent of last year's January 1 readings. This year's snowpack is consistently below last year's measurements nearly statewide.

- **Precipitation** - December is normally a dry month at lower elevations in Colorado and 1989 was no exception. Significant storms near the end of the first week and again around the 10th brought enough moisture to the Arkansas Basin so that this area ended the month with around 115 percent of normal precipitation. In the north, the Yampa and White Basins and the North and South Platte Basins received around 100 percent of normal precipitation at lower elevations. West of the Continental Divide, monthly precipitation decreased from north to south with 51 percent of normal in the Gunnison Basin and around 10 percent of normal in the San Juan, Dolores, and Animas Basins. December precipitation was around 50 percent of normal in the Rio Grande Basin.

- **Reservoir** - Storage volumes in the state's 69 major irrigation reservoirs is currently 106 percent of average for

January 1. These levels are 93 percent of last year's storage amounts. The reservoirs in the Colorado, Arkansas, and Rio Grande Basins are presently storing much below last year's levels. The lowest is the Rio Grande Basin at only 59 percent of last year's storage volume. The only basins reporting volumes below the 25-year average are the Colorado and Rio Grande Basins at 80 percent and 91 percent of the average storage, respectively. The remainder of the state's basins are storing volumes of 102 percent to 125 percent of average.

**BASIN OUTLOOK REPORTS  
and Federal-State-Private  
Cooperative Snow Surveys**

*by Michael Gillespie  
Data Collection Office Supervisor  
USDA Soil Conservation Service*

Most of the annual streamflow in the Western United States originates as snowfall that has accumulated high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are combined with snowpack data to prepare runoff forecasts. Streamflow forecasts are coordinated by Soil Conservation Service and National Weather Service hydrologists.

Snowpack data are obtained by using a combination of manual and automated SNOTEL measurement methods. Manual readings of snow depth and water equivalent are taken at locations called snow courses on a monthly or semi-monthly schedule during the winter. In addition, snow water equivalent, precipitation and temperature are monitored on a daily basis and transmitted via meteor burst telemetry to central data collection facilities. Both monthly and daily data are used to project snowmelt runoff.

- **Streamflow** - Streamflows in the northern part of the state are forecast to be near normal, while the southern regions are predicted to be well below average. Streamflows are forecast to be slightly below normal in the Yampa, White, and North Platte River Basins as well as the South Platte Basin. Streamflows in the Upper Rio Grande, Dolores, Animas, San Juan, and San Miguel River Basins are forecast at 40 percent-60 percent of average. The Gunnison River Basin is forecast at 50 percent-80 percent of average. The Arkansas and Colorado River Basins are below average at 70 percent-90 percent. If dry winter conditions continue in the southwestern corner of the state, water users can expect water shortages through the summer.

**PROCEEDINGS OF THE INTERNATIONAL  
SYMPOSIUM ON THE DESIGN OF  
WATER QUALITY MONITORING SYSTEMS**

Proceedings of the International Symposium on the Design of Water Quality Information Systems, held June 7-9, 1989,

in Fort Collins, Colorado, have recently been published. The Symposium, co-sponsored by Colorado State University and the U.S. Environmental Protection Agency, examined water quality monitoring as an information system. Forty-two papers on the topic are included in the 487 pages of the Proceedings. NWWA has been a cooperating organization for the Symposium.

The papers cover such general topics as systematic approaches to monitoring system design, statistical aspects of design, procedures to ensure adequacy of data records for statistical analysis, data analysis methods, computer software for data handling and analysis, and case studies illustrating many of the design concepts presented during the Symposium.

The Proceedings were published through the Colorado Water Resources Research Institute as Information Series No. 61 and can be ordered by contacting Bette Hart, Bulletin Room, Colorado State University, Fort Collins, Colorado 80523 [phone 303/491-6198].

**CWRRI CONTINUES INTERN PROGRAM**

The Institute's intern program, initiated in 1989 to increase student interest in Colorado water issues, continues in 1990. **Joe Pollara**, a graduate student in Agricultural Engineering, worked at CWRRI during fall semester assembling information for a 25-year report that describes Institute research and information transfer activities. Last summer Joe worked for the water rights section of the Denver Water Department. He was assigned to lysimeter studies taking place in Denver and on the Western Slope. Joe's update on the program follows.

**Mid-Winter Interim Lysimeter Report** - During the break between semesters at Colorado State, I returned to the Denver Water Department to continue analysis of the lysimeter data collected during the 1989 growing season. The first project was an update of the Symphony spreadsheets with the data collected at the end of the season. Some preliminary final results for Blaney-Criddle k-values and potential evapotranspiration were obtained for the Pole Creek golf course, Corral Creek Ranch and Lawrence Ranch sites. The Pole Creek lysimeters are predominantly Kentucky Bluegrass with some Creeping Red Fescue found in one of the bucket lysimeters. The two ranch sites boast a variety of species, but are mostly irrigated pasture grass. Results were also obtained for the bucket lysimeters located in Winter Park, Dillon, Fraser and three Denver golf courses. All these grasses can be considered residential.

Following the analysis, some comparisons between potential and actual evapotranspiration were performed between the bucket and square lysimeters at Pole Creek and Corral Creek Ranch. Some further comparisons between the 1989, 1988 and 1987 k-values were also performed, as were the consumptive use totals for the three respective seasons. During the 1990 season I hope to collect another season of data, and from that point develop this four-year study on consumptive use into a topic that meets the partial

requirements for attaining my Masters degree in Agricultural Engineering.

Martina Gessler, who received a B.S. degree in Civil Engineering in December, will provide support for CWRRI's publications and technology transfer functions. Martina has a strong interest in technical writing and work experience in both water-related engineering and public relations. As editor of *Moments Magazine*, published biannually by the College of Engineering, she redesigned the magazine format and doubled circulation to 2,000. Martina was one of four students in the College of Arts, Humanities and Social Sciences selected to represent the Colorado State Alumni Association as Honor Seniors for the 1989-90 academic year. Her other honors include The Outstanding Civil Engineer Award, Colorado Engineers Council Scholarship and Colorado State University President's Scholarship.

#### INSTITUTE TESTS CHEMIGATION VALVES

Chemigation is the process of applying chemicals (pesticides and fertilizers) to land or crops in or with water through a closed irrigation system. Beginning January 1, 1990, Colorado's Chemigation Act requires any person utilizing chemigation to file a chemigation permit application with the Colorado Department of Health for each irrigation system. Section 6.04 of the act also requires that manufacturers or assemblers of chemigation valves conform to Colorado standards and certification procedures for the valves. It designates CWRRI to test and certify that all models of pipeline check valves and injection line check valves comply with the Act's requirements. By agreement with CWRRI, Colorado State's Hydraulics Laboratory, operated by the Department of Civil Engineering, tests and certifies valves for compliance with the Act and the Institute issues the certification. Jim Ruff and Tom Brisbane of CSU's Hydraulics Laboratory are in charge of the testing program. Seven valve tests have been conducted to date for California, Colorado and Nebraska manufacturing companies.

#### CWRRI PRESENTS RESEARCH WORKSHOP

CWRRI Director Neil Grigg conducted an Institute workshop at the Colorado Water Congress's annual meeting on January 25. Presiding was Ralph Curtis, a member of the CWC Board of Directors. Grigg reported on "Research to Improve Water Management Efficiency." Jim Loftis, Associate CWRRI Director, discussed "Research to Improve Water Quality Management," and Tom McKee, State Climatologist, summarized "Drought in Colorado."

#### NOMINATIONS REQUESTED FOR UCOWR AWARD PUBLIC SERVICE IN WATER RESOURCES

The Universities Council on Water Resources requests nominations for its Public Service in Water Resources Award, which recognizes individuals, groups or agencies who have made significant contributions to increased public awareness of water resources development, use or

management. The activity should have contributed significantly to public awareness in the area of water resources development, use and management, covering any one or a combination of the natural biological and social sciences concerned with analysis of water resources. Its effects should be of regional if not national scope, and may have private or public sponsorship. Activities may focus on primary or secondary schools, legislative or other public fora or the media. University classroom programs are not eligible. Send letter nominations of not more than one page, plus supporting materials, to: the Chair, Education and Public Service Committee, Universities Council on Water Resources, c/o Dr. Duane D. Baumann, Executive Director, 4543 Faner Hall, Southern Illinois University, Carbondale, IL 62901-4526. Deadline: March 31, 1990.

#### UCOWR DISSERTATION/THESIS AWARD

This award is given to the best dissertation, as evidenced by a summary paper, in each of three areas: Engineering and Physical Sciences; Environmental and Biological Sciences; and Social and Behavioral Science.

Eligibility: Submission from institutions will normally be a PhD dissertation. Under limited circumstances Masters theses can be submitted, but they will be reviewed in the context of dissertation-level competition and criteria.

Paper Format: Up to 15 pages double-spaced (no more than 3500 words) summary paper prepared from the thesis or dissertation. The applicant should be in the process of graduation or within two years after graduation when submitting the paper. The paper should include and stress:

- original abstract of thesis
- section on highlights of literature reviewed and list of the most related articles (maximum of 10 references)
- section on significant contributions of the research to the advancement of water resources research
- technical endorsement of the paper by the major advisor and his/her opinion about the contribution of the paper

Review Process: A panel in each category will review each paper. Papers will be ranked by each reviewer and graded 0-20 on each of the following items:

- originality and innovative aspects
- technical quality and soundness
- applicant's understanding of related research
- contribution and impact to water research
- overall paper presentation

Submit seven copies of paper to: Colorado Water Resources Research Institute, 410 University Services Center, Colorado State University, Fort Collins, CO 80523. Qualified entries will be forwarded to the UCOWR Office.

Deadline: February 22, 1990.

Governor Roy Romer presented his views on Colorado water issues at the WATER MARKETING 1989 conference, November 17, sponsored by the Institute of Advanced Legal Studies, the University of Denver College of Law. His remarks are reprinted below.

**COLORADO IN THE WAKE OF THE TWO FORKS DECISION**  
**ADDRESS BY ROY ROMER, GOVERNOR OF COLORADO**  
**UNIVERSITY OF DENVER COLLEGE**  
**NOVEMBER 17, 1989**

I am pleased to be here today and to discuss what is an important issue for Colorado. Today, I understand, marks the end of the public comment period on the EPA's potential veto of the permit for the Two Forks project. I believe it is an appropriate day to begin a discussion of what we might learn from our experience with Two Forks.

Let me open this discussion by saying I am upbeat about the future of this state. You probably have heard a great deal today about our uncertain water future, and we do face tremendous challenges. But we must remember that all this is against a backdrop of a wonderfully beautiful state, a recovering economy, an abundance of human and natural resources, and a population that is willing to invest in its future. Our challenge is to forge a rational water future for Colorado -- one which reflects the many values which Coloradans place on water and which allows us to ensure adequate water supplies for the future.

The first step, I believe, is to try to understand the lessons of the Two Forks experience. As you know, I support a permit for Two Forks with a 25-year shelf life and conditions for conservation, metropolitan cooperation and the development of interim supplies. I understand that the process has not finished. Nevertheless, I believe we can begin to draw some conclusions and to assess together where we go from here.

It seems to me that there are profound lessons to be learned from the Two Forks experience. They concern far more than just how to go about permitting a big water project. They are fundamental lessons of governance and institutions. They also show us the dangers of failing to address divergent public interests and values in the formulation of public policy.

I believe the principal lesson is this: Our system of planning and developing water was designed a century ago. The state has changed profoundly since then, and so, to some extent, has water law. But the institutions by which we plan and develop water have not changed. As a result, I believe they are increasingly out of step with Colorado and with the values of its citizens.

Two Forks has been the most recent and most dramatic example of this. I firmly believe we will never be able to move forward on water in any meaningful way until we come to terms with this inadequacy and reform or overhaul the institutions by which we plan for and develop water.

Specifically, I believe the prescription for our water future can be summarized in three words -- conservation, cooperation and inclusion. We need to agree that

conservation means the wise and efficient use of water, and that it is in the best interest of Colorado. We need to find a way to cooperate in the planning, financing, development and distribution of water, especially in the Denver metropolitan area. And we need to recognize that public values in Colorado have changed dramatically since the system was established, and we must find ways to include these interests and values in the process. Until we do these three things, I believe the future for Colorado water will continue to be one of confrontation and stalemate.

Let me address each of these items -- conservation, cooperation and inclusion.

#### Conservation

A fundamental fact in the West is that water is a limited commodity. If it were plentiful, of course, we wouldn't need to worry nearly so much about storage projects or appropriation doctrines or water rights. But water is limited, and when we need more for our cities, we have to disrupt the natural environment to get it -- to dam canyons or divert mountain streams or dry up farms or drain aquifers. And because we have to do such things, I believe it is absolutely essential that we use the water wisely and efficiently.

I believe that one of the primary reasons why a large number of Coloradans did not support Two Forks is that the project's proponents did not satisfy their own constituents that the water they already had was being used efficiently.

Therefore, I suggest the first thing that needs to be done in order to regain the public trust is for those institutions which plan for water in the metro area to commit to an aggressive conservation program. Denver has made a good start by instituting a new rate structure, by speeding up its metering program and by offering rebates for water-saving plumbing fixtures. I want to commend Denver for this.

But I want to challenge this metro area to do more -- to become a national model for water conservation. I am not sure what the goal should be -- perhaps 50,000 acre feet a year, perhaps 75,000 acre feet, perhaps more. But I know we can save tremendous amounts of water through a variety of measures outlined in the Two Forks EIS. Perhaps it is time for a requirement for ultra-low flow toilets. Perhaps it is time to require municipalities to formulate conservation plans. I am flexible on the strategies, but I think we need to develop a new conservation ethic in Colorado.

There are a variety of steps we can take at every level. For instance, I am working with the Highway Department to overhaul the irrigation system along I-25 between Broadway and Colorado Blvd. We have been very inefficient in our irrigation practices along this highly visible corridor. The citizens have a right to expect government to set an example, and we need to make the changes necessary to stop the waste. Let me say that aggressive water conservation can be consistent with the goal many civic leaders have for a green city. I agree that the urban environment is important. But there are ways to plan and to landscape and to irrigate and to educate that will allow us to have green cities while still saving a great deal of water.

### Cooperation

Second, let me address the issue of metro cooperation. To be blunt, I do not believe that the way we plan to finance, develop and distribute water in the metro area is adequate for the future. I do not believe it will work the way we need it to work. There are too many jurisdictions, with scores of independent entities involved at one level or another. There also is too much competition and too little coordination between these entities. And I believe that, in planning for the area's future water needs, these entities do not always reflect all the values of the people they are supposed to serve. That, at least, has been the experience with Two Forks. We simply cannot continue to plan and develop water in this way. I believe we must make fundamental changes if we are ever to regain control of our water future. Local control is important, but chaos must not be the price we pay for it. Without changes, we will continue to face great expenses, delays, and crises.

I believe we need to reduce the number of entities that deal with water in the metro area. Ultimately, I believe we need a single entity to coordinate the planning and financing of water acquisition and distribution in the metro area. This will not be easy. It will take time and thought, and is inextricably tied to other metropolitan issues. It also will be made more difficult by the failure of the Two Forks application. But it is more necessary than ever before. I have begun a series of discussions with the important water actors on questions of governance in the metropolitan area. One of my top agenda items is cooperation on water issues. I do not yet know what shape the solution will take. But we need to find one, and I am ready to help in any way I can.

### Inclusion

Third, I think the Two Forks experience teaches us that we need a process which is more inclusive. It demonstrates in part that our present system does not adequately take into account all of the important interests and values of the people of Colorado.

We must learn from the successful campaign against Two Forks that groups which do not believe there is a place for them within the system will find effective ways to fight from outside the system. I refer specifically to the use of

the 1041 process and of the federal permitting process by opponents of Two Forks. My point is that water planners along the Front Range cannot expect to outlast or to ignore these forces. For better or worse, the federal government will continue to be active in these decisions. And local governments will continue to use tools such as 1041 process to protect their interests. We need a system which adapts to these new realities rather than one which attempts to deny or defy their existence.

I believe it is better to find a non-federal solution -- to design a state process and legal framework which includes these interests rather than leaving them no choice but to work outside the process. Specifically, I think we need to provide assurances to the people outside the metro area that their economic interests and quality of life will not be sacrificed to meet the water needs of the metropolitan area. That means that we need a state system that ensures that western slope and other interests will be heard and will have a place in the decisions that are made. The Front Range and "state water policy" must be more sensitive to how, where and when water is diverted from one basin to another.

We also need statutes and institutions which reflect the changing attitudes of Coloradans toward water and which recognize the many benefits which water brings to our state.

For instance, water is a mainstay of our tourist economy. Our sparkling streams, white-water rafting, spectacular waterfalls, and the knowledge that the West Slope will have water to develop for its own future all are important. And we need to preserve and protect endangered species in Colorado.

Of course, once a system is developed that has a place for all interests, it is incumbent upon those interests to work within it. But we cannot expect opponents of a water project to work within a state system that has no place for them.

I do not have specific answers to all the questions I have raised. We all need to work together over the next months and years to find the answers. The apparent failure of the Two Forks application creates a tremendous challenge to the people of Colorado to design a rational water future.

The greatest danger is that we will sink into internal fights and recrimination, that the ill will that has been created will be perpetuated through litigation and other fights that will drag on for years. I hope we can avoid all that and get on with forging a water future for Colorado which is wise and effective and which takes into account the interests of all Coloradans.

I want to close as I began -- by affirming that I am upbeat about the future of Colorado. Our water future is a major challenge, but I am confident that we will meet it adequately. And I will do everything I can to see that the solution we find is the best for all of Colorado.

## FROM COOPERATIVE EXTENSION

by Jim C. Loftis, Associate CWRI Director and  
Paul D. Ayers, Israel Broner and Lloyd Walker  
Extension Agricultural Engineers

**Closed System Pesticide Handling**--Public concern over pesticides in groundwater is the driving force behind various water quality initiatives being instituted by EPA. At the same time, worker exposure to pesticides is a concern of OSHA. The result of these efforts will be new regulations governing pesticide handling. These regulations are still being drafted; however, the general concept is a closed system approach.

One type of closed system involves the pesticide container. Agricultural chemical companies are beginning to use containers designed to seal the pesticide from the environment during transportation, storage and emptying. These containers range in size from 15-150 gallons and feature couplings, metering devices, siphons, or pumps. The containers are never opened in the traditional sense, but rather a hose is connected to the coupling and the materials transferred from the container to the mix tank using a pump. When the container is empty, it is returned unlined to the supplier for refilling. This type of container and method of use creates no solid waste (225 million pesticide containers in landfills in 1986) and eliminates rinsing and handling of rinsate. The 2-1/2 gallon jug currently in widespread use will likely become obsolete.

The other closed system approach involves the mixing and loading area. Proper facilities and management are basic for this closed system. The key element of the facility is a concrete pad sloped toward the center and a pump. All mixing and loading operations are carried out on this pad. In this way all spills and spray system rinsate are contained. Another facility feature is rinsate tanks labeled by pesticide. Rinse water used to clean the spray system of the pesticide containers as well as spilled liquid are stored in the appropriate rinsate tank. The rinsate is then used as dilution water in subsequent field strength pesticide mixes. The rinsate tanks and the pesticide storage area are within the confines of the concrete pad containment system. Pesticides are stored in a building with appropriate security. The entire concrete pad can be covered by a metal building shell if desired.

Proper management is the key to appropriate use of this facility. The physical facility which emphasizes containment must be matched by a management approach of containment. The materials brought into the facility (chemicals and water) must exit in the appropriate manner. This would include field strength pesticides applied on fields, properly rinsed containers sent to approved landfills, refillable containers returned to suppliers, and other wastes and residues sent to a hazardous waste disposal facility. However, a management goal should be to eliminate hazardous waste through proper material handling. Most liquid wastes can be recycled through the rinsate tanks and

ultimately incorporated into a field mix spray. Solid wastes (i.e., contaminated soil) can be minimized or eliminated through attention to cleanliness. This would include keeping the concrete pad free of soil debris during operations.

Managing the operation of the rinsate tanks is an important detail. The tanks should be no larger than 500-gallon capacity. They must be labeled as to material stored. No material should be put into the tank unless it is known when and how it will be used. The tanks should be cleaned every three weeks and no material should remain in the tanks over the winter. Since the contents of the tanks will be a weak pesticide-water mix (rather than only water), proportions of the liquid in creating field strength mixes must be adjusted accordingly. The mixing and loading crews must understand the operation of the rinsate tank system.

A final closed system approach involves rinsing of spraying systems. Standard procedures involve flushing water through the spray system using the system pump. Rinsate is sprayed on the ground. Regulations require the rinsate to be treated as hazardous. Thus options would include rinsing on the loading pad and collecting and storing the rinsate or rinsing the spray system over the target field. Both approaches have shortcomings: rinsing on the pad creates unnecessary worker exposure to chemicals and field rinsing involves additional time and fuel in traveling to the field. Two alternatives are becoming more widely used in the aerial application industry. The first involves rinsing the spray system on the ground in a closed manner. A suction line is attached to the bottom of the aircraft spray tank. Water supply hoses are attached at each end of the boom. Another hose is used at the top of the tank. As the water flushes the system, a pump sucks out the rinsate and discharges it to a rinsate tank. The second alternative involves field rinsing using an on-board rinse tank. The rinse tank contains about 20 gallons of water which is discharged at the top of the spray tank. At the completion of a spraying operation, the pilot makes additional field passes while activating the rinse tank pump. Thus the system is rinsed as the final act of the spraying operation.

While EPA and OSHA may be regulatory agencies driving these pesticide handling changes, lending institutions are also becoming involved. A bank does not want to inherit a polluted pesticide handling site. Thus they may add loan clauses addressing pesticide handling procedures. Currently all of these regulations and procedures are in draft form and will become established over the next few years. However, all of the closed system approaches outlined here are presently available and meet the performance criteria implied by the evolving regulations.

## WATER NEWS DIGEST

### Federal Water Rights

The trial between the federal government and the State of Colorado over reserved federal water rights that began in Greeley on Jan. 8 will set a precedent in Colorado and possibly the nation. Lois Witte, Deputy Colorado Attorney General handling the case for the state, says it is probably one of the biggest water court cases ever tried in Colorado. To be decided is whether the federal government, which owns 20 percent of Colorado's forests, is legally entitled to water flowing through national forests in the South Platte Basin, which includes the Cache La Poudre and Big Thompson Rivers. The basin encompasses portions of four national forests - Arapahoe, Roosevelt, Pike and San Isabel. The claim is based on a clause in the Organic Act that established national forests, allowing the federal government to secure "favorable conditions of water flows." The Colorado Attorney General's Office and approximately 50 Colorado water users and developers say the claim will endanger Colorado's economic development and could cause some people to lose their water in dry years.

A decision in favor of the federal government would give it water rights by decree to the date national forests were established. These relatively senior water rights would allow the federal government to use as much as 60 percent of the stream flows in average years and a higher percentage in dry years, says Ward Fischer, attorney for the Cache La Poudre Water Users Group. The Forest Service claims regular scouring flows are needed to transport sediment and prevent flooding. But Fischer says while this idea may apply to large alluvial rivers that flow through relatively low areas, it does not apply to the Rocky Mountain Region.

Justice Department attorney Andy Walch said it would be rare for water levels to sink so low that forest diversions would leave other users dry. He said the federal government has already agreed to subordinate any rights it obtains to 25 of the approximately 50 user groups that have raised objections, including the cities of Fort Collins, Greeley, Longmont and Golden. The case is expected to continue through Thanksgiving of this year, and to eventually wind up in the Supreme Court. If the federal government wins, it will probably file similar cases across the West. Neither the federal government nor the State of Colorado has conducted studies to determine the economic and agricultural effects of the Forest Service's proposed water diversions.

Sources: Fort Collins Coloradoan 1/8-9/90; Denver Post 1/8-9/90

### Water Supply and Development

A plan to pay Colorado, Wyoming and Utah farmers not to grow crops every third year so their excess water can be sold to growing cities in Arizona and California is stirring controversy among state water officials. Resource Conservation Group Inc. of Golden presented its proposal in November to members of the Upper Colorado River Commission's Technical Committee. The plan is backed by water lawyers, investors, and former Western Governors: John Love of Colorado, Ed Herschler of Wyoming, Scott Matheson of Utah and Bruce Babbitt of Arizona. Eric Kuhn, Assistant Secretary-Engineer for the Colorado River Water Conservation District, said that based on the oral presentation the project could have a serious impact on irrigators in the area between Grand Junction and Cortez. Referring to the Galloway proposal of 1985, Rollie Fischer, Director of the CRWCD, said "This is a concept that is possibly more viable and equally dangerous." (The Galloway proposal wanted to charge southwestern states for using unclaimed water and use the funds to build reservoirs in western Colorado.) Bill McDonald, Director of the Colorado Water Conservation Board, said "It's simply not in Colorado's interest to dry up (farm land) to send water to the lower basin."

Nevertheless, proponents of the plan hope that by mid-1990 they can win over the seven Colorado River Basin States (Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming). A Denver Post editorial said the strongest argument for the plan is that it will help dilute the Colorado River's salt content. But it also noted that the plan could have serious socio-economic impacts for the rural areas most affected. The wisdom of contracting to deliver water in specified years, drought or no drought, was also questioned.

Sources: Associated Press (Denver Post 12/25/89, 2/31/89), Rocky Mountain News 12/22/89

- **Aurora** - Four members of the original Metropolitan Cooperation Group - Arvada, Westminster, Thornton and Aurora - have tentatively decided to join in a new Front Range Water Authority. Marshall Kaplan, Dean of the University of Colorado's Graduate School of Public Affairs, has been coordinating the process. The individual city councils of the four municipalities will decide the makeup of the authority, but the goal is to combine resources and avoid duplication while building water projects. Any water rights acquired or projects built would be financed by utility rates, since the Authority won't have taxing ability. The Front Range Water Authority is an outgrowth of the Metropolitan Cooperation Group, a pre-Two Forks effort at regional cooperation in the Denver Metro area. Other

members of the original MCG were Denver, Littleton and Lakewood plus Adams, Arapahoe and Jefferson Counties.

Source: Denver Post 1/8/90

(Note: On January 22 the Aurora City Council gave initial approval to Aurora's membership in the Front Range Water Authority)

- **Douglas County** - County Commissioners, who vetoed the Dawson Ridge Metropolitan District's proposal to create a reservoir near Sedalia by digging a gravel pit, say they will continue to fight the proposal. The district says it now will ask for state approval of the project from the Colorado Mined Land Reclamation Division. The site of the planned reservoir, purchased by the District, is at the mouth of Jarre Canyon, where Mobile Premix has tried twice, unsuccessfully, to obtain a mining permit. The district's attorney says state law allows it to override county authority since the plan would provide water for the district.

Source: Denver Post 12/21/89

- **Greeley** - To finance construction at two mountain dams and improvements at its Bellvue Treatment Plant, the Greeley Water-Sewer Board will ask the City Council to approve \$3 million in water bonds. The two dams, Comanche and Seaman, need structural improvements. The State Engineer condemned Comanche in 1984 and required improvements on the spillway by 1990 or abandonment of the facility. The city applied for an extension and has until January 1, 1991 to make improvements. The project will be partially financed through a \$835,060 low-interest loan from the Colorado Conservation Board. Work on Seaman Reservoir, scheduled for repairs for five years, will begin in 1992. The water board included the project in the 1990 water bonds to save money on bond issues. The water bonds also would pay for a \$470,000 cover basin at the Bellvue Water Treatment Plant, an improvement needed to comply with stricter federal water quality standards.

Source: Greeley Tribune 1/5/90

- **San Luis Valley** - Maurice Strong, who formed American Water Development Inc. four years ago hoping to tap a huge aquifer in the San Luis Valley, has left the project. The company hoped to pump 200,000 acre-feet per year and sell some of it to Front Range suburbs. Strong, on leaving the project, said he has some concerns that the project might not be built to benefit the San Luis Valley.

Source: Denver Post 12/21/89

#### Water Conservation

#### - **Low-Flow Toilets** -

A Denver Post article on low-flow toilets says water districts that have introduced them overwhelmingly agree that they not only save water

but also cause no sewer problems. California water

districts near Santa Barbara and in the Monterey Peninsula South of San Francisco have reduced water usage by 20 to 30 percent. In New York City a "retrofit" law took effect in mid-November, and the City expects to save 20 million gallons during the first year alone. A New York City Environmental Protection spokeswoman said she estimates a yearly changeover of 200,000 toilets. Low-flow toilets have enabled the Monterey Peninsula Water Management District to avoid a moratorium on new water taps, according to a district spokesman. He said that 8.5 million of the toilets are in use worldwide, and contrary to some fears, a reduction in wastewater actually prolongs the life of sewer lines and treatment plants.

- **Denver** - The Denver Water Board hopes that homeowners and businesses will join in its efforts to conserve water by replacing their old toilets with the new, low-flow models. Customers can qualify for an \$80 rebate by installing the new fixtures, which use 54 percent less water than the conventional 3.5-gallon per flush toilets and 68 percent less than the old 5-gallon per flush toilets. The Board, which has budgeted \$300,000 for rebates, is one of the first major utilities in the nation to offer such a program. Liz Inman, Water Board Conservation Officer, says if demand is high the budget will probably be increased. About 20 calls a day have been received from interested customers since the program was approved in October, and the Veteran's Administration has expressed interest in installing the 1.6 gallon toilets in its repossessed homes.

Source: Denver Post 1/1/90

- **Boulder** - City officials are devising a Water Treatment Master Plan that includes the 1.6-gallon per flush toilet, water-saving showerheads, and Xeriscape lawn vegetation. The plan attempts to stabilize Boulder water use, which has increased from about 4.5 billion gallons in 1971 to about 7.3 billion gallons in 1989. Boulder has enough water rights - in fact, they are considering selling their share in the Windy Gap water project - but city officials want to preserve healthy levels in streams through the city and ensure that supplies last until at least 2020. The City began public discussions of water policies on January 18, and the City Council will review the plan this summer.

Source: Denver Post 1/19/90

#### Water Legislation

#### - **Senator Hatfield Urges Nationwide Water Management Plan**

- "The possibility of a water crisis is truly frightening. I have always

believed that the next major war will be fought over access to raw materials, principally water. While countries can function without oil, they cannot survive without water."

Oregon Sen. Mark O. Hatfield is asking Congress to authorize the first systematic national assessment of water needs and facilities ever undertaken across the country. Legislation the Republican introduced late last year

proposes a five-year, \$18 million study by an independent commission authorized to survey and propose radical changes in bureaucracy and legal underpinning of water management from the lowest municipal utility or irrigation district to the Corps of Engineers and the Bureau of Reclamation.

Hatfield suggests a major new department of natural resources in which overlapping, conflicting responsibilities of 16 different agencies would be consolidated. In the water-parched West, if not the rest of the country, such recommendations would be instantly controversial. But Hatfield believes accumulated needs and shortcomings in national water stewardship require a far-reaching examination and restructuring regardless of the political backlash.

In drafting his plan for a water study, Hatfield relied extensively on a proposal presented last spring to the Western Governors Association by a panel headed by North Dakota Gov. George Sinner. The resulting WGA "white paper" concluded that conflicting values and overlapping regulations have reduced water policy to a kind of "gridlock".

Ticking off problems - recurring drought in the South, the ominous threat of global warming, and turf wars over control of projects from California's Auburn Dam to the Yakima River Basin in south-central Washington - the WGA found the federal regulatory mechanism crippled by redundancy and cross-purpose.

Without conceding any of the state's traditional authority, the WGA review said the time had come for closer coordination. However various sides view the argument, the threat to the resources is widely conceded by nearly every recent analysis.

In a report prepared four years ago, the Congressional Research Service warned the nation faces a bill of as much as \$9.4 billion to carry out all the repairs likely to be needed in the public water systems by the turn of the century. Inherent in facing how to pay that bill, the CRS said, will be the question of how much the consuming public should pay for water.

Source: Gannett News Service (Ft. Collins Coloradoan 1/19/90)

**- Bishop, McInnis, Prinster Expected to Introduce Water Bills** - The Grand Junction Daily Sentinel reports that State Senators Tilman Bishop and Scott McInnis plan to reintroduce their bill to compensate basins of origin when water is diverted. The bill died in the House last year. Representative Dan Prinster, who introduced his own, more comprehensive basin-of-origin bill last year, also plans to introduce another bill this year. He said he will include more than the Bishop/McInnis bill, such as requirements that water diverters pay for problems they cause such as increased salinity or lost fishing habitat. Other water bills being planned, says the Sentinel, include: a measure consolidating the activities of the Water Conservation Board

and the Colorado Power and Water Development Authority (Bishop); and the establishment of a statewide trail system (Bishop).

Grand Junction Daily Sentinel 1/5/90

**- Wild and Scenic Rivers** - Water rights, endangered species, water quality, and the environment are among the issues delaying designation of new wild and scenic rivers in Colorado. Action is expected on only one or perhaps two designations in 1990 - the Cache la Poudre and North St. Vrain Creek - from a total of 35 potential wild and scenic rivers in Colorado. U.S. Representative Hank Brown of Greeley and the City of Fort Collins hope to designate 18.5 miles of the Poudre River as a national recreation area. And U.S. Representative David Skaggs' press secretary says a final round of local hearings on a plan to protect 19 miles of North St. Vrain Creek west of Lyons will be held this winter. U.S. Representative Howard Nielson of Utah has also introduced a bill in Congress to designate 12 miles of the Colorado River through Westwater Canyon a scenic river.

Source: Grand Junction Daily Sentinel 1/7/90

**- Wilderness Areas** - Senator William Armstrong introduced his Colorado wilderness bill on January 18. The Associated Press said the bill was described as "too little, too late" by environmentalists and as a fair compromise by water interests and developers. Representative Ben Nighthorse Campbell and Senator Tim Wirth were said to be encouraged by Armstrong's proposal and his stated willingness to find a solution to the wilderness controversy. Armstrong said his bill was drawn to accommodate future transmountain diversion of water from the Western Slope to the Front Range and to allow for possible mining, timber cutting and oil and gas drilling in a few areas currently designated as wilderness study areas. He proposes to solve the wilderness water rights dilemma by directing federal land managers to ask the Colorado Water Conservation Board to seek instream flow rights under state water law. Armstrong proposes nearly 40 percent less than the 751,000 acres proposed by Wirth, but said his proposal for national recreation areas would add another 122,300 acres.

Source: Associated Press (Fort Collins Coloradoan 1/19/90)

**- Uranium Mill Tailings** - SB77, sponsored by Senator Bob DeNier of Durango, would authorize a Colorado uranium mill tailings remedial action fund through the transfer of \$16 million from the state severance tax trust fund to the program. DeNier said the money would be available immediately to match federal funds for cleanup and also would eliminate annual demands on the Legislature to come up with matching funds. The bill was approved January 17 by the Senate Health, Environment, Welfare and Institutions Committee. It calls for a total of \$32 million in severance tax funds, up to half of it to come from a fund maintained for local government grants and loans. Tim Schultz, Director of the Department of Local Affairs, said the state provides 10 percent of cleanup costs and the federal government 90 percent. A cleanup program

at Durango is nearing completion, but the state faces similar action in Grand Junction, Rifle and Gunnison, said DeNier, and the Grand Junction project alone may cost \$250 million.

Source: Associated Press (Fort Collins Coloradoan 1/18/90)

## The Environment

over a 5-year period shows that the environment will be a top concern in the 1990s. Researcher Paul Talmey said "people see the economy getting better and better, so concern for the environment is coming back." About 200 people attended a presentation by Talmey and a panel discussion at a seminar titled "Knowing the '90s - Colorado's Emerging Public Opinion Trends." The seminar was held Dec. 5 at the Tabor Center in Denver.

Source: Rocky Mountain News 12/6/89

- **Environment 2000** - Colorado's four major environmental threats are air pollution, loss of wetlands, non-point source surface water pollution and pesticides, according to a report released in early January by a Governor's Task Force. Appointed by Governor Romer in 1988, a group of 80 volunteers from government, business, industry and community groups studied Colorado's air, land and water to determine the most serious environmental issues facing the State. A separate group studied threats to Colorado's natural resources. The two-year study, named Environment 2000, is funded by the Environmental Protection Agency. The Environmental Status Report concludes the first phase of the project. A subcommittee is establishing environmental goals for Colorado and will recommend ways the State can achieve these goals. The Colorado Department of Health, the Department of Natural Resources and the Governor's Office are administering the study.

Source: Fort Collins Coloradoan 1/11/90

- **Arkansas River** - Nominees are requested for a state-federal task force to help with the management process of the Arkansas River. In October the U.S. Bureau of Land Management and the Colorado Division of Parks and Outdoor Recreation began joint management of a stretch of the river near Buena Vista. Organized special-interest groups will each nominate one person to the task force for their area of interest, and people are encouraged to contact the group representatives listed below to suggest nominees:

- Fishing interests: Leo Gomolchak, Trout Unlimited, at the group's Denver office, 595-0620.
- Commercial outfitting interests: Pete Makris, President, Colorado River Outfitters Association, Buena Vista (719)395-8233.

- The environmental community: Kirk Koepsel, Colorado Environmental Coalition in Denver, 837-8701.
- Private boaters: Bill Baker, Colorado Whitewater Association, Englewood, 972-8437.
- Local government: Bill Simpson, Upper Arkansas Council of Governments, Canon City, (719)275-8350.
- Riverfront property owners and cattlemen: Corwin Brown, President, Colorado Cattlemen's Association, Denver, 296-1112.
- Water development interests: Bud O'Hara, Colorado Water Congress, Pueblo, (719)584-0236.

Source: Rocky Mountain News 12/30/89

## Stormwater Regulation

The Coalition of Arid and Semi-Arid Entities (CASE), includes 28 cities, counties and flood control districts and represents a constituency of more than 16 million citizens across seven Western states.

The agencies have banded together to help the Environmental Protection Agency implement stormwater-quality management programs in dry climates. In September, the coalition presented EPA Administrator William Reilly with a common position statement. The EPA's proposed stormwater rule will affect all the CASE constituents, who will be expected to bear the cost of the program. Under the EPA proposal, storm sewer systems must be issued a federal permit in order to discharge stormwater containing pollutants from domestic, commercial and industrial activities. The requirement will apply initially to systems serving more than 100,000 people but will eventually include all local governments with storm sewers. CASE has estimated that the permit application process alone could cost its members \$80 million.

Local authorities in dry regions of the West are concerned that the EPA proposal is biased toward the humid conditions which prevail in Eastern states. According to CASE, the data collection requirements proposed by the agency "could create tremendous compliance problems for permit applicants situated in drier regions of the country." The Coalition is asking the EPA for maximum flexibility for local governments in complying with technical aspects of stormwater regulation. CASE also has formed a technical advisory group, and has asked that EPA representatives meet with the group to discuss in more detail Western concerns with the program. The final stormwater quality rule is expected to be issued by the EPA next June. The 28 CASE member agencies are from Arizona, California, Colorado, Idaho, New Mexico, Nevada, Texas and Utah. The Denver region is represented in CASE by DRCOG and the Urban Drainage and Flood Control District. Contact Russ Clayshulte at DRCOG, 455-1000.

Source: DRCOG Notes

- **Virginia Developing Stormwater Management Regulations** - The State's Division of Soil and Water Conservation (DSWC) has proposed stormwater management regulations to implement legislation passed this spring by Virginia's General Assembly. An environmental engineer with the DSWC's Urban Programs says the regulations set the minimum requirements for localities to follow in adopting stormwater management programs. The proposed regulations will also govern all state agencies involved in land clearing and soil movement activities. Localities may establish requirements for stormwater management plans after July 1, 1990, and state agencies would have to adopt the requirements of the new regulations by January 1, 1991. Also mandated by the Virginia General Assembly is a flood prevention and protection assistance fund and a state flood protection plan, which is in the early stages of development.

Source: Water News, Virginia Water Resources Research Center, Vol. 20, No. 10, Oct. 1989

### Water Quality

In January state oil inspector Mike Powell began an inventory of all aging underground fuel tanks in Colorado. State officials estimate that there are about 25,000 of the tanks in Colorado, and more than 8,000 of those may be leaking, according to a federal estimate. About 600 leaking tanks or lines have been identified in the past three years. New state and federal laws require tank owners to register each tank, install leak-detection equipment, inspect old tanks annually, replace corroded equipment and clean up pollution from past leaks. The state offers financial assistance. The Colorado Department of Health shares responsibility for the underground tanks with the oil inspector's office. Underground tank installers are now required to be licensed and have their equipment certified.

Source: Associated Press (Grand Junction Sentinel 1/2/90)

- **Canon City** - Cotter Corporation began a health study in January to determine if contamination from its uranium mill has affected Canon City residents. A study group will examine the effects of consumption of groundwater, surface water, exposure to soils and sediments, inhalation of radon gas or airborne dust, and consumption of fish, vegetables, fruits, meat and milk produced in Lincoln Park. The study, approved by the Colorado Department of Health, is part of a federal court agreement resulting from a suit filed by the State.

Source: Associated Press (Coloradoan 12/23/89)

- **Crystal River** - Mid-Continent Resources Inc. faces actions by two state agencies, the Water Quality Control Division and the Mined Land Reclamation Board, related to an overflow of coal mine sediments into the Crystal River. The two actions are for violations of separate permits: one concerns the maintenance of sediment ponds

(MLRB) and the other the quality of effluent discharged from the mine (WQCD). A company spokeswoman said last year's subzero temperatures in February, combined with deep snow and avalanches, caused the problem. She said it took days of work with heavy equipment to plow the road to the ponds and then break the ice and begin to clean the ponds. State inspectors testing Coal Creek water samples found the per-liter limit for suspended solids far beyond the established limit. The company has ordered a water-treatment plant to clean all the mine water and workers have cleaned the sediment ponds every month since February to keep the discharge running clear, she said.

Source: Grand Junction Daily Sentinel 1/5/90

- **Eagle County** - Former U.S. District Judge Richard Dana has been appointed to settle a dispute between the Colorado Department of Health and Gulf and Western Industries Inc. over leaks of contaminated water. The Eagle Mine, covering 110 square miles in Lincoln County, contains more than 7 million tons of tailings, and rains and runoff have drained toxic metals from the tailings into the Eagle River. Colorado officials say despite a state and federal cleanup plan, polluted water continues to leak into the river at a high rate.

Source: Special to Rocky Mountain News by Andrew Wood, 12/23/89

- **Boulder** - A lawsuit filed in Boulder District Court charges that Syntex Chemicals Inc. contaminated groundwater by dumping toxic chemicals on their Boulder property. Plaintiffs include the YMCA of Boulder County and Flatiron Industrial Park Company. The lawsuit says the chemicals, despite reclamation efforts, have migrated and continued to migrate onto nearby property. A state health official said that the state and the Environmental Protection Agency are looking into the extent of the contamination. Syntex installed groundwater cleanup equipment and removed 28,000 tons of hazardous materials from the old landfill in 1988. A company spokeswoman says the company has installed a treatment system on its property that is cleaning up the contamination.

Source: Rocky Mountain News 1/12/90

- **Telluride/Ouray** - In 1983 Colorado's Attorney General's Office sued Idarado Mining Company, seeking the cleanup of mining wastes near Telluride and Ouray. After a nine-week trial in 1987, U.S. District Judge Jim Carrigan approved a Colorado Department of Health plan for the cleanup, which involved covering Telluride's tailings pile with a 4-foot thick cap of dirt, building a 3 1/2 mile conveyor to remove pilings from Red Mountain, and treating Red Mountain Creek with lime, then diverting it into settling ponds where dissolved metals would settle to the bottom. Idarado wants to stabilize the tailings and revegetate them gradually with grasses, using methods that State Health officials say are unproven. The company backs its proposal with bonds that would pay for cleanup costs if the new methods don't work. The 10th Circuit

Court of Appeals granted a stay to Idarado on December 19, thus putting the cleanup on hold until after Idarado's appeal next spring.

Responding to citizen complaints, on January 16 Governor Romer ordered renewed negotiations between Colorado's Department of Health and the Idarado Mining Company. Citizens fear that the Health Department's plan could inflict more damage on the environment and also disrupt summer tourist traffic. Informal talks between the two sides have continued, and negotiators for Idarado, the Health Department and the Attorney General's Office have met once since Romer's directive.

Source: Denver Post 12/31/89, 1/17/90

- **Rocky Flats** - Construction of a trench system at the base of Hillside 881 to remove chemical contaminants from groundwater at the site began on January 15, according to a news release from EG&G Inc. From the trench, the water will be pumped to a surface treatment system where ultraviolet light and hydrogen peroxide will destroy organic contaminants. Ion exchange resins will remove metal compounds, including uranium.

Source: Associated Press (Denver Post 1/16/90)

- **Rocky Mountain Arsenal** - The Defense Department has cut this year's budget for environmental cleanup at the Rocky Mountain Arsenal by \$10 million even though Congress this year appropriated \$600.8 million to clean up pollution at military facilities, \$83 million more than President Bush requested. An Army spokesman said Pentagon officials originally budgeted \$213 million for the cleanup, but was later told it would receive only \$174 million. The cut prompted an angry letter to Defense Secretary Dick Cheney from Denver Congresswoman Pat Schroeder, demanding an explanation for the budget cut.

Source: Rocky Mountain News Washington Bureau 1/3/90

- **Sugarloaf** - Boulder City officials want to build a pressurized pipeline to replace the aging pipeline now carrying water from Lakewood Reservoir to the Betasso water treatment plant. Construction would include a 60-foot wide corridor over 4 miles, including parts of Sugarloaf Mountain. Boulder officials say the pipeline is needed because of stricter federal standards governing clean water. Sugarloaf residents have formed a committee to fight it, citing concerns from safety to environmental damage and loss of minimum stream flow.

Source: Rocky Mountain News Boulder Bureau 1/12/90

- **Denver** - Repair of the Thornton-North Washington Pump Station was completed in early January, using a new technology that carried sewage around the station while repairs were being made. The Colorado Health Department had rescinded a permit issued to the Metropolitan Sewage Disposal District, which planned to dump 25 million gallons of raw sewage into the South Platte River, after complaints from area officials and environmentalists. The

repairs were necessary because of the increasing sewage flow from the Thornton area.

Source: Denver Post 1/5/90

- **Arkansas Valley** - Residents may face multimillion-dollar costs to upgrade their drinking water supplies. Las Animas Mayor Leonard Hudnall called a meeting of Arkansas Valley town officials in January to discuss how to cope with tougher federal water quality standards expected under the revised Clean Water Act within two years. He said most valley drinking water wouldn't meet tougher regulations on hardness and salinity.

Source: Rocky Mountain News 1/5/90

- **Eastlake** - The small Adams County community of Eastlake may soon be annexed by Thornton. Although the 100 residents would rather stay independent, their sewer system is on the verge of failure and if something isn't done the Colorado Department of Health may condemn the homes. Proposals have been studied to hook up to either Thornton or Northglenn. Thornton would provide the least expensive alternative; hooking up to Northglenn would cost 25 percent more, but would not require annexation. Eastlake residents have voted to increase property taxes to help pay a portion of connecting to a sewer system, and task force planners say it will probably be Thornton.

Source: Denver Post 1/4/90

- **Mesa County** - A proposed rule requiring that property titles note the cleanup of uranium mill tailings is part of the law that authorized the tailings cleanup in Mesa County. Local title company officials, real estate agents and lenders protested the rule at a November 9 hearing and in written comments, complaining that it could make it difficult to sell the cleaned properties and curtail title insurance, thus making it difficult to sell mortgages on the secondary market. The Department of Energy is expected to decide on the rule this spring. A report, including a transcript of the hearing and written public comments, can be read at the Mesa County Public Library, 530 Grand Avenue, and the U.S. Department of Energy Grand Junction Projects Office, 2597 B 3-1/3 Road, Grand Junction.

Grand Junction Daily Sentinel 1/6/90

## Agriculture

- **Amendment Would Bar Absentee Farm Ownership** - A proposed amendment to Colorado's constitution would bar absentee foreign ownership of Colorado farms and ranches, and if approved by voters would put strict guidelines on takeovers by large corporations. Dave Carter (National Farmers Union), Bill Glover (Family Farm Initiative Committee), John Stencil (Rocky Mountain Farmers Union), and Jim Brophy, a farmer from Yuma, said they hoped the title for the proposed amendment would be set soon so signatures can be obtained to put the issue on the

November election ballot. They said a family farm initiative would limit the involvement of corporations and investment firms in the partnerships that own and operate farms. The amendment would also prohibit contract feeding, where a processor or grain trader owns the animals and contracts for someone to feed and care for them in a feedlot. Carter said Nebraska has had similar legislation on the books since 1982.

Source: Associated Press (Fort Collins Coloradoan 12/21/89)

- **Russians Visit Local Farms** - Soviet visitors toured Weld County in early January, saying they were impressed with the farms and had a difficult time believing yield figures given them during the tour. The group was accompanied by J. Paul Wayne, a graduate student at Colorado State, who helped negotiate an American-Soviet Agricultural Exchange. Wayne acted as interpreter for the group. In February more than 30 members of the Colorado Agricultural Leadership Program will spend two weeks in the Soviet Union.

Source: The Fort Collins Coloradoan 1/11/90

- **IRS Water Depletion Allowance** - Engineers from the U.S. Internal Revenue Service met with High Plains Water District (Lubbock, TX) staff in December to review and approve data necessary for cost-in-water income tax depletion allowance claims. To file a claim, landowners need to establish the amount of water in storage, the cost of water at the date of purchase or acquisition, plus the amount of water used during the tax year (base). Using District tables and maps, landowners can obtain information they need to establish their base for a depletion allowance or obtain one year of decline data to file their claims if a base is already established. The District has lists of tables containing approved cost-in-water land values by year for each county. Maps compiled by the district illustrate the saturated thickness of the Ogallala Aquifer Formation for different time intervals, providing the amount of water in storage. Other District maps are used to find the amount of water depletion in feet for any tax year. The maps and tables date back to 1948.

The price paid for water in storage is determined from actual land sales. The average selling price for dryland farm sales is subtracted from the average selling price of irrigated land sales and the difference is the price of the water.

Source: The Cross Section, January 1990, published by High Plains Underground Water Conservation District No. 1, Lubbock, TX

- **Emergency Loans for Farmers** - Due to damages caused by weather conditions between May and August of 1989, farmers in Larimer, Weld and Jackson counties are eligible for emergency loans. The Farmers Home Administration stated that farmers have 8 months to apply. To be eligible, they must be able to repay the loan, be

unable to get credit elsewhere, have adequate security, and multiperil or Federal Crop Insurance if available.

Source: Ft. Collins Coloradoan 12/26/89

## Recreation

### - Reservoir Recreation

The Longmont City Council is keeping alive the discussion of opening Union Reservoir, east of Longmont, to public recreational use. Plans began in 1986 when city voters authorized the issuance of bonds to buy controlling interests in the Union Reservoir. County Manager Fred Wilson says with the bond election came the implied promise that the reservoir would be converted to public recreational use. He feels a minimal amount of capital improvements would make the lake available.

However, the go-ahead for construction seems to be stalling until a decision can be made as to the possible expansion of the reservoir. Wilson said Longmont needs to keep the expansion option as open one possible method of assuring adequate water supplies when Longmont outgrows its present water storage capabilities. One Council member also urged that any city recreational plan protect the wildlife and bird habitat on the northwest side of Union Reservoir from disturbances by boating or hiking.

Source: Longmont Times Call 11/22/89

- **Stagecoach Reservoir Has Fish Loss** - It may be two or more years before Stagecoach Reservoir, Colorado's newest state park lake, can develop into the excellent trout fishery that experts predicted it would be. The 715-acre reservoir 20 miles south of Steamboat Springs suffered a crushing blow this fall when a combination of pollution and oxygen deficiency killed every fish in the lake (approximately 150,000). Bill Elmlad of the Colorado Division of Wildlife said the cause was hydrogen sulphide, created by decomposing dried cattle manure left in the area from years of grazing. The oxygen deficiency stemmed from the natural richness of drowned vegetation in the new reservoir.

Elmlad said the combination of the two created a situation in late summer in which only the top 12 feet of water were inhabitable by trout. On October 19, when dropping water temperatures caused a mixing of all levels of water, the fish died. "The lake should clean itself out in two or three years, helped by the flushing effect of spring runoff," Elmlad said. In the meantime, new, catchable-sized fish will be stocked in the lake.

Source: Denver Post 11/24/89

- **Recreational Costs to Rise** - Hunting and fishing are like automobiles, housing and taxes. The price keeps going up. A gradual license fee hike approved by the 1988 Colorado Legislature is being phased in through 1992. For example, a resident fishing license, which cost \$11.25 in 1989, will jump to \$20.25 in 1992. A resident small-game hunting and fishing combination license cost \$15.25 in

1989; it will be \$30.25 in 1992. Perry Olson, Director of the Colorado Division of Wildlife, concedes there will be even more fee increases in the next decade to support an increasing annual budget. In order to help alleviate this, he sees a need for a wildlife funding base that includes people who don't fish or hunt. One idea is a user tax on outdoor gear such as hiking or bird-watching equipment, which would supplement license revenue.

Until such a solution can be implemented, hunters and fishermen will have to continue to carry the financial burden of new wildlife programs and increased production of the state's 14 fish hatcheries.

Source: Denver Post 12/31/89

## COLORADO WATER RESEARCH

A summary of water research awards and projects recently initiated is given below for those who would like to contact the investigators to receive information.

### COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523

- Theoretical and Observational Marine Boundary Layer Studies, Stephen K. Cox, Atmospheric Science
- Mechanisms of Plant Cell Wall Resistance to Attack by Polysaccharide Degrading Enzymes: A Study Using Nuclear Magnetic Resonance Analysis, Vincent G. Murphy, Agricultural & Chemical Engineering
- Range Improvement Research for the Central Shortgrass Plains, Harold Goetz, Range Science
- Evaluation of Large-Scale & Long-Term Impacts of Changes in Management & Climate on Properties of Great Plains Soils, Edward T. Elliott & Vernon C. Cole, Agronomy
- Computer Modeling, Software Development and Documentation for Watershed Hydrology, Jose D. Salas, Civil Engineering
- Evaluation of Revegetation Techniques, Edward F. Redente, Range Science
- Wind Tunnel and Numerical Modeling of Coastal Marine Flows, Robert N. Meroney, Civil Engineering
- Radioecological & Ecotoxicological Investigations at Rocky Flats, Floyd W. Whicker, Radiology - Radiation Biology
- Colorado Bioprocessing Center, Eric H. Dunlop, Agricultural & Chemical Engineering
- Wind Tunnel and Numerical Modeling of Coastal Marine Flows, Roger A. Pielke, Atmospheric Science
- Study of Improved Methods for Predicting Chemical Equilibria, Terry G. Lenz, Agricultural & Chemical Engineering
- Grassland/Atmosphere Response to Climate Change: Coupling Regional & Local Scales, Roger A. Pielke, Atmospheric Science
- Studies of Dynamics and Electrification of Deep Convection and Mesoscale Cloud Clusters...Steven A. Rutledge, Atmospheric Science
- Pathway Analysis - Radionuclide Ingestion/Nevada Test Site, Thomas B. Kirchner, Natural Resource Ecology Lab
- Design Criteria and Integrated Management Technology for Surface and Center Pivot Irrigation..., Israel Broner, Agricultural and Chemical Engineering
- Interactions of Water and Nutrient Dynamics in a Pinyon-Juniper Woodland, Floyd Whicker, Radiology-Radiation Biology

### UNIVERSITY OF COLORADO, BOULDER, CO 80309

- Collection of Atmospheric Gases, Mark Losleben, Institute of Arctic and Alpine Research
- Ocean Surface Currents Computed from Sequential Infrared Satellite Images, William Emery, Aero-Colorado Center for Astrodynamics Research Aerospace Engineering
- Dynamic Behavior of Fiber and Particle Reinforced Composites, S.K. Datta, Mechanical Engineering
- Coordinated Research: Self-Adaptive Database Support for Derived Data in Distributed Engineering Design Systems, Roger King, Computer Science

- The Structure and Dynamical Properties of Earth's Core**, John Wahr, Mechanical Engineering
- Using Multi-Sensor Data to Model Factors Limiting Carbon Balance in Global Grasslands**, Carol Wessman, Geological Sciences
- Arctic Ocean Atmosphere-Ice System Studies Program**, Roger Barry, Geography
- Drag Anchor Tests in Clay**, Hon-Yim Ko, Civil, Environmental & Architectural Engineering
- From the Continental Divide to the Denver Plain: A Meditation on the Boulder Creek Watershed**, Michael Crane, Fine Arts
- Fundamental Studies on Hydrology, Hydraulics and Geometry of River Networks**, V.K. Gupta, Cooperative Institute for Research in Environmental Sciences
- Verification of Soil Liquefaction Analysis by Coordinated Geotechnical Centrifuge Studies**, Hon-Yim Ko
- Development and Experimental Verification of Models for Estimation of Uplift Water Pressures in Cracks in Dams**, Tissa Illangasekare, Civil, Environmental and Architectural Engineering
- Fracture Mechanics of Concrete Gravity Dam: Part I: Static Loading**, Victor Saouma, Civil, Environmental and Architectural Engineering
- An Advanced Decision Support System for Irrigation Canal Management**, Kenneth Strzepek, Civil, Environmental and Architectural Engineering

#### 9TH HIGH ALTITUDE REVEGETATION WORKSHOP

This workshop will be held March 1-2, 1990, at the Fort Collins Marriott Hotel, 350 E. Horsetooth Rd. in Fort Collins, Colorado. Speakers will update attendees on the current regulatory environment, water quality issues and techniques, tailing and mine waste reclamation, microbiological aspects of reclamation, visual and aesthetic planning, and various reclamation projects. The Keynote address will be given by James J. Scherer, the EPA Regional Administrator from Region VIII Headquarters in Denver. For information contact: Gary L. Thor, HAR Committee Secretary, Dept. of Agronomy, Colorado State University, Ft. Collins, CO 80523. Phone: 303/491-7296.

#### COLORADO WATER THE NEXT 100 YEARS

Join your friends, associates and neighbors in a lively three-hour program to entertain ideas of how water can be managed most effectively. Brief informative talks by scholars and water professionals will precede the public discussion. The talks will focus on: conservation, water quality, and legal and engineering aspects of managing water. Written results that reflect the consensus of participants will be distributed to all interested parties. This program, a project of the Colorado Endowment for the Humanities and Front Range Community College, is scheduled as follows:

Alamosa	February 17, 1990
Pueblo	March 3, 1990
Greeley	March 17, 1990
Montrose	September 22, 1990
Durango	October 6, 1990
Steamboat Springs	November 10, 1990

Contact Project Director, Front Range Community College,  
3645 West 112th Avenue, Westminster, CO 80030;  
(303/466-8811 ext. 434 to receive more information.

#### SHORT COURSES

**Design of Water Quality Monitoring Networks**, Colorado State University, Fort Collins, CO, June 11-15, 1990. This short course will present detailed procedures for designing a water quality monitoring system. Following a review of basic statistics, the course will address the use of statistics in the analysis of water quality data and the ramifications of such analysis on the design of the entire monitoring system. Analyzing and redesigning an existing monitoring network will be emphasized citing case studies. For further information contact: Water Quality Short Course, Office of Conference Services, Rockwell Hall, Colorado State University, Fort Collins, CO 80523. Phone: 303/491-6222.

#### CALLS FOR PAPERS

**North Atlantic Treaty Organization Advance Research Workshop, "Nitrate Contamination: Exposure, Consequence, and Control,"** University of Nebraska-Lincoln, September 10-14, 1990. Persons who wish to attend the workshop as full-time and active participants should send a letter of intent along with a curriculum vitae and a 200-word abstract of the proposed paper to the Co-Organizer, Robert D. Kuzelka, University of Nebraska Water Center, 103 Natural Resources Hall, Lincoln, NE 68588-0844. Phone: 402/472-3574. Workshop topics include an overview of nitrate problems in Europe and North America, monitoring analysis and modeling of exposure assessment; health consequences of exposure; nitrate contamination control and treatment; and a systems approach to risk analysis and risk management. Workshop participants are expected to be experienced professionals with a strong research motivation in the area of nitrate contamination. Deadline: March 1, 1990.

**Seventh Annual South Carolina Water Resources Conference, "Water Resources for the 21st Century: Dilemmas and Strategies in Designing Water Budgets,"** September 19-21, 1990, Columbia, SC. Topics should address water quantity, water use, water law, water supply and demand, water-related developing technologies and data needs, or other water budget issues pertinent to South Carolina. Abstracts and summaries of no more than 250 words should be submitted by April 2 to Linda M. Small, South Carolina Water Resources Commission, 1201 Main St., Suite 1100, Columbia, SC 29201. Phone: 803/737-0800.

The conference is cosponsored by the SC Sea Grant Consortium, the Strom Thurmond Institute of Government and Public Affairs at Clemson University, and the SC Water Resources Research Institute.

**ASDSO 7th Annual Conference, New Orleans, LA, October 14-18, 1990.** ASDSO invites all persons interested in the safety of dams to submit abstracts of papers. Abstracts, one page, single-spaced, must be submitted to ASDSO prior to the established deadline (exceptions may be discussed) and should include paper's title, all authors' names and affiliations, and biographical sketches (one page, single-spaced in paragraph form). No resumes. Include full mailing address and telephone numbers. Submit abstracts to: Association of State Dam Safety Officials, P.O. Box 55270, Lexington, KY 40555-5270. Phone: 606/257-5140 or 5146. Deadline: March 1, 1990.

**WATERMATEX '91, "Second international conference on Systems Analysis in Water Quality Management,"** Durham, NH, June 3-6, 1991. Papers are being sought in the area of systems analysis in water quality management and will be published in the book series Advances in Water Pollution Control. Conference organizers also seek computer demonstrations and hands-on sessions of computer applications and simulations of environmental processes. University computer facilities will be accessible during the conference. The conference sponsor is the International Assoc. on Water Pollution Research and Control (IAWPRC). Cosponsors are APWA, WPCF, USEPA and the University of New Hampshire. Send 1,000-word abstract to: WATERMATEX '91, New England Center Program Office, 15 Strafford Ave., Univ. of New Hampshire, Durham, NH 03824. Deadline: April 1, 1990. For information contact: New England Center Program Office at 603/862-1900.

**Fifth International Conference on Rain Water Cistern Systems, Keelung, Taiwan, R.O.C., August 4-10, 1992.** Interested participants are invited to submit by air mail abstracts of papers to: The Organizing Committee, 5th International Conference on Rain Water Cistern Systems, Dept. of River and Harbor Engr., National Taiwan Ocean University, Keelung, Taiwan 20224, Republic of China. Abstracts should be written in English, not to exceed 250 words, and should be submitted double-spaced on bond paper. The paper title, author(s), complete name(s), their affiliation(s), and full mailing address(es) must be included. Deadline: August 31, 1990.

## POSITIONS AVAILABLE

**Assistant Professor and Assistant Aqueous Geochemist,** Agricultural Experiment Station in the Department of Land, Air and Water Resources, University of California, Davis. This is an eleven-month (plus one month paid vacation), tenure-track teaching and research position in the College of Agricultural and Environmental Sciences.

Land, Air and Water Resources is a multi-disciplinary department consisting of soil, plant, and atmospheric scientists, hydrologists, aquatic biologists, and water resources engineers. Departmental teaching and research focus on basic and applied aspects of soils, plants, the atmosphere, and water resources and their interactions in an agricultural as well as an environmental context.

**Responsibilities:** The appointee is expected to develop a research program in aqueous geochemistry with special emphasis on ground water quality involving laboratory, computer and field-based studies. Possible research areas include kinetics of mineral weathering, stable and radioactive isotope chemistry, chemistry of hypersaline waters, and mobility, reactivity and accumulation of trace elements in the vadose region and saturated zone. The appointee will develop and teach new upper-division undergraduate and graduate courses in "Aqueous Geochemistry". Supervision of graduate students, student advising and participation in University service and professional activities are expected. The successful candidate will be expected to complement existing teaching and research programs.

The applicant must have a Ph.D with emphasis in geochemistry and a strong background in aqueous low-temperature geochemistry and physical chemistry. Demonstrated knowledge and interest in mineral solubility, hydro-geochemical modeling and advanced analytical methods are desirable. Salary commensurate with experience within the Assistant Professor rank at the University of California. Expected appointment date on or about July 1, 1990. Applications and inquiries should be directed to: J.W. Biggar, Chair, Aqueous Geochemist Search Committee, Department of Land, Air and Water Resources, University of California, Davis, CA 95616, Telephone (916)752-0681/0453.

Applications should include a resume; academic transcripts; statement of research and teaching interests and experience in each; copies of publications, reports, in-press and submitted manuscripts; a summary or abstract of the Ph.D dissertation; and names, addresses, and telephone numbers of at least four references. Deadline: February 28, 1990.

**Faculty Positions, Environmental Toxicology- Chemistry, Water Resources Engineering, and GeoScience** are currently open at the Water & Energy Research Institute (WERI), Guam. All positions have the rank of assistant or

associate professor, depending on qualifications of the applicant, and are both research and teaching oriented. A Ph.D with academic experience in the respective field and U.S. citizenship or permanent residence status are required.

Initial appointments are via a three-year contract (the nine-month school year). Subsequent appointments are either tenure-track or one-, two-, or three year non-tenure track appointments. For additional information, contact Dr. Shahram Khosrowpanah, Water & Energy Research Institute of the Western Pacific, UOG Station, Mangilao, Guam, 96923 USA.

**Engineering Faculty Positions - Texas A&M University, Civil Engineering.** The Dept. of Civil Engineering at Texas A&M University has several positions open with the following areas of emphasis: (1) infrastructure engineering (including nondestructive evaluation, materials engineering, structural engineering and mechanics, and transportation engineering); (2) waste and environmental quality engineering (including environmental engineering and hazardous materials); (3) construction engineering; (4) water resources; and (5) geotechnical engineering.

Special considerations will be given to those candidates with expertise and/or practical experience in numerical analysis and computational mechanics; risk analysis (including applied probability and statistics); expert systems (including uncertainty analysis) and artificial intelligence; control theory, robotics, and automation; engineering design (including CADD and decision analysis); and systems engineering (including quality management and human factors).

Ideal candidates will have a proven track record of refereed publications, funded research, effective teaching, and a clear potential for leadership. These positions are tenure-track. Rank and salary are commensurate with qualifications and experience. These positions will be filled on a timely basis. Interested persons should send summaries of personal data, education, publications, professional experience, and any other noteworthy accomplishments, together with names and addresses of three references to: Faculty Search Committee, Dept. of Civil Engineering, Texas A&M University, College Station, TX 77843-3136.

**Cooperative Extension Assistant/Associate Groundwater Quality Specialist-Kearney Agricultural Center, University of California, Parlier--**This is an academic career-track position subject to 3-year administration review for reappointment. The purpose of this position is to develop and implement extension teaching and applied research programs on groundwater contamination. Emphasis will be to develop and implement strategies for reducing and preventing groundwater contamination through extension teaching and applied research programs. Geographical emphasis will be placed on the San Joaquin Valley and the Central Coastal Valleys. Clientele include state and federal regulatory agencies, policy makers, and county extension staff. Develop a multidisciplinary approach for addressing groundwater contamination problems. This approach requires coordination and cooperation with specialists and faculty involved in resources management, toxicology, fertilizer and pesticide management, economics, etc. Develop and maintain coordination with federal, state and local agencies involved in groundwater contamination. Provide educational leadership and technical information support for county advisors and assist them in identifying and defining the needs of underrepresented groups.

**Qualifications:** Ph.D and background in areas such as groundwater hydrology, chemistry, and soil physics, or a closely related field is required, and demonstrated knowledge and interest in groundwater contamination with emphasis on finding solutions to pollutant transport problems. **Salary:** Commensurate with experience and within the Assistant/Associate Specialist rank in the University of California. **Data Available:** January 1, 1990.

**Application:** Applications and inquiries should be directed to Blaine Hanson, Groundwater Quality Specialist Search Committee Chair, Land, Air and Water Resources, University of California, Davis, California 95616, telephone (916)752-1130. Applications should include a resume, official undergraduate and graduate academic transcripts; statements of research and teaching interests and experience; copies of publications, and reports; a summary or abstract of the Ph.D dissertation; and names, addresses and telephone numbers of at least three references. Applications will be received until April 1, 1990.

## CONFERENCES

- Mar. 21-22 FROZEN SOIL IMPACTS ON AGRICULTURAL, RANGE, AND FOREST LANDS, Spokane, WA. Contact: Conferences and Institutes, Washington State University, 208 Van Doren Hall, Pullman, WA 99163-9986.
- Feb. 28-Mar. 1 COLORADO GROUNDWATER ENGINEERING AND MANAGEMENT CONFERENCE, Denver, CO. Contact: Janet Lee Montera, Civil Engr., Colorado State University, Ft. Collins, CO, 80523 (303/491-7425).
- Mar. 1-2 9TH HIGH ALTITUDE REVEGETATION WORKSHOP, Ft. Collins, CO. Contact: Gary L. Thor, HAR Committee Secretary, Dept. of Agronomy, Colorado State University, Ft. Collins, CO 80523, (303/491-7296).
- Mar. 30-31 WATER IN THE 20TH CENTURY WEST: DOCUMENTING THE ARIZONA EXPERIENCE, Phoenix, AZ. Contact: Arizona State Archives, 1700 W. Washington, Suite 442, Phoenix, AZ 85007, (602/542-4159).

- Apr. 1-5 AWRA/CWRA JOINT SYMPOSIUM, INTERNATIONAL ASPECTS OF WATER RESOURCES, Toronto, Canada. Contact: AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192 (301/493-8600).
- Apr. 9-13 AGU TENTH ANNUAL "HYDROLOGY DAYS," Ft. Collins, CO. Contact: Janet Lee Montera, Mgr., Civil Engr. Conf. Section, Colorado State University, Ft. Collins, CO, 80523, (303/491-7425).
- Apr. 17-19 COPING WITH EXTREMES - 58TH ANNUAL WESTERN SNOW CONFERENCE, Sacramento, CA. Contact: Neil Berg, U.S. Forest Service, P.O. Box 245, Berkeley, CA 94701, (415/486-3456).
- Apr. 17-20 17th ANNUAL ASCE WATER RES. PLANNING AND MGMT. DIV. & WATER RES. INFRASTRUCTURE SYM., Fort Worth, TX. Contact: Kyle E. Schilling, Inst. for Water Res., Casey Bldg., Suite 2594, Fort Belvoir, VA 22060, 202/355-2370.
- Apr. 25-28 ASSOCIATION FOR ARID LANDS STUDIES - WESTERN SOCIAL SCIENCE ASSOCIATION ANNUAL MEETING, Portland, OR. Contact: E.R. Gay, Dept. of Economics, BA402, Univ. of Arkansas, Fayetteville, AR 72702, 501/575-6222.
- Apr. 29-May 4 14th INTERNATIONAL CONGRESS ON IRRIGATION & DRAINAGE, Rio de Janeiro, Brazil. Contact: The Secretary, Int'l Commission on Irrigation & Drainage (ICID), 48 Naya Marg, Chankypuri, New Delhi 110 021 (India).
- May 16-18 43rd ANNUAL CONFERENCE - CANADIAN WATER RESOURCES ASSOCIATION - "INNOVATIONS IN RIVER BASIN MANAGEMENT". Penticton, BC, Canada. Contact: C.D. Sellers, Chrm., 1990 Conf., Canadian Water Res. Asso., c/o Klohn Leonoff Ltd., 10180 Shellbridge Way, Richmond, S.C. V6X 2W7 Canada.
- June 21-22 INTERNATIONAL SYMPOSIUM ON MAPPING & GEOGRAPHIC INFORMATION SYSTEMS, San Francisco, CA. Contact: A. Ivan Johnson, A. Ivan Johnson, Inc., 7474 Upham Ct., Arvada, CO 80003, 303/425-5610.
- July 9-11 1990 WATERSHED MANAGEMENT SYMPOSIUM, Durango, CO. Contact: Robert Riggins, USACERL, P.O. Box 4005, Champaign, IL 61824-4005.
- July 9-13 NATIONAL CONFERENCE ON IRRIGATION & DRAINAGE, ENGINEERING AND WATERSHED MANAGEMENT SYM., Durango, CO. Contact: Robert Riggins, USACERL, P.O. Box 4005, Champaign, IL 61824-4005.

### WATER ISSUES FORUM

Thursday, March 29, 1990, 11:30-1:30

#### "WATER FOR THE WILDERNESS"

##### Speakers:

Gregg Hobbs - Davis, Graham and Stubbs  
Lori Potter - Sierra Club Legal Defense Fund

##### Moderator:

Chips Barry, Executive Director  
Colorado Department of Natural Resources

Ramada Conference Center, 1475 South Colorado Boulevard

Make your reservation now for the spring meeting of the **WATER ISSUES FORUM** by calling 491-6308. Luncheon cost will be approximately \$8.00; you will have a choice of two luncheon selections. Don't miss a lively discussion of this important issue!

AWARAWA JOINT SYMPOSIUM INTERNATIONAL ASPECTS OF WATER RESOURCES, Toronto, Canada. Contact: AWA, 240 Grosvenor Lane, Suite 120, Bethesda, MD 20814-2902 (301) 251-8000.

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Colorado Water Resources Research Institute  
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