

Colorado Water

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

WATER ITEMS AND ISSUES . . .

June 1994

BUILDING 'WALLS' OF WATER KNOWLEDGE -- Editorial by Robert C. Ward	2
Water Research	3
Water Supply	9
University Water News	10
Water Publications, Databases	11
Editor's In-Basket	15
Water News Digest	17
Hydrology Days Honors Art Corey	22
Legislators and Students 'Talk Water'	23
Meetings, Calls for Papers, Short Courses	23
Calendar	28

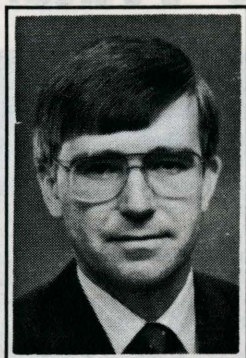
QUENCHING THE URBAN GIANT --see page 24



Water Wizard John VanSciver, Colorado Department of Natural Resources, poses water trivia questions

First legislative water festival held at Capitol Building in Denver, April 21. See page 23.

**Colorado
State
University**



BUILDING "WALLS" OF WATER KNOWLEDGE

by Robert C. Ward

The research results summarized on page 4 of this issue of *COLORADO WATER* appear to describe typical, detailed research that is not well-connected to practical water management in Colorado. Let me

take this opportunity to walk you through the background of this research and its relevance to current groundwater quality improvement efforts in Colorado.

As the article states, the research on solubility of chlorothalonil (a fungicide used in agricultural production) stems from past efforts to better understand how the fungicide moves through the soil profile and reaches groundwater. The previous research involved a number of faculty and graduate students who conducted several connected/integrated studies over the years, most focused on the situation in the San Luis Valley and operated with considerable support from the people of the Valley. The reference list at the end of the article illustrates many of these connections, but not all of them. Each of the studies addressed a specific question that evolved out of previous existing knowledge. The collective efforts of all the studies are slowly beginning to describe how the behavior of agricultural chemicals affects groundwater quality in the valley. This understanding is not emerging quickly nor easily.

The study described on page 5 addresses the narrow question of the precise solubility of a particular chemical. In trying to determine why model predictions for the San Luis Valley were not confirmed by field measurements, researchers questioned the solubility assumption they were using in the models. Where did the solubility estimate come from? In examining the literature, it became obvious that a solubility estimate for this particular chemical had been handed down for a number of years without a careful examination of its accuracy.

Recall, however, that while this particular question may seem abstract, it is part of a much larger, ongoing effort involving many faculty and students. As a part of the larger effort, the need for a better understanding of this particular chemical was a question very coherently addressed by a graduate student seeking a Master of Science degree. This blend of research, education and outreach to real problems is the essence of an applied research program in higher education.

I like to view this situation as a wall of knowledge that we, as a society, are building brick by brick (or knowledge bit by knowledge bit). Jim Hatheway's thesis is one more bit of knowledge that adds to this wall. It fits very nicely with the knowledge bits provided by previous students working in concert with a number of faculty. Eventually, we will gain the

understanding we need to operate our food production systems in a sustainable manner that is compatible with a safe environment. But we cannot understand such complex systems without the efforts of many people, both on our Colorado campuses of higher education and in our agricultural communities. In particular, this evolving approach to water knowledge is sustained by faculty who understand the limitations of our current knowledge and craft specific projects for students. Also, the cooperation of Colorado water users and managers is critical to maintaining the relevance of higher education's water research.

We in higher education "see" the connections of our water research to the needs of Colorado water users and managers. However, too often we fail to explain these connections to the layman. If it occurs over long periods of time and connections are not provided, water research may seem rather disconnected from the needs of water users. Hopefully, CWRRI and *COLORADO WATER* can maintain the connection. Efforts to obtain new water knowledge, within an educational and outreach environment, represent the essence of CWRRI's water research program.

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WATER RESEARCH

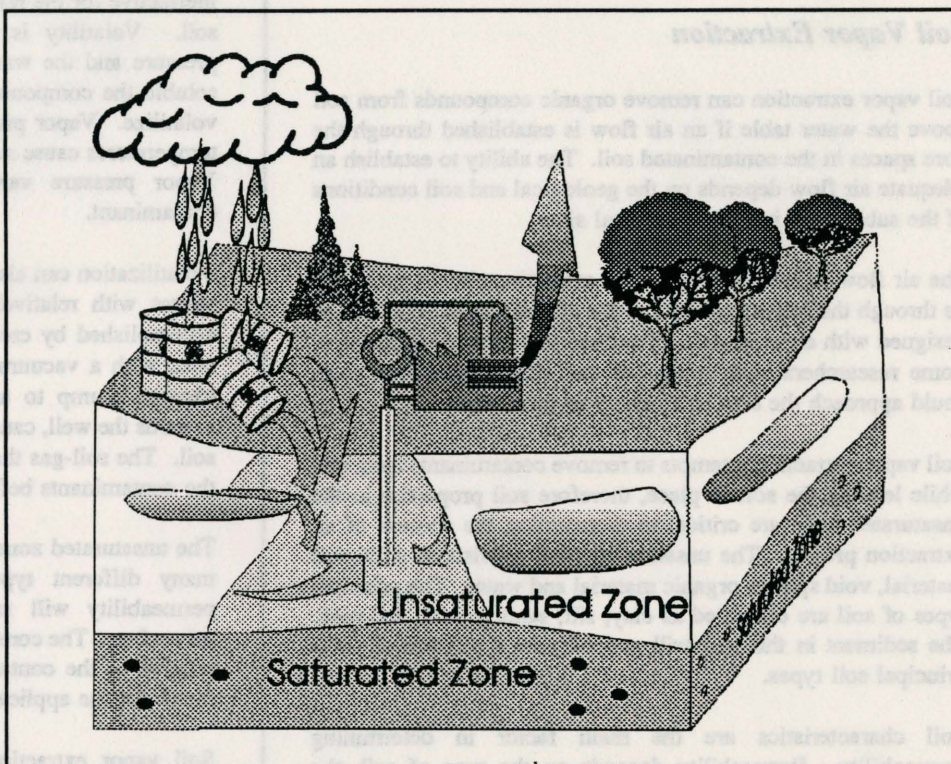
WHEN IS SOIL VAPOR EXTRACTION TECHNOLOGY APPROPRIATE FOR REMEDIATION?

by David L. Barnes and Bob Lange

Sources of Contamination

Regardless of contamination sources, water quality is at risk when contaminants exist in the soil above the water table. Contaminants in the soil between the ground surface and underground water can include industrial solvents, pesticides, herbicides, and petroleum products resulting from leaking underground storage tanks, accidental spills, household chemical waste, landfills, waste ponds, and a host of other sources.

The types of organic compounds left in the soil can vary as much as the sources of contamination. The complexity of any groundwater remediation technique increases with the presence of multiple types of contamination, since each compound present can be expected to react differently to remediation techniques.



Background

Pump and treat technology is relatively well established for groundwater remediation in the fully saturated zone but these methods do not remove contaminants from the unsaturated zone above the water table. Soil vapor extraction, which is analogous to a pump and treat technology is becoming a popular method to remove contaminants from the unsaturated zone.

With funding from the Department of Energy, the Colorado Water Resources Research Institute is nearing completion of a detailed technical review of soil vapor extraction technology. In addition to this technical review, an informational brochure is being prepared and targeted for managers and policy makers charged with evaluating this technology. This research should help clarify the strengths and weaknesses of soil vapor extraction and evaluate the steps that should be taken while evaluating a particular site.

The subsurface can be divided into two major sections, the saturated zone and the unsaturated zone. These two zones are

divided by the water table. The saturated zone is beneath the water table and the unsaturated zone is above the water table. Soil vapor extraction is interested in removing contamination from the unsaturated zone.

One of the most straightforward methods to remove contamination in the soil above the water table is excavation, but physical excavation of contaminated soil in the unsaturated zone can be very costly and time-consuming. Even if the soil is removed it must be treated on site, treated off site, or removed for disposal. In some cases, soil vapor extraction can be a lower-cost and more efficient solution than excavation of contaminated soil. In other cases, this technology could be ineffective or less effective than other technologies for removing contamination from the unsaturated zone.

Removing contamination from soil in the unsaturated zone is a very important part of ensuring the long-term cleanup of groundwater. Cleaning up groundwater directly can be only a

Fig. 1. Removal of Contaminants in the Unsaturated Zone Using Soil Vapor Extraction

partial solution for remediation of underground contamination. Organic contaminants can be left in the zone above the water table. They can exist as gases, dissolved in water, or as small pockets of non-aqueous phase liquids called globules. The presence of the contamination in the soil can become a source of contamination for the groundwater. Water infiltrating through the contaminated soil in the unsaturated zone can pick up organic compounds that can move down into groundwater aquifers.

Soil Vapor Extraction

Soil vapor extraction can remove organic compounds from soil above the water table if an air flow is established through the pore spaces in the contaminated soil. The ability to establish an adequate air flow depends on the geological and soil conditions of the subsurface in each individual site.

The air flow induced by soil vapor extraction should optimally be through the largest portions of the contaminated zone and be designed with consideration of surface and subsurface features. Some researchers have suggested that site investigation costs could approach the cost of clean-up in most cases.

Soil vapor extraction attempts to remove contaminants from soil while leaving the soil in place, therefore soil properties in the unsaturated zone are critical to determining the success of an extraction project. The unsaturated zone consists of solid soil material, void spaces, organic material and water. The principal types of soil are classified as clay, silt, sand, gravel, and rock. The sediment in this soil will generally be a mixture of these principal soil types.

Soil characteristics are the main factor in determining permeability. Permeability depends on the type of soil, the soil's water content, and the direction of flow. Soils with a high permeability will allow air flow better than soils with a low permeability. Some generalizations can be made about a soil's permeability based on its composition. For instance, clay soils will tend to have a lower permeability than sandy soils, and the soil's permeability to air decreases with an increase in moisture content.

Similarly, some generalities can be made from the hydrogeology of an area; for example, soils that are located near the water table will have lower permeabilities to air due to the higher moisture content. The geological placement of the soil layers has an effect on the permeability; for instance, permeability is generally higher horizontally than it is vertically.

Soil vapor extraction removes contaminants by carefully creating an air flow in the unsaturated zone that removes the vapors and

enhances the volatilization of contaminants in the soil pores. Soil vapor extraction assumes that compounds contained in the unsaturated zone will become gases or volatilize. Contaminants can exist in the soil pores as liquid globs, dissolved in water, attached to the soil particles, and/or as vapor. Volatility is important to determine how much of a substance can be expected to exist as a vapor in the unsaturated zone. To be removed with soil vapor extraction, contaminants must be able to exist in a vapor form. Soil vapor extraction will be ineffective for the removal of non-volatile compounds from the soil. Volatility is dependent upon the compound's vapor pressure and the water solubility of the substance. The more soluble the compound is in water the less likely it will be to volatilize. Vapor pressure is temperature-dependent -- higher temperatures cause substances to have a higher vapor pressures. Vapor pressure varies greatly depending on the type of contaminant.

Volatilization can also be enhanced by replacing air in the pore spaces with relatively fresh air. The replacement of air is accomplished by creating an air flow through the unsaturated zone with a vacuum. The vacuum is created by attaching a vacuum plump to an extraction well which pulls the vapor towards the well, causing fresh air to flow into the contaminated soil. The soil-gas that is extracted is usually treated to remove the contaminants before discharge.

The unsaturated zone at any individual site will be made up of many different types of soil. Areas of high and low permeability will most likely be scattered throughout the subsurface. The combined effects and positioning of these areas relative to the contamination is probably the biggest limiting factor for the application of this technology.

Soil vapor extraction can be expected to be one of many different processes used in a given site for remediation. In the past few years, groundwater remediation techniques for the saturated zone, such as air sparging, have been used in conjunction with soil vapor extraction systems.

Soil vapor extraction is not applicable to every soil contamination situation. If soil vapor extraction technology is being considered for a site, a comprehensive study of the area should be done to determine the type of contaminant, the geology, the hydrogeology, and the soil properties of the contaminated zone.

This research was made possible with funding from the United States Department of Energy (DOE). The technical review and informational brochure will be presented to the DOE this fall and will be available through CWRRRI upon request.

CUBIC FEET PER SECOND -- Sometimes referred to as "second feet," cfs is the basic measurement of flowing water. A cubic foot per second is roughly 7.48 gallons per second, which is 646,317 gallons per day. Thus, a flow of or right to one cfs is a flow of or right to 646,317 gallons in 24 hours, which is almost two acre-feet.

PROTECTING THE SAN LUIS VALLEY'S GROUNDWATER FORMULATION CHEMICALS AND THE FUNGICIDE CHLOROTHALONIL: EFFECT ON SOLUBILITY AND IMPLICATIONS ON SOIL MOBILITY

by James Hatheway, Jr. and Richard W. Walters

From M.S. Thesis by James L. Hatheway, Jr., Colorado State University
Determination of the Water Solubility of the Fungicide Chlorothalonil.

The San Luis Valley, located in south-central Colorado, overlies two aquifers that have made the valley one of the state's most bountiful agricultural areas. The shallow (unconfined) aquifer, which rests atop the deeper artesian (confined) aquifer, is the primary drinking water source for most of the valley's population. Farmers, who make up the majority of valley inhabitants that rely on groundwater as their main supply of drinking water, are very aware of the threat that agricultural chemicals can pose if not handled properly.

Background

In 1990, as part of a national effort to help farmers improve irrigation practices and maintain water quality, the San Luis Valley was selected as the site of one of 45 national water quality improvement projects. The goal of the demonstration project was to help farmers reduce pollution of groundwater by agricultural chemicals through the adoption of recommended best management practices. State and federal agencies had two options available: the time-consuming process of collecting field data, or using available computer models to simulate the effects of management practices on, and the movement of, agricultural chemicals through the soil.

Two such models were available to model chemical movement from the surface and through the vadose zone: **Opus**--developed by the Hydroecosystems Research Group, U.S. Department of Agriculture, Agricultural Research Service; and **PRZM**--The Pesticide Root Zone Model. The PRZM model was created to help users define the risk from leaching of pesticides and the effects of land management on pesticide transport. The models were evaluated in a 1990 CWRRI project which showed that their predictions did not agree with field observations for the pesticide Atrazine.

Subsequent research evaluated two additional models: a solute transport model called **CMLS** and a hydrologic index for ranking relative pollution potential called **DRASTIC**. The models were used to determine which pesticides had the highest potential for leaching to the groundwater and which had the greatest likelihood for groundwater contamination.

The model and index results were compared with results from a direct sampling program completed in the San Luis Valley in conjunction with the Colorado Department of Health. Direct sampling showed pesticides such as chlorothalonil in the groundwater, while the models predicted that Chlorothalonil should not leach to groundwater.

Why the difference in results?

Even though models predicted that chlorothalonil should not leach to the groundwater, it was found there. This suggests that a factor not accounted for in the models, perhaps increased solubility due to the interaction with formulation chemicals, enhances the mobility of the fungicide. Solubility is defined as "the amount of a substance that can be dissolved in a given solvent under specified conditions" (Webster's New World Dictionary, Second College Edition). Formulation chemicals, by enhancing solubility, allow greater amounts of a substance (in this case, a fungicide) to be held in solution or suspension.

Pesticides are ranked for two separate processes: mobility and persistence. Chemicals that have both a high mobility and a high persistence pose the greatest risk of contaminating the groundwater. If a chemical is very mobile it is capable of reaching a groundwater aquifer, but if it also degrades rapidly, the concentration of that chemical in the groundwater will be negligible. Similarly, if a chemical is very persistent but is immobile, it will remain at the surface of the soil and pose very little threat to an aquifer.

The Solubility Value of Chlorothalonil

To evaluate whether the formulation chemicals affect pesticide fate, researchers focused on the fungicide chlorothalonil. The initial objective of the research was to evaluate the soil absorption and mobility of Chlorothalonil. The study considered:

- (1) if the data on the chemical used in the model was accurate, and
- (2) whether the formulation of the product had any effect on its movement into the groundwater.

Chlorothalonil was chosen because of its wide usage in the San Luis Valley, its low water-solubility value, and because the formulation used has a high inert chemical composition. High amounts of inert material in a formulation indicate a situation where it is particularly difficult to keep the pesticide in solution or suspension.

The water solubility value of Chlorothalonil, reported as 0.6 mg/L at a temperature of 25 degrees C, was established in the early 1960s. This value was presented in the literature without supporting experimental data. Using more current, accurate and

acceptable methods of measurement, the solubility value for Chlorothalonil was found to vary with temperature:

<u>Solubility Value</u>	<u>Temperature</u>
0.49 mg/L	8.5 degrees C
0.91 mg/L	23.0 degrees C
1.85 mg/L	37.5 degrees C

The solubility value of 0.91 mg/L at 23 degrees C represents a 50 percent increase in the original reported value, 0.6 mg/L at 25 degrees C.

In contrast, the concentration of Chlorothalonil in a formulated product (Bravo500®) is 500 g/L, which is more than 5 orders of magnitude more concentrated than the water solubility of Chlorothalonil. The high concentration of Chlorothalonil in Bravo500® is achieved at least in part by the presence of organic molecules that increase the capacity of water to keep Chlorothalonil in solution or suspension.

The researchers conducted preliminary tests to evaluate the solubility of Chlorothalonil in water solutions containing Bravo 500®. Complications due to the high concentrations of Chlorothalonil and inert ingredients in Bravo500® limited experiments to Bravo500® solutions in water containing 1 mg/L of Chlorothalonil (i.e., a 5 order of magnitude dilution of Bravo 500®). Under these conditions, the solubility value of Chlorothalonil was enhanced to 0.94 mg/L at 23 degrees C.

Field Application

When applied in the BRAVO 500 formulation on a per-acre basis, the following range in water volumes and Chlorothalonil concentrations are used:

<u>Volume of Water</u>	<u>Chlorothalonil Concentrations</u>
5 gal.	26,700 mg/L
150 gal.	423 mg/L

These concentrations are significantly higher than the values found from the solubility experiments, which ranged from 0.91 mg/L to 1.85 mg/L for temperatures ranging from 23 to 37.5 degrees Centigrade (77 to 100 degrees Fahrenheit). This temperature range, coincidentally, encompasses the temperature range which might be encountered during the growing season.

The water solubility of Chlorothalonil in BRAVO500® solutions typical of those applied in the field has not yet been studied. However, the volume of water required for application is relatively small when considered per square foot of soil, and seems to indicate it is unlikely that application procedures caused Chlorothalonil penetration into the soil. It also appears likely that formulation chemicals would be sufficiently diluted by natural moisture conditions and reasonable irrigation practices such that formulation chemicals would not enhance the mobility of chlorothalonil in soil, although experiments are planned to test this hypothesis.

The Effect of Formulation Chemicals

Even though the formulation chemicals may not significantly increase the relative mobility of Chlorothalonil, a factor that may contribute is naturally occurring macromolecules such as humic materials (decayed plant and animal matter). Previous research has found that macromolecules, moving along with water, may under certain circumstances enhance the movement of hydrophobic chemicals (chemicals that do not mix with water) through soils. Research is ongoing in the Environmental Engineering labs at Colorado State University to investigate the effect that formulation chemicals have on the environmental behavior of pesticides including environmental accumulation, biodegradation and chemical reactions.

The studies described above include the cooperative efforts of the U.S. Department of Agriculture, Agricultural Research Service; the U.S. Environmental Protection Agency; Cooperative Extension; Colorado Agricultural Experiment Station; the Colorado Department of Health; CWRRI; and participating farmers and ranchers of the San Luis Valley.

Note: Richard W. Walters is an Associate Professor of Civil Engineering at Colorado State University.

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NITRATE CONTAMINATION in the SOUTH PLATTE BASIN

by Greg Silkensen

The U.S. Geological Survey's National Water Quality Assessment Program (NAWQA) has issued a report, **NON-POINT AND POINT SOURCES OF NITROGEN IN MAJOR WATERSHEDS OF THE UNITED STATES**, that shows excessive nitrogen concentrations in many American streams. Nitrates were also listed as a major source of river and stream pollution in the Environmental Protection Agency's 1990 water quality inventory. The next inventory, to be submitted to Congress on a biennial basis, should be released soon.

Sources of nitrogen in streams include commercial fertilizers, animal wastes, and atmospheric deposition. Although the impact these sources have on nitrogen concentrations in surface water varies considerably, some broad generalizations can be made:

commercial fertilizers are the dominant source of nitrogen in streams in western, central, and southeastern regions of the U.S. where agriculture is intensive;

atmospheric deposition is the dominant source of nitrogen in watersheds in the northeastern U.S.;

animal manure is the second most significant source of nitrogen in watersheds in the southern, central, southeastern, and northeastern U.S., and;

atmospheric deposition is the second most significant source of nitrogen in the western United States.

CWRRI Project Looked at Problems in South Platte

A research project funded in part by the Colorado Water Resources Research Institute was designed to investigate such nitrate pollution problems in the South Platte watershed in northeastern Colorado. Areas north and south of Greeley, Colorado, currently have a high number of wells supplying groundwater with more than 10 parts per million (ppm) nitrates. These levels of nitrates in drinking water constitute a threat to human health. Livestock are also at risk. The source of the groundwater contamination is nitrates in the irrigation water that seeps down through the soil, carrying field fertilizers and other sources of nitrogen. This type of "non-point source" nitrate contamination of the South Platte aquifer is difficult to assess due to the lack of a data base and a method of identifying and

quantifying the nitrate leaching amounts or potential for nitrate leaching.

Non-point source contamination of groundwater aquifers from irrigated agriculture varies significantly because of different management practices, soils, and climate. A numerical model that estimates levels of nitrates leached, combined with spatial distribution of soils and cropping practices, would allow the identification of the geographical extent and spatial distribution of nitrate leaching "hot spots." Researchers were able to produce maps showing the spatial distribution of Nitrate Leached (NL) for a selected test area within the Poudre River basin.

The study looked at the effect of nitrates from feedlot manure, nitrates from inorganic fertilizers, irrigation methods, cropping patterns, and soil types. Studies showed the amount of feedlot organic manure and the soil types played an important role in the amount of nitrates that reached the groundwater. This gives water management agencies, farmers, and agribusiness a regional viewpoint and better understanding of the causes of nitrate groundwater contamination. Vulnerable areas of agricultural land overlying ground water aquifers can be quickly and economically identified through the use of computer-based geographic information systems (GIS), and best management practices (BMP's) can be more focused toward reducing groundwater contamination over large areas.

Roger M. Hoffer, Professor of Forest Sciences at Colorado State, was principal investigator on the project, which was done in cooperation with personnel of the USDA's Agricultural Research Service.

To order a copy of the project completion report, **SPATIAL DISTRIBUTION OF NITRATE LEACHING "HOT SPOTS" AND NITRATE CONTRIBUTIONS TO THE SOUTH PLATTE RIVER BASIN AQUIFERS**, by B.K. Wylie, D.G. Wagner, R.M. Hoffer, S. Maxwell, see page 11.

Copies of the USGS report, published as Water Resources Investigations Report 94-4001, are available at a cost (\$2 for each paper copy and \$4 for the microfiche version) from the USGS Open-File Services Section, Box 25425, Denver Federal Center, Denver, CO 80225 or telephone (303) 236-7476.

WATER RESEARCH AWARDS

A summary of water research awards and projects is given below for those who would like to contact investigators. Direct inquiries to investigator c/o indicated department and university.

Colorado State University, Fort Collins, CO 80523

- *San Francisco Bay Climate Change, Kenneth Wilson, Cooperative Fish & Wildlife Research. Sponsor: US Fish & Wildlife Service.
- Hydraulic Model Study of Rock Creek and Crested Dam Sediment Management, Albert Molinas, Civil Engineering. Sponsor: Pacific Gas and Electric Company.
- *Gas Phase Transport of Volatile Organic Compounds in the Vadose Zone, David McWhorter, Agricultural and Chemical Engineering. Sponsor: University of Waterloo.
- Land Use/Water Availability in the Rio Grande Basin, Dennis J. Dean, Forest Sciences. Sponsor: US Geological Survey.
- Effects of Sediment Contaminants on Benthic Macrovertebrates, William Clements, Fishery and Wildlife Biology. Sponsor: Colorado Division of Wildlife (DOW).
- Arkansas River Research Study, John D. Stednick, Earth Resources. Sponsor: DOW.
- *Incremental Assessment of Habitat, Discharge and Modification for Low Flow, Steven R. Abt, Civil Engineering, Corps of Engineers. Sponsor: NOAA.
- *Hydrological Forecasting System Evaluation, Lynn Johnson, CIRA. Sponsor: NOAA.
- *Colorado Agricultural Pollution and Environmental Regulation Information Network, Steven M. Carcaterra, Cooperative Extension. Sponsor: Colorado Department of Health (DOH).
- *Efficient Use of Fertilizer and Soil Nitrogen, Ingrid Burke, Natural Resource Ecology Lab. Sponsor: USDA/ARS.
- *Improved Measures of Economic Impacts of Drought in Arid Regions, Robert A. Young, Agricultural and Resource Economics. Sponsor: NSF.
- Fish Composition of the Yampa and Little Snake Rivers, John Hawkins, Fishery and Wildlife Biology. Sponsor: National Park Service (NPS).
- Stream Stability Investigations, Chester Watson, Civil Engineering. Sponsor: Corps of Engineers.
- *Climate Change in the Colorado Rocky Mountains: Bounding Projected Changes in Region..., Roger A. Pielke, Atmospheric Science, NPS.
- *Responses of Hydrologic and Aquatic Ecosystem Processes to Potential Climate Change..., Jill S. Baron, Natural Resources Ecology Lab. Sponsor: NPS.
- *Application of Sewage Sludge to Dryland, Kenneth A. Barbarick, Agronomy. Sponsor: City of Littleton.
- Evaluation and Redesign of a Water Quality Monitoring Network, Thomas G. Sanders, Civil Engineering. Sponsor: Water Transport Company, Netherlands.
- EPA Region VIII - Ecosystem Management Planning, Robert G. Woodmansee, Natural Resources Ecology Lab. Sponsor: EPA.
- Development of Graphical User Interface for MODFLOW, Luis Garcia, Agricultural and Chemical Engineering. Sponsor: USBR.
- *Carbon Balance in Global Grasslands, David Shimel, Natural Resource Ecology Lab. Sponsor: NASA.
- Endangered Fish Larval Studies (Composite of an Anesthesia and Three-light Trap Projects, Darrel E. Snyder, Fishery and Wildlife Biology. Sponsor: NPS.
- Methodology to Assess Loss of Agricultural Irrigation Benefits in the U.S., John B. Loomis, Agricultural and Resource Economics. Sponsor: USBR.

University of Colorado, Boulder, CO 80309

- *Westside Main Canal Modeling Study, Edith Zagona, Civil Engineering. Sponsor: Imperial Irrigation District.
- *Conceptual Planning for Integrated Analyses (Integral) of Water Resource Systems and Power Operations, Edith Zagona, Civil Engineering. Sponsor: Tennessee Valley Authority.
- A Test of the Dependence of Secondary Production On Unicellular Algae In Running Water Ecosystems, William Lewis, Environmental, Population & Organismic Biology. Sponsor: National Science Foundation.
- Continue Design and Development of the Power and Reservoir System Model (PRSYM), Edith Zagona, Civil Engineering. Sponsor: Electric Power Research Institute.
- *Work Plan for Study of Dissolved Gases in Groundwater as a Measure of Oxidation-Reduction Status, Donald Runnells, Geological Sciences. Sponsor: Electric Power Research Institute.
- Arsenic Occurrence in Drinking Water Sources, Marc Edwards, Civil Engineering. Sponsor: American Water Works Association.
- Pilot Studies to Design and Model Soil Aquifer Treatment Based on Soil Variability and Effluent Pretreatment, Gary Amy, Civil Engineering. Sponsor: Arizona State University.
- *Application of the Influence Diagramming Technique to DOE Environmental Restoration Projects, James Kiedmann, Civil Engineering. Sponsor: University of Chicago.
- Investigations of Natural Groundwater Hazards at the Proposed Yucca Mountain High-Level Nuclear Waste Repository, Charles Archambeau, Physics. Sponsor: Technology and Resource Assessment Corporation.
- *Comparative Lithological Mapping Using Multipolarization, Multifrequency Imaging Radar and Multispectral Official Remote Sensing, Fred Kruse, Geological Sciences. Sponsor: Arizona State University.

DOE Environmental Remediation Cost Risk Analysis, James Diekmann, Civil Engineering. Sponsor: Arizona State University.
 *Scaling Theories of Hydrology, Hydraulics and Geometry of River Networks, V.K. Gupta, CIRES. Sponsor: NASA.

*Indicates additional funds and/or extension of date

WATER SUPPLY

FROM THE STATE ENGINEER'S OFFICE--Colorado Water Supply Conditions Update -- This winter the state's snow pack measurement has continually fluctuated, one month seeing a drop in snowpack compared to average, and the next an increase. The snowpack rose during April, and finished the month at 89% of normal. This is below last year's banner amounts. The increase in snowpack was welcomed across the state as it brings additional needed water. It also resulted in an increase in the Surface Water Supply Index (SWSI) values from the previous month.

April's statewide precipitation of 144 percent of normal contributed to the snowpack increase. The National Weather Service 30 day outlook, as of May 1, is for above normal temperatures and below normal precipitation over the entire state. Their May 1 ninety day outlook is for below normal temperatures over all but the southwest corner of the state, and above normal precipitation statewide.

The SWSI, developed by the Office of the State Engineer and the U.S.D.A. Soil Conservation Service, is used as an indicator of mountain-based water supply conditions in the state's major river basins. It is based on snowpack, reservoir storage, and precipitation for the winter period (November through April). During the winter period, snowpack is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight.

Regional Water Supply -- The water supply situation in much of the West in 1994 is guarded. The far West and Idaho show the most severe conditions. If carryover storage had not ranged from good to excellent in most areas, the water supply would be quite low in 1994. Some areas can expect water supply shortages during 1994, particularly water users in Nevada. The Palmer Drought Severity Index ratings for April 30, 1994 continue to show that most of the West, particularly the far West, is drier than last year...Accumulated precipitation and snow water equivalent data show that below average precipitation continued in most of the West through May 1.

In the Colorado River Basin, Lake Powell inflow should be at 74 percent. In northern California, the San Joaquin, Sacramento and Coastal Basin streamflows continue to decline. Snowpack water content is 30 percent of average statewide. A drought watch was declared on May 2, but an average of 90 percent reservoir carryover storage in the state should be sufficient to meet most needs. Still, 1994 will be classified as a "critically dry" year, and the long-term water supply outlook remains precarious should another dry winter follow this year.

Sources: *Western States Water, 5/10/94; Water Supply Conditions Report for the Western States, 5/1/94 (USBR)*

Basin	May 1, 1994 SWSI Value	Change From Previous Mo.	Change From Previous Yr.
South Platte	+2.7	+4.1	+0.7
Arkansas	+0.3	+1.9	-1.9
Rio Grande	+1.7	+1.8	-1.3
Gunnison	+0.1	+1.4	-3.7
Colorado	0.0	+0.6	-3.3
Yampa/White	-1.5	+1.2	-3.0
San Juan	-0.3	+1.4	-2.7
Dolores			

SCALE							
-4	-3	-2	1	0	+1	+2	+3+4
Severe Drought	Moderate Drought		Near Normal Supply		Above Normal Supply		Abundant Supply

UNIVERSITY WATER NEWS

Cooperative Extension Agent Receives Environmental Leadership Award

Follow-up to the list of water education publications and activities in the February issue of *COLORADO WATER* -- Nancy Zuschlag, Jefferson County Extension Agent, was one of nine individuals selected to receive the 1992 Governor's Environmental Leadership Award. Nancy directs the Eagle's Nest and Owl's Roost Environmental Discovery Program, an informal 4-H youth program through which about 500 4th and 5th grade students each summer learn about the wise use of Colorado's natural resources. More than 10,000 Colorado youth have participated in the program since its start in 1972. Jefferson County R-1 School District is a partner in this program.

CSU, Catholic University of Chile to Have Collaboration/Exchange Program

The U.S. Information Agency has awarded a three-year collaboration project between Colorado State University and the Pontificia Universidad Catolica de Chile PUC) in the area of water resources and environmental engineering. The project will include a teaching exchange program including regular courses, short courses, seminars and conferences; and the development and implementation of research collaboration by faculty and graduate students from both institutions. Principal investigators for the project are Jose D. Salas from CSU and Bonifacio Fernandez from PUC.

As an additional note, the Colorado International Trade Office will distribute profiles of water researchers and programs at Colorado's research universities in the countries of Argentina, Brazil, Chile and Bolivia. A hoped-for result is greater collaboration on water resource issues with these countries as well.

PEOPLE

Water Engineer J. Robert Barkley Receives Honorary Degree

Retired water engineer J. Robert "Bob" Barkley, who supervised the early growth of one of the state's most powerful water-management agencies, has been awarded an honorary doctor of science degree from Colorado State University. A group of Colorado State administrators and faculty presented Barkley with the award at his Denver home April 18. The honorary degree recognizes candidates whose accomplishments reflect Colorado State's duties and responsibilities and whose work is recognized as meritorious in Colorado and throughout the world.

Barkley, 84, is a 1932 graduate of Colorado State in civil and irrigation engineering. He spent 29 years at the Northern Colorado Water Conservancy District as chief engineer and then

as secretary-manager. During his career, Barkley pioneered watermarketing systems like the open-rate contract system and the use of supply-and-demand forces to determine water distribution. He also made great efforts to educate the public about water issues. His ideas and innovations have been hailed and copied throughout the West.

Barkley also was instrumental in establishing a productive and long-lasting relationship between the Northern Colorado water Conservancy District and Colorado State. This relationship helped Colorado State become a major education and research institution in the field of water-resource management. Barkley's association with Colorado State goes back to the presidency of Charles Lory. Lory was active in national water affairs and was a key leader in gaining approval for the Colorado-Big Thompson Project.

Barkley's nomination for the honorary degree received support from dozens of individuals including U.S. Senator Hank Brown, former Colorado State President A. Ray Chamberlain, former Colorado Governor John Love, U.S. Department of the Interior Assistant Secretary for Water and Science John M. Sayre and many Colorado State faculty members.

Source: *Comment*, 4/28/94

Professor Wins Distinguished Faculty Award

Roger M. Hoffer, Professor of Forestry and Remote Sensing at Colorado State University, is the winner of the Distinguished Faculty Award for this year. Hoffer came to Colorado State in 1988. Since then, he has made the remote sensing and Geographic Information Systems program at Colorado State one of the best in the nation. Remote sensing, which includes the use of aerial photos and satellite imagery, can be used to extract data on natural resources from different areas. GIS is used for mapping and can identify things such as potential erosion areas. Both remote sensing and GIS can be used in a variety of disciplines.

Hoffer has directed a number of research projects, including the recently concluded CWRRI study on the sources of nitrates found in the South Platte River Basin (see page 7). He also has received funding from the National Geographic Society, the United States Forest Service, NASA and many other agencies. Hoffer was one of the first to analyze digital Landsat MSS data, which measures land surface features.

Partial Source: article by Diana Sherman, *Collegian* Reporter

CE Prof Receives Society's Highest Honor

Vic Koelzer, Professor Emeritus of Civil Engineering, was elected as an Honorary Member of the American Society of Civil Engineering, the society's highest honor.

WATER PUBLICATIONS, DATABASES

NEW CWRRI REPORTS

*To order CWRRI reports contact the CSU
Bulletin Room, Aylesworth Hall, Colorado
State University, Fort Collins, CO 80523;
Phone 303/491-6198.*

Spatial Distribution of Nitrate Leaching 'Hot Spots' and Nitrate Contributions to the South Platte River Basin Aquifers, by B.K. Wylie, D.G. Wagner, R.M. Hoffer, S. Maxwell and M.J. Shaffer. Completion Report No. 181. Price: \$5.00.

USGS REPORTS

National Water Summary An Analysis of Stream Quality in the U.S.

The latest USGS National Water Summary -- a state-by-state analysis of stream quality -- reports that despite enormous pressure from urban development and population growth, stream water quality is holding its own or even improving slightly, but still falls below desirable levels in many places. The 590-page report is seventh in a series of reports prepared by the U.S. Geological Survey, Department of the Interior. It also notes that data on biological and toxicological aspects of stream-water quality are fragmentary and leave many questions about water-quality changes unanswered.

Much of the data used in the USGS report are the result of long-term cooperation with many state and federal agencies. Data were supplied from the USGS National Water Information System (NWIS) with supplemental data from the EPA national data base, STORET. Water-chemistry and physical-sediment data were compiled from about 1,400 stream water-quality stations that had at least 10 years of records for analysis of trends. Water quality data obtained from analyses of water samples collected at monitoring stations are stored in the USGS National Water Information System and the EPA's national data base known as STORET.

The report shows that long-term, fixed-station sampling networks can detect broad changes in water quality that arise from environmental policies or from changes in economic conditions. Programs such as the USGS's new National Water Quality Assessment (NAWQA) Program are designed to supplement this information by examining local cause-and-effect relationships and looking for the toxic chemicals and biological indicators that typically have not been sampled at long-term stations.

The report includes state-by-state summaries. Stream quality changes, as shown in the trend analyses, indicate little change in most rivers of Colorado. However, improved irrigation and agricultural practices in the western part of the state show

improving trends for rivers like the Gunnison where salinity has improved.

All of Colorado's major drainage basins are affected to some degree by nonpoint source pollution. The historic mining districts, particularly in the mountains, contribute toxic trace elements to more than 1,300 miles of streams and rivers. Sediment is the most prevalent nonpoint-source pollutant and affects 2,154 miles of streams in the mountains and plains. Of the 31,470 miles of streams in Colorado, 28,105 miles meet water-quality criteria for fishing. Colorado has 9,062 miles of streams that have swimming as a designated beneficial use. The data used in the summary of Colorado's stream water quality were obtained from water samples collected at 14 monitoring stations at which data collection is continuing.

Copies of the report, "National Water Summary 1990-91 -- Hydrologic Events and Stream Water Quality," published as USGS Water-Supply Paper (WSP) 2400, can be purchased for \$43 per copy from the USGS Branch of Distribution, Denver Federal Center, Box 25286, Denver, Colorado 80225. Orders must specify the report number (WSP 2400) and include check of money order payable to "U.S. Department of the Interior-USGS." An order form and further information about the National Water Summary program may be requested via Internet (nwsu@usgs.gov).

Source: *USGS Press Release 1/3/94*

*To obtain the following reports, contact:
USGS Open-File Services Section, Box
25425, Denver Federal Center, Denver, CO
80225. Phone: 303/236-7476.*

Nonpoint and Point Sources of Nitrogen in Major Watersheds of the United States--USGS National Water Quality Assessment Report, WRI 94-4001.

Water-Quality Variations and Trends in Monument and Fountain Creeks, El Paso and Pueblo Counties, Colorado, Water Years 1976-88, by B.C. Ruddy. Prepared in cooperation with the Colorado Springs Department of Utilities, 1993. WRI 91-4176.

Analysis of Residential Use of Water in the Denver Metropolitan Area, Colorado, 1980-87, by D.W. Litke and L.F. Kauffman. Prepared in cooperation with the City and County of Denver, Board of Water Commissioners, 1993. WRI 92-4030.

Hydrology of the Hart Syncline Area, Northwestern Colorado, by W.P. Van Liew and S.G. Robson. Prepared in cooperation with the U.S. Bureau of Land Management and Moffat County, 1993. WRI 92-4050.

MISCELLANEOUS REPORTS

Proceedings, CONSERVE93, The New Water Agenda. The two-volume set contains summaries of the oral presentations, panel discussions and workshops presented during this 5-day conference held December 12-16, 1993 in Las Vegas, Nevada. Order forms available from: American Water Resources Association, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192. Phone 301-493-8600; FAX 301/493-5844. Price: \$70/AWRA member, \$85/non-member plus \$10 postage and handling.

ATMOSPHERIC INFORMATION AVAILABLE ON GOPHER

The Atmospheric Sciences Department at the University of Illinois, Urbana-Champaign, is opening a new full-scale World Wide Web (WWW) server, The Daily Planet. This environmental information server will continue the work started with the university's Weather Machine. The server features current weather information, lists of other weather servers and sources of weather data, atmospheric sciences community information, information about the university's department, plus a look at some online hypermedia instructional modules for atmospheric sciences under development.

Weather World is accessible from The Daily Planet menus, and it offers over 160 current images, 600 archived images, and 60 MPEG animations. Many are updated hourly and others twice a day, including current satellite imagery, surface maps, upper air maps and plots, and forecast maps. The text products currently found in the Weather Machine gopher server also will be available soon. To get to Weather World, access The Daily Planet by feeding the following to a WWW client:

<http://www.atmos.uiuc.edu/>
Access "Weather Data" and then pick "Weather World."

Please direct all inquiries to webmasters@www.atmos.uiuc.edu.

Source: EOS, 4/12/94

NEW MAP AVAILABLE WITH CLIMATE DATA

A new map of the land cover regions of the conterminous United States and its accompanying digital data set combines satellite imagery, digital elevation, ecoregion, and climate data sets to build a database containing 159 separate land cover regions across the lower 48 states. Additional small-scale maps depict the length of vegetation greenness, the onset of greenness, and peak greenness. The map, "Seasonal Land Cover Regions," is available for \$3 from USGS Map Distribution, Box 25286, MS 306, Denver Federal Center, Denver, CO 80225; the complete digital data set and documentation for the map are available on CD-ROM for \$32 from Customer Services, EROS Data Center, Sioux Falls, SD 57198.

Source: EOS, 4/12/94

CWRRI Reports Now Accessible Through CARL

All CWRRI completion reports are now indexed and accessible in Morgan Library's CARL at Colorado State University.

CWRRI has available a limited number of copies of the report, **INTERBASIN WATER TRANSFERS: COMPENSATION FOR THE BASIN OF ORIGIN** by Edward Sparling. Call 303/491-6308 to receive a copy.

1994 STUDENT PAPER COMPETITION

American Water Resources Association (AWRA)
Universities Council on Water Resources (UCOWR)
Hydrolab Corporation

AWARD 1--Given by Hydrolab Corporation for Best Student Paper Presentation at the Annual AWRA meeting November 6-10, 1994, in Chicago, Illinois. Cash prize of \$300 and one year's membership in AWRA.

AWARDS 2 & 3--Two awards given by UCOWR and AWRA to the students who submit the best technical paper. One award is given for undergraduate paper and one award is given for the best graduate paper. Cash prize of \$250 and one year's membership in AWRA for each award. Publication in the Water Resources Bulletin for each award.

SUBJECT: Any water resources topic.

REQUIREMENTS: Author must be a student or have received a degree during the 1993-94 academic year.

SUBMISSION: Mail two (2) copies by SEPTEMBER 16, 1994 to: Dr. N. Earl Spangenberg, Student Paper Competition, College of Natural Resources, University of Wisconsin-Stevens Point, Stevens Point, WI 54481.

Cover page (removed during review to ensure anonymity) should contain: author's name, address, and telephone number (should appear only on this page); title of paper (repeat first page of text); division - undergraduate or graduate; institution and (anticipated) date of graduation; faculty contact - name, address, and telephone number. Paper should comply with "Instructions to Authors," Water Resource Bulletin 30(1):173-182, Jan.-Feb. 1994. Should contain no more than 5,000 words and four (4) figures. FOR QUESTIONS CALL: Earl Spangenberg at 715/346-2372.

ABOUT UWIN, INTERNET, GOPHER AND WATERTALK

About UWIN

The Universities Water Information Network (UWIN) was established under the auspices of the United States Geological Survey (USGS) and the Universities Council on Water Resources (UCOWR). UWIN's main objective is to serve as a clearinghouse for water resources information and to provide a forum for members of the water resources community -- both individuals and organizations. Current services include:

- a directory of water resources professionals that can be searched by name, areas of expertise, organization and geographic area;

- the USGS WRSIC Database, a directory of abstracts of water resources research since 1967 that can be searched by key words; and

- the National Institutes for Water Resources (NIWR) Directory which contains the NIWR publications directory and water resources information for the public directory. Each state institute's expertise directory is being posted.

The UWIN gopher server is located at UCOWR Headquarters. You can access this server directly over the Internet and by modem as described on the next page. When you make a connection, the UWIN main menu will be the first menu that comes up. The gopher server you contact first determines which menu you will see. As every gopher server provides a gateway to all other gopher servers, you can access UWI from anywhere. This is a valuable point for modem users. For example, most universities have gopher servers of their own that all have a menu option of 'other gopher servers.' By dialing a local gopher server, you can choose this option and get to UWIN in the USA or Illinois listing (in the U's). Thus, telephone charges can be made minimal for modem users.

Fay Anderson, UWIN
c/o UCOWR Headquarters
4543 Faner Hall
Southern Illinois University
at Carbondale
Carbondale, IL 62901-4526

TEL: 618/536-3375 or -7571

FAX: 618/453-2671

email: Faye@uwin.c-wr.siu.edu

About the Internet

The Internet is actually not a single network but a conglomeration of about 10,000 networks. This mega-network

electronically connects about one million host systems and ten million end users around the globe. The Internet grew out of a Department of Defense network in the late 1960s. Many other networks have been added since that time including the National Science Foundation's NSFNET. The name Internet derives from Interconnected Networks. There is no central administration of the Internet. All of these networks are linked to use common communications protocols called TCP/IP.

The Internet is subsidized by the U.S. Government and is designed to support academic and government research. It provides access to services such as remote log in, e-mail, file transfer, supercomputers, bulletin boards, directory assistance, library catalogs, and a myriad of informational databases. Some parts of the Internet are used for private or governmental research and cannot be accessed. It is not a commercial network and the only costs the user incurs are those associated with their access method. As most universities now provide access to the Internet over their computer systems, academics have wide access to this network. In addition, many institutions which are Internet sites allow external accounts which allow potential users access to their facilities. Thus, the costs associated with accessing the Internet are typically minimal, if not free.

About Gopher

Gopher software was developed in response to the tremendous growth of the Internet and the resulting need to get around an environment that was growing increasingly complex. Gopher is a network navigational tool that allows users to get the information they desire easily. The name gopher is a multilayered pun. The software was developed at the University of Minnesota, the home of the Golden Gophers. Also, the software enables users to 'gofer' the information they need. Gopher provides a means to 'tunnel' through the Internet's resources and to stop at the gopher 'holes' they find interesting.

Gopher is set up as a server/client protocol. Gopher servers (e.g. UWIN) are computers running special software that structures information so that it can be readily accessed by clients. This server software allows UWIN to offer a service to other computers which have the matching client software. Gopher client software is available for free from many Internet sites. Most universities have it readily available for many types of computers (IBM-compatible, Apple, UNIX, etc.). Getting Gopher client software is a relatively easy process and it opens up access to the multitudes of information available over the Internet.

WaterTalk: A Bulletin Board System of UWIN

UWIN has developed a new bulletin board system, **WaterTalk**, to bring the "Information Superhighway" to the water resources community. **WaterTalk** is designed to provide a forum for communication about water resources related research, management, planning, and teaching.

BY GOPHER --

If you access gopher through a Unix login, you can connect directly to a host:

gopher gopher.c-wr.siu.edu

xgopher gopher.c-wr.siu.edu (if using xwindows version)

Then from the UWIN main directory, choose the WaterTalk option

If you access gopher through CSUgopher, select:

Off Campus Information

Gopher...Other Gopher and Info Servers...

North America

USA

Illinois

University Water Info Network

Then log on as *bbs* and use *uwin* as the password

BY TELNET --

telnet gopher.c-wt.sin.edu

Then log on as *bbs* and use *uwin* as the password

BY MODEM --

Before dialing, set communication parameters. Try 8 data bits, 1 stop bit, and on parity. If unsuccessful try 7 data bits, 1 stop bit and odd parity. For best results, set your communications software to emulate a v100, ANSI, or compatible terminal.

Dial (618)453-3324

Log on as *bbs* and use *uwin* as the password.

WaterTalk is accessed in the same manner as UWIN.

Accessing Water Talk Once you have connected to WaterTalk, you can either log on as a *guest* or create a permanent account to access WaterTalk (*guest* can only read the bulletin boards). To participate, you must create an account. Enter your name, phone, postal and e-mail addresses, and create a password. The system also asks for your terminal type (and if you are unsure, it will offer a suggestion). Thereafter, use your name and password to log on to WaterTalk. Only the system administrator will have access to your personal information.

Water Talk Boards

WaterTalk is set up as a series of boards. The first board is called "Information" and contains the policies and procedures of the system as well as a listing of "Frequently Asked Questions" and their answers. Each of the water resources related boards is centered around a particular topic. Currently, the following boards are available:

Hydrology: devoted to the discussion of various aspects of hydrology

International: specializes in the discussion of international water resources issues

Water Quality: focuses on the management planning issues related to groundwater and surface water quality (this board was initiated by the Interstate Groundwater Management Forum)

Water Policy: intended for the discussion of various water policy issues

Using WaterTalk

Watertalk follows a very simple user-driven interface and has a handy HELP option. To get started, hit <ENTER> and select for the menu of boards available. Then you can choose <S> to select the board that you desire to engage and choose <R> to read this board.

With WaterTalk, you can:

- read messages
- post messages
- e-mail other participants
- do on-line conferencing, and
- upload/download files.

For Further Information about WaterTalk or UWIN contact:

faye@uwin.c-wr.siu.edu

EDITOR'S IN-BASKET

Willows Water District Recharge Project Given Major Engineering Award

Willows Water District's innovative use of aquifer recharge technology has been recognized for Engineering Excellence by the American Consulting Engineers Council/Colorado Chapter. The aquifer recharge effort, directed by Willows manager Khanh T. Le and consulting Engineer John C. Halepaska, was cited in the research category and is among the eight Colorado engineering efforts to be included in the national competition for Engineering Excellence.

Metropolitan Unveils New Water Rate Plan

Metropolitan Water District of Southern California's board recently adopted a major policy change that will eliminate the two-year-old standby charge from property tax bills, require new demand to pay for system expansion, and encourage conservation. The action guarantees the district firm new revenue sources, which will reduce the need for large annual water rate increases, especially during dry periods. The new rate structure provides a more equitable method of allocating costs between existing and new demands for urban Southern California.

Major components of the new plan, which goes into effect during the 1995-96 fiscal year, include:

- A continuation of the basic water rate structure for wholesale treated and untreated water, including the seasonal storage program.

- A readiness-to-serve charge to replace the standby charge and cover the district's bond payments for water dependability and water quality projects not covered by property taxes.

- A new demand charge to recover the costs of accommodating new growth and demand.

- A treated water peaking charge to encourage member agencies to develop alternatives to MWD supplies during summer peak demand periods.

- A connection maintenance charge to recover a portion of the costs of maintaining connections between MWD's regional distribution system and those of its member agencies.

Nebraska's Special Protection Area Program Addresses Non-point Source Contamination

Nonpoint source contamination of groundwater in Nebraska has been associated with commercially fertilized row crop agriculture, shallow depth to water, irrigated cropland, and sandy

coarse soils. However, nonpoint source contamination has also been identified in areas not typically considered at risk. The Special Protection Area (SPA) Program is Nebraska's somewhat unique approach to managing non-point source pollution. The designation of an SPA allows state and local agencies to move from the voluntary to the regulatory arena in addressing nonpoint source ground water contamination. Both the Nebraska Department of Environmental Quality (NDEQ) and local Natural Resources Districts (NRDs) have the potential to place mandatory controls on farm operators in Nebraska. The NDEQ is responsible for evaluating ground water data, conducting intensive site-specific studies, holding public hearings, defining boundaries to proposed areas, and designating SPAs where appropriate. Appropriateness is measured on the basis of the presence of non-point source contaminants at levels of impairment, concern, or increasing concentration trends or the imminent threat that nonpoint source pollutants will impair desired uses of the ground water resource.

The process of SPA designation can take three years. When an SPA is designated, the NRD in the area has 180 days to develop an action plan to address the nonpoint source contamination. The action plan must be submitted to the NDEQ and approved. Once the action plan is approved, stabilization or reduction of the problem begins. Farm operators within SPAs may have restricted fertilizer application rates. They may also be required to attend education classes about nitrogen and irrigation management. Farm operators within SPAs may also be required to allow soil samples to be analyzed for nitrogen content and to provide annual reports on soil testing results, fertilizer usage, and other information until a petition to the NDEQ justifies the removal of SPA status.

Source: Nebraska Department of Environmental Quality

Agreement Designates SCS as Lead Agency to Help Farmers Determine Wetlands

Four federal agencies with wetlands protection responsibilities, in a new memorandum of agreement (MOA), recognize the U.S. Department of Agriculture's Soil Conservation Service (SCS) as the lead federal agency for delineating wetlands on agricultural lands. The MOA, among the Departments of Agriculture, Interior, the Army and the Environmental Protection Agency (EPA), implements one of many recommendations regarding federal wetlands policies included in the Clinton Administration's August 24, 1993 approach to managing America's wetlands.

Changes in Wetlands Delineations...

Under the agreement, farmers will be able to rely on Soil Conservation Service wetland maps for determining the extent of wetlands under both the Farm Bill (also known as the Swampbuster program) and Section 404 of the Clean Water Act.

Previously, farmers participating in U.S. farm programs received a wetland map from the SCS for Swampbuster purposes only. If that farmer needed a Section 404 permit for work in wetlands, the Corps of Engineers or the EPA required an additional wetland delineation. The agreement eliminates this duplication of effort and gives the farmer one wetland determination from the federal government. Farmers can now rely on a single wetland determination by SCS for Swampbuster and Section 404 purposes. The Section 404 regulatory program will continue to be administered by the Corps of Engineers or the EPA.

Background on the Agreement...

On August 24, 1993, the Clinton Administration announced a comprehensive package of wetlands policy reforms that will improve the protection of wetlands and make wetlands programs more fair and flexible for landowners. The MOA, signed on January 6, 1994, implements one of the more than 40 initiatives in the Administration's Wetlands Plan. It was developed in response to concerns that previous practices may have led to confusion and inconsistent application of Federal wetlands programs and policies on agricultural lands.

SCS Prepares for its new Responsibilities...

The SCS, in addition to the Fish and Wildlife Service (FWS) and EPA, will continue to participate in the interagency wetland delineation training sponsored by the Corps, which is based on the most current manual used to delineate wetlands for purposes of Section 404. Completion of this training will be prerequisite for field staff of all signatory agencies who delineate wetlands on non-agricultural lands using the 1987 Corps Wetland Delineation Manual. The interagency wetland delineation training will address agency responsibilities as defined by the MOA, SCS National Food Security Act Manual (NFSAM) wetland delineation procedures. Under the MOA field offices are also encouraged to provide supplemental interagency wetland delineation training, as necessary, to prepare the SCS field staff for making Section 404 wetland delineations.

Sources

Army, Interior, EPA, USDA Press Release. January 6, 1994. Release No.0019.94.

Environmental Protection Agency, Department of Agriculture, Department of Defense, Department of the Interior. 1994. "Interagency Memorandum of Agreement Concerning Wetlands Determinations for Purposes of Section 404 of the Clean Water Act and Subtitle B of the Food Security Act." *Federal Register*, 59 FR 2920, January 19, 1994.

(Summarized by David Williams)

American Rivers Announces Most Endangered Rivers of 1994

American Rivers released its report on the continent's most endangered and threatened rivers of 1994 on April 19th. The

Clarks Fork of the Yellowstone River, which flows through Montana and Wyoming, is the most endangered river of North America, according to the organization.

Rivers on the endangered and threatened rivers lists flow through 32 U.S. states, plus Washington, D.C., Canada and Mexico. The endangered rivers, except the Clarks Fork of Yellowstone are, listed in alphabetical order:

1. Clarks Fork of the Yellowstone River (Montana, Wyoming) - most endangered;
2. Anacostia River (Maryland, Washington D.C.);
3. Clavery River (California);
4. Columbia/Snake River System, including the White Salmon and Yakima River tributaries (Idaho, Oregon, Washington);
5. Mississippi River (Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Tennessee, Wisconsin);
6. Missouri River (Iowa, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota);
7. Penobscot River (Maine);
8. Rio Grande (Colorado, New Mexico, Texas, Northern Mexico);
9. Thorne River (Alaska);
10. Virgin River (Arizona, Nevada, Utah).

The Most Endangered River

The Clarks Fork of the Yellowstone is imperiled by a proposed gold mine two-and-a-half miles from Yellowstone National Park. To contain the millions of tons of acid-generating waste created by the mine, plans are to construct a 90-foot high dam and a 74-acre storage reservoir. The storage reservoir and its plastic liner will need to contain the acid-generating rock under water in perpetuity.

American Rivers also named 20 other threatened rivers. By geographic region and in alphabetical order they are: the Chatahoochee River (Alabama, Georgia); Clinch/Powell Rivers (Tennessee, Virginia); Everglades (Florida); Moise/Sainte Marguerite Rivers (Quebec); Saugus River (Massachusetts); Chippewa/Flambeau River System (Wisconsin); Eleven Point River (Missouri); Platte River (Nebraska); Trinity River (Texas); Animas River (Colorado); Las Angeles River (California); San Pedro River (Arizona); Santa Margarita River (California); Snowmass Creek (Colorado); Blackfoot River (Montana); Fraser River (British Columbia); Fortymile River (Alaska); Rogue/Illinois River System (Oregon); and Tongue River (Montana).

WATER NEWS DIGEST

WATER ALLOCATION

River District to Fight USFS Over Bypasses

The Colorado River Water Conservation District plans to fight the U.S. Forest Service over federal claims to water from ditches and reservoirs on national forest lands. Since 1985 the USFS has required the Overland Ditch and Reservoir Co. of Hotchkiss to bypass 2 cfs of water from its reservoir on Grand Mesa into Cow Creek -- 22 percent of the irrigation company's stored water. Overland protested but did not legally fight the USFS over the issue in 1985 because the company would have lost the opportunity for an interest-free loan from the Bureau of Reclamation to repair its dam. The bypass flows are needed to protect the trout fishery in Cow Creek and for endangered fish species in the Gunnison River. However, the water never reaches that far as it is diverted 4.5 miles below the Overland Reservoir by two ranches which hold junior water rights.

Grand Junction *Daily Sentinel* 4/26/94

Colorado River Water Bank Could Help Colorado

A recent proposal by Nevada to establish a Colorado River water bank has Colorado state officials cautiously optimistic. A major point which pleases Colorado is that shortages of water in Nevada and California must be handled among the lower-basin states of Nevada, California, and Arizona. A second point is that no private water marketing should occur between the lower-basin and the upper-basin states of new Mexico, Colorado, Wyoming, and Utah. This proposal, if enacted, could help upper-basin states store additional water and allow more flexibility for releasing water for endangered species. Water could be stored over several years and then used when it's needed. A three-state commission would manage the bank and set the price for water.

Grand Junction *Daily Sentinel* 5/6/94

WATER PROJECTS

Battle Over Rights to Proposed Reservoir Goes to Court

The Dominguez Reservoir Corporation has proposed building a \$560 million reservoir on the Gunnison River near Whitewater and leasing the water to Las Vegas. Dominguez is claiming a conditional right to water which the USBR filed for in 1971. Colorado water law, however, will not permit a conditional water right unless a contract to sell the water exists. Opponents to the Dominguez plan argue that because the USBR dropped plans for the same project in 1984, efforts by Dominguez to revive it since 1987 are not valid. A ruling is expected within 60 days.

Grand Junction *Daily Sentinel* 3/29/94

Plans for Dam near Edwards Abandoned

Plans for a 5,780 acre-foot reservoir on the East Lake Creek Ranch near Edwards by the Upper Eagle Regional Water Authority have been abandoned. A report on the site by a geologist, as well as previous report on the area, found unfavorable geological conditions, leading the water authority to withdraw their water right filing for East Lake Creek. Plans for the reservoir stem from heavy growth in the Beaver Creek, Arrowhead, Avon, Edwards, and Eagle-Vail areas and anticipated future growth.

Denver *Post* 3/25/94

Increase in Trinidad Lake Base Pool Debated

Gov. Roy Romer recently visited Trinidad Lake State Park to discuss efforts to increase the base pool of the lake, currently set at 4,500 acre-feet. Several local and state agencies want the U.S. Army Corps of Engineers, which operates Trinidad Dam, to increase the base pool by an additional 11,467 acre-feet. The Corps is favorable to the plan, and is conducting an environmental assessment which should be available by July. Seven thousand additional acre-feet of water for Trinidad Lake has been purchased by the Colorado Division of State Parks from Pueblo Reservoir, but will not be moved until the allocation is approved by the Corps.

Pueblo *Chieftain* 4/4/94

NCWCD Pipeline Work Begins

Construction began in early April on a pipeline to supply water to several cities in Weld, Adams, Boulder, and Morgan counties. The Southern Water Supply Water Project, being constructed by the Northern Colorado Water Conservancy District, will take water from Carter Lake southwest of Loveland and deliver it to Broomfield by June of 1995. Connecting lines will also supply the towns of Fort Lupton, Hudson, Fort Morgan, Superior, and Louisville. The project began in the late 1980s when Broomfield's water supply was threatened by Rocky Flats. Several other cities, in particular Fort Lupton, became interested due to nitrate problems with current municipal water wells. The entire project is expected to be complete by spring of 1996.

Greeley *Tribune* 4/14/94

NATIVE AMERICAN WATER RIGHTS

Bureau Water Regulations May Allow Tribes to Lease Water

Indian tribes in Arizona and California could lease their federal reserved water rights to other water users under new regulations proposed by the U.S. Bureau of Reclamation. The proposal opens the door for five Indian tribes in the two states to lease

undeveloped water from their reservations. Such sales would stimulate reservation economic growth, according to the USBR. The regulations would also clamp down on illegal diversions from the Colorado River, set a framework for water marketing and banking, and boost efforts toward water conservation. Cities such as Needles, California, which has no water right for diversions from the Colorado River, will have to obtain a water right, and such diversions will count as part of the total amount of Colorado River water allocated to each lower-basin state.

Grand Junction Daily Sentinel 5/12/94

WATER TRANSFER

USFS Dispute Stalls Plans for Windy Gap Water Transfer

The South Adams Water District has approached Greeley about purchasing up to 6,700 acre-feet of the city's Windy Gap water allotments. However, Greeley will not consider the proposal until a dispute with the U.S. Forest Service is resolved. Greeley and the USFS are in the midst of a battle over the issuance of new permits for city-operated reservoirs on USFS land. The USFS wants Greeley and a number of other Front Range cities to release bypass flows from its reservoirs as a condition for renewal of operating permits. The water would be for downstream maintenance of aquatic habitat. Adams County is seeking water to replace a portion of groundwater contaminated with nitrates. Greeley will not make any commitments or begin negotiations with South Adams Water District until the permit issue is resolved.

Denver Post 4/30/94

WATER QUALITY

Colorado Springs Could Face Fines for Wastewater

The Colorado Department of Health may fine Colorado Springs for having too much silver in wastewater flowing into Fountain Creek. In seven of thirteen months between March 1993 and March 1994 the city violated the silver standard. Municipal waste treatment plants aren't designed to take silver out of wastewater. The solution will include educating the city's commercial wastewater customers about pouring waste liquids containing silver down the drain. Those businesses include hospitals, veterinarians, photo labs, and publishers. Letters to the businesses from the city have not been successful, and a monitoring program may have to be established, requiring businesses to keep strict records. If the city resolves the problem soon it may not have to pay any fines.

Colorado Springs Gazette Telegraph 4/21/94

Army Sues Colorado Again over Arsenal Cleanup

After losing one U.S. Supreme Court appeal, the U.S. Army has again filed a federal lawsuit contending that Colorado's groundwater pollution standard for the nerve gas byproduct DIMP is too strict. The suit claims that the state's DIMP

standard was adopted without any reliable toxicological data to support it. Colorado maintains that some 123 drinking water wells near the Rocky Mountain Arsenal are polluted by Army-made DIMP, and that water samples from 39 of the wells show DIMP levels exceeding the Colorado health standard of 8 parts per billion (ppb). The Army wants Colorado to use the EPA's standard for DIMP, which is 600 ppb. EPA has so far refused Colorado's requests for a stricter limit. The question of a safe limit is open to deliberation as the area around the arsenal northeast of Denver is the only location in the country contaminated by DIMP. The Army produced chemical weapons at the facility for four decades before the arsenal was used by Shell Oil Company for pesticide manufacturing. The site was finally closed in the early 1970s.

U.S. Water News 5/94

Lead Found in Brass Water Pumps

People who have installed new brass pumps in water wells within the last year are being urged to drink bottled water until their wells are tested for lead. EPA has issued a warning that lead used to make the brass for the pumps can leach into the water in potentially dangerous amounts. EPA urges that any brass pump recently installed should be tested. The main problem occurs during the first year the pump is in operation, which is why owners of newly purchased pumps are being warned. The problem may be worse in areas where the water is very corrosive. Two suits have been filed against four pump manufacturers, alleging their projects can contaminate drinking water with lead and are defective. Plastic and stainless steel water pumps do not produce excessive lead levels.

Denver Post 4/19/94

ENVIRONMENT

Snowmass Creek Added to Threatened-River List

Snowmass Creek has been added to American River's annual list of 20 most threatened North American rivers because of an attempt to reduce its minimum flow rate. Aspen Skiing Company has requested that the minimum flow for Snowmass Creek be reduced from 12 cubic feet per second (cfs) to 7 cfs because the higher flow was an error. The company hopes to use the water for additional snow-making. Minimum flows are set by the Colorado Water Conservation Board at the lowest level to sustain a trout fishery. When CWCB agreed to lower the flow standard a group of residents filed a lawsuit which is currently before the Colorado Supreme Court. Critics say the drop in winter flows will damage trout spawning areas.

Grand Junction Daily Sentinel 4/20/94

Couple to Defy EPA Order on Gunnison River Flow

A Delta couple plans to ignore a federal order to restore the Gunnison River after they were accused of harming endangered fish by diverting it. Sandra Tarr bulldozed part of the river to

strengthen the banks and prevent it from damaging her farm's irrigation system. EPA ordered the Tarrs to reverse the changes within a 15-day period or face penalties of up to \$25,000 a day. Tarr reportedly tried to get a permit for the project, but when the process was delayed went ahead with the project anyway.

Greeley Tribune 4/24/94

Contamination Within Guidelines

Colorado State University researchers have concluded that soil, water, and crops downstream of the Summitville mine disaster have elevated levels of heavy metals, but contend they remain within safety guidelines. Results of the two-year study by CSU, CSU Cooperative Extension, and the USGS were presented during a meeting of the Governor's Summitville Task Force.

Montrose Daily Press 4/13/94

Public Outcry May Doom Mine Near Yellowstone

An environmental group predicts that public opposition to a proposed gold mine near Yellowstone National Park will doom the venture. The Greater Yellowstone Coalition believes public pressure will block construction of the mine. Crown Butte Mining Inc. wants to mine an estimated \$700 million worth of gold near Cooke City, Montana, just north of the Wyoming-Montana border and near the northeastern corner of Yellowstone. Opposition centers around water which flows into the park and could be contaminated by the project.

Denver Post 5/16/94

Arkansas River Water Quality Shows Improvement

Historic leaching of heavy metals from mines near Leadville and concentrated mining pollution from the Yak Tunnel have been polluting the Arkansas for decades, killing and stunting fish and other aquatic life. In 1989 a Colorado Division of Wildlife (DOW) project to remove rough fish from a tributary Clear Creek Reservoir went awry, killing every living thing for 30 miles downstream. But two EPA Superfund cleanup projects to deal with mining pollution near Leadville, and the DOW restocking project on the river, have worked wonders. The Colorado River rainbow trout which were used to stock the river are thriving within a few miles of the mine pollution source, algae levels in the river have improved as well as the number and size of insects -- a clear indication that the overall food projection has improved according to DOW biologists.

Denver Post 4/27/94

WILDERNESS

Water Bogs Down Bill on RMNP

A proposal to designate more than 90 percent of Rocky Mountain National Park as a wilderness area is becoming inundated by the same issue that delayed another Colorado

wilderness bill for nearly a decade -- water. The bill, introduced by Rep. David Skaggs, D-Colo., would designate 240,650 acres as wilderness, preventing any further development in those areas of the park currently containing no roads or human development. The bill creates a federal reserved water right for the park, a controversial concept generally opposed by state water interests but supported by environmentalists.

Greeley Tribune 5/3/94

WETLANDS

Settlement Thrown Out in EPA Wetlands Dispute

A federal judge has rejected a settlement of Telluride ski resort wetland's violations negotiated by the EPA, the Justice Department, and the resort. The agreement required the ski area to restore about 15 acres of wetlands in the mountain village, create about 27 acres of wetlands near Montrose, pay \$143,000 in fines to the EPA, provide \$42,000 to San Miguel County for wetlands, and maintain all restored and created wetlands. The deal was estimated to cost Telluride resort \$2 million. Judge John Kane said the settlement was less stringent in several respects than the EPA's own policy advises, and civil penalties are the minimum the EPA stated it would accept in settlement of the litigation. In addition, the settlement ignored public complaints that the financial penalty amounted to less than the cost of an average lot in the mountain village. Kane ruled the EPA and Telluride Resort must come up with a tougher settlement or go to trial. The resort has the option of appealing the decision.

Montrose Daily Press 4/22/94

WILDLIFE

Colorado's Native Species Threatened

Of the state's 73 native species of fish and amphibians, 25 percent are threatened, endangered, or flat-out extirpated, according to the Colorado Division of Wildlife (DOW). Another 47 percent have dropped to the point that they may be added to the threatened and endangered list. Last fall the Colorado Wildlife Commission added the two latest aquatic species to the state endangered list: Boreal toads and the Rio Grande sucker. In addition, there are numerous fish and amphibians in a "special concern" category which the DOW plans to address before they become listed.

Montrose Daily Press 4/6/94

Threatened Species Escape San Luis Ditch Fish Kill

Evidently no state or federal threatened or endangered species were killed when a deadly substance was recently placed in the San Luis Ditch, killing about 4,800 fish. Colorado Division of Wildlife officials checked nine sites along the ditch, La Jara Creek, and the confluence of the Rio Grande and La Jara Creek at various intervals to determine the extent of the kill. A gallon

container bearing the odor of a fish pesticide was found. The kill was 100 percent effective in the first 8 miles of the ditch, with rainbow trout from fingerlings to 18-inchers all dead. In La Jara Creek the kill included common carp, white suckers, fathead minnows, and northern pike. It does not appear the poison reached the Rio Grande. The container and dead fish will undergo testing. This is the second such kill in the area in the past month. The earlier kill occurred near South Fork on the Rio Grande, but killed much fewer fish.

Pueblo Chieftain 4/21/94

Disease Threatens State's Wild Rainbow Trout

The Colorado Division of Wildlife (DOW) has confirmed the existence of whirling disease among rainbow trout in the Gunnison River Gorge. Long-term implications are unknown, but hundreds of thousands of fish are in jeopardy -- perhaps all naturally reproducing rainbow trout in the state. Whirling disease is a parasitic affliction that affects trout and salmon. Rainbow trout seem particularly vulnerable. The disease first appeared in the state in the 1980s, and has spread despite efforts to contain it to the Arkansas, South Platte, Rio Grande, and Colorado river basins.

The DOW initially believed the disease posed no threat to fish in the wild; only to those in hatcheries. That assumption was challenged last fall when wild rainbows were found to have virtually disappeared from the Colorado River in Middle Park. Circumstantial evidence suggested whirling disease. Sampling in the Gunnison Gorge was authorized after the disease was discovered at the Roaring Judy hatchery on the East River near Almont.

Because Kokanee salmon were believed to not be susceptible to whirling disease, 1 million young were stocked in Blue Mesa Reservoir last spring. It has been subsequently discovered the salmon do indeed carry the disease. High water releases from the reservoir last spring sent trout and salmon through the dam into Gunnison River Gorge and its famous Black Canyon stretch. This section of the river is generally considered the state's premier fishery for large, wild rainbow trout. DOW biologists will sample other prime fishing waters including the South Platte River below Spinney Mountain Dam, however, little can be done about the disease.

Colorado Springs Gazette Telegraph 4/21/94

LITIGATION

Ruling Against AWDI is Upheld by State Supreme Court

American Water Development Inc. has no right to underground water in the San Luis Valley and has been denied permission to pump water out of the valley by the Colorado Supreme Court. The court ruled AWDI's actions would drastically deplete surface flows of natural streams in the area, including the Rio Grande River and San Luis Creek, and ordered the company to pay \$3.1 million in expenses and court costs. The plan, if

successful, would have removed 200,000 acre-feet of water from the valley annually. AWDI is considering its options.

Montrose Daily Press 5/10/94

Government Drops Water Rights Appeal

The federal government is dropping its appeal of a district judge's denial of water rights in four national forests in Colorado sought by the U.S. Forest Service. Officials reported the U.S. government filed a motion with the Colorado Supreme Court asking for voluntary dismissal of the appeal of the decision handed down in February of 1993 by Judge Robert A. Behrman. In the original decision Judge Behrman denied a USFS request for water rights in four national forests. At issue was whether the USFS was legally entitled to any water flowing through land it owns in Colorado. The government claimed reserved water to protect the land. Behrman denied the request, and the USFS appealed last September. The decision to drop the appeal surprised northern Colorado water entities, as the original case cost \$10 million in attorney's fees.

Denver Post 3/26/94

RECREATION

Aspen Skiing Co. Appeals USFS Decision

The Aspen Skiing Company has appealed a U.S. Forest Service decision to approve the company's plans to expand onto Burnt Mountain, but setting several conditions. Provisions of the decision limit the company to one gondola on Burnt Mountain and require the company to monitor water levels during snowmaking on Snowmass Creek, and buy new buses, among other conditions. The appeal was filed for clarification, and to get a more precise interpretation of the decision. The skiing company also questioned the above conditions in addition to the USFS decision to remove the eastern portion of Burnt Mountain from the ski area's permit.

Grand Junction Daily Sentinel 4/27/94

USBR Proposes Recreational Use of Canal Roads

The road that runs along the Highline Canal in the Grand Valley may be opened for use as a hiking and biking trail if a proposal by the U.S. Bureau of Reclamation is adopted. As Grand Junction has grown and construction has gotten closer to the canal system, there is increasing pressure for recreational use along the waterway. Implementation of the plan would require cooperation of the Grand Valley Water Users Association, which remains reluctant to discuss the issue. Ditch company constituents are concerned with the potential for trespassing on private property, problems with livestock, and increased safety liability for the public. Issues which must be addressed include: law enforcement authority of the promoting agency; liability issues; operation and maintenance costs for trails; and permission of adjacent landowners for the recreational use of the

canal right-of-way. The USBR has begun working with Grand Junction city officials on a canal trail system.

Grand Junction Daily Sentinel 4/25/94

BLM Seeks Protection of San Miguel River

Overuse of the fragile ecosystem along the San Miguel River between Telluride and Naturita has prompted the U.S. Bureau of Land Management to stop allocating outfitter permits for that section of the river. The moratorium affects a 38-mile stretch of the river. The moratorium will allow the BLM to prepare an ecosystem management plan for the 43,000-acre San Miguel River Special Recreation Management Area. Eight current commercial outfitters holding permits for the area will be allowed to continue operations, but use will be held at 1993 levels until the management plan is complete. Part of the problem is due to the growth of Telluride and a lack of affordable housing. New residents settle in tents on BLM, USFS, and state land semi-permanently, increasing litter, illegal firewood cutting, vandalism, and sanitation problems along the river. The BLM is working with the Montrose Planning Commission and the San Miguel River Coalition to develop guidelines on how the river corridor should be managed.

Grand Junction Daily Sentinel 4/14/94

Windsor Lake Trail to be Complete by Late Summer

Construction of the 1.66-mile Windsor Lake Trail should be complete by late summer. According to the Windsor Recreation Department, a contract with Great Outdoors Colorado for a grant of \$50,000 will ensure completion of the project which includes a 42-foot truss bridge of weathered steel which will span over an outlet channel on the lake. The 10-foot wide trail of crusher-fine gravel will wind around the lake located north of downtown Windsor. The town of Windsor matched the \$50,000 grant.

Greeley Tribune 5/4/94

ENDANGERED SPECIES

South Platte Water Wanted for Ecosystem Health

The following is a summary of news articles from the *Greeley Tribune* on 4/17/94, 4/29/94, 5/23/94.

Interior Secretary Bruce Babbitt, on a recent visit to Colorado's Rocky Mountain National Park, called on water users in Wyoming, Nebraska, and Colorado to develop a basinwide plan to assure that more water reaches the Platte River to help endangered species in central Nebraska. At issue are the habitats of the endangered Whooping Crane and other species which utilize the Platte River watershed in Nebraska. Low water flows in the river are endangering the continued existence of the cranes.

The U.S. Fish and Wildlife Service (FWS) has asked the U.S. Forest Service (USFS) for help in ensuring additional water

reaches Nebraska. During the past year cities and other water entities in the South Platte watershed which operate reservoirs located on Forest Service land have been prevented from renewing longterm special-use permits to operate the reservoirs. The USFS is attempting to require additional water releases from reservoirs located in Colorado.

The Front Range cities of Greeley, Fort Collins, Loveland, and Boulder all operate such reservoirs, and are opposing USFS plans to require bypass flows as a condition for permit renewal. The Forest Service wants the bypass flows to help aquatic habitats and endangered species downstream of the reservoirs, both in Colorado and Nebraska. During winter months some of these facilities completely shut off water releases. The USFS maintains it has the right to re-evaluate permits when it involves compliance with federal laws such as the Endangered Species Act. The cities maintain they should not be subject to new conditions if they are not changing their methods of operation.

Three entities with reservoirs on USFS land -- Fort Collins, Greeley, and the Water Supply and Storage Company -- have recently offered to release additional water into the Poudre River during winter months in an effort to head off a court battle with the USFS and expedite renewal of their reservoir operation permits. In all an additional 800 acre-feet of water is being proposed for release from Barnes Meadow Reservoir and Chambers Lake.

Nebraska officials, meanwhile, are encouraged that the federal government is looking upstream -- to Colorado and Wyoming -- for additional water to aid threatened and endangered wildlife along the Platte River. However, Nebraska officials are aware Colorado and Wyoming both want assurances that any additional water from the upper states will actually help the endangered species. Colorado, in particular, is reluctant to release additional water from the South Platte basin as long as groundwater use is unregulated in Nebraska.

Editor's Note: Colorado Water Resources Research Institute has funded a number of studies pertaining to this ongoing issue:

- Ecological Integrity Task Force -- defining what is ecological integrity's goal for Colorado
- Water Rights Administration
- Platte River DSS research among Nebraska, Wyoming, and Colorado

Survey of Models of South Platte River

CWRRI is always seeking new ways of bringing higher education expertise to this problem.

1994 HYDROLOGY DAYS HONORS ART COREY

The Fourteenth Annual **Hydrology Days**, held April 5-8, 1994 at Colorado State, was dedicated to Dr. Arthur T. Corey, Professor of Agricultural Engineering at CSU from 1956 to 1978, in recognition of his contributions to subsurface hydrology. This recognition is very fitting -- the **Hydrology Days** meetings and Art Corey's professional life both have been dedicated to student involvement in basic research and the profession of hydrology. Participation at professional meetings greatly enhances the educational experience of students studying water resources at Colorado's institutions of higher education.

Hydrology Days goes further than simply providing opportunities for students to present papers. Students are judged by professionals and awards are given for the best presentations. The blend of student presentations with those of well-known professionals in the field is a unique characteristic of **Hydrology Days** and, as a result, draws both students and professionals from across the United States.



H.J. Morel-Seytoux introduces luncheon speaker, Doug James

The 1994 **Hydrology Days** included papers on such topics as a Decision Support System for water rights in the South Platte River watershed, relationships between sediment and flushing flows, flow rates through flaws in membrane liners, a review of the 1993 water year in Colorado, and of course, a session on "Characterization of Soil Capillary and Hydraulic Properties" for which Professor Corey is so famous. The **Hydrology Days** proceedings contains nearly forty papers. It is available through **Hydrology Days Publications**, 57 Selby Lane, Atherton, California 94027-3926.

Two luncheon speakers were featured as part of this year's **Hydrology Days**. Dr. L. Douglas James is the director of the Hydrologic Sciences Program at the National Science Foundation. David W. Walker of Walker Water Services, Littleton, Colorado, is a former director of the Colorado Water Conservation Board.

The two speakers, one representing a national, highly scientific approach to hydrology, and the other an applied, practical, and regional approach, exemplify **Hydrology Days'** goal of bringing together diverse approaches and expertise to solve water resource problems.



The Honoree, Art Corey, with Doug James, Director of NSF's Hydrologic Sciences Program.

Winners of the student paper and poster awards for 1994 are:

- | | |
|----------------------------|---|
| M.S. Oral Presentation: | Ranjit S. Jadhav
University of Cincinnati, Ohio |
| M.S. Poster Presentation: | Bruce H. Vaughn
University of Colorado at
Boulder |
| Ph.D. Oral Presentation: | Cindy S. Kao
University of California at
Berkeley |
| Ph.D. Poster Presentation: | Jim C. Washburne
University of Arizona, Tucson |



Art Corey and participants at poster session

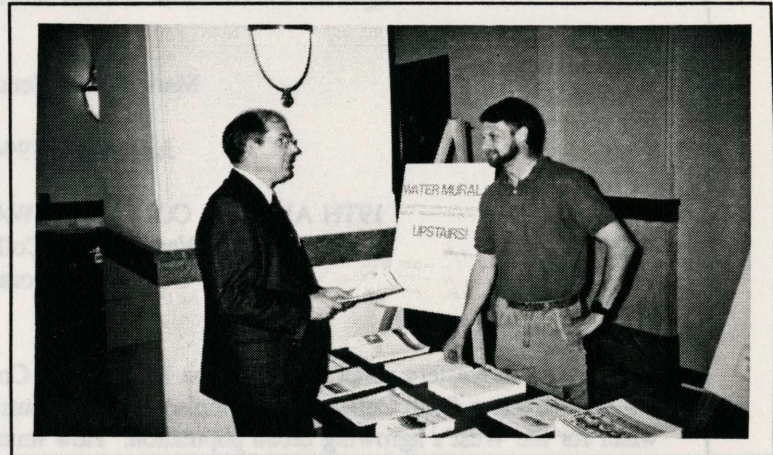
When leading hydrology professionals mix with students, discussions are excellent and learning is maximized. Dr. Morel-Seytoux, chief organizer, must be thanked for his hard work in organizing an outstanding learning experience for all of those in attendance.

LEGISLATORS AND STUDENTS "TALK WATER" AT CAPITOL FESTIVAL

The Colorado Senate and House Agriculture and Natural Resources Committees, the Water and School Lands Interim Committee, and the Central Colorado Water Conservancy District sponsored the 1994 Legislative Water Festival at the State Capitol Building in Denver on Thursday April 21, 1994. The purpose of this first-ever water festival for legislators was to educate and entertain legislators about water topics in Colorado. Children's water festivals for grades K-12 have been ongoing in Colorado since 1991. The same concept was adopted to share water education efforts with Colorado legislators.

Water presentations included:

- Water Wizards:** Legislators competed against 5th graders from Scott Elementary School in Greeley, answering water trivia questions in team competition. Sponsored by the Colorado Department of Natural Resources.
- **Water Use and Abuse -- the Gold Rush to Now:** Teen tour guides spoke about their involvement in the Colorado Division of Wildlife River Watch Project, and taught about gold panning, yucca face-painting, and Native American folklore. Sponsored by the Zuni Alternative High School, Denver Public Schools.
- **Where Our Water Comes From:** Legislators were introduced to the concept of transmountain water diversion and the competition between East and West Slopes over limited water supplies in Colorado. Sponsored by the Northern Colorado Water Conservancy District and the Colorado River Water Conservation District.



Student Intern Greg Silkensen discusses CWRRI materials with Bill Thompson, Rocky Mountain Farmers Union

Exhibits of water related-materials were displayed in the lower level of the Capital Building by: Ute Water Conservancy District, USDA Soil Conservation Service, Colorado Water Quality Control Division, Colorado Association of Soil Conservation Districts, Cooperative Extension Service, Colorado Foundation for Agriculture, Colorado Environmental Coalition, Environmental Defense Fund, Nature Conservancy, Trout Unlimited, Colorado Corn Administrative Committee, Lower South Platte Water Conservancy District, Colorado Water Resources Research Institute, and Denver Water Board, and the Northern Colorado Water Conservancy District. A complimentary lunch was served to the legislators by the Colorado Foundation for Agriculture, and included bar-b-qued lamb, potato salad, deviled eggs, fruits and vegetables, milk, juice and cookies.

FIRST ANNUAL SOUTH PLATTE AG TOUR

August 18, 1994

The purpose of this tour is to showcase new developments in Best Management Practices for irrigation, nutrient management, manure utilization, and ag chemical management. Participants will visit on-farm and Experiment Station research and demonstration sites.

New production tools such as in-season soil sampling, improved irrigation systems, chlorophyll measurement, on-farm composting equipment, remote sensing, nutrient management plans, computer modelling, and geographic information systems will be demonstrated and discussed.

There is no cost for this full-day tour of the South Platte basin, which includes lunch and a barbecue dinner. Events begin at 9:00am at CSU's Agricultural Research, Development, and Education Center (ARDEC). Buses return to ARDEC at 5:30 and 6:00pm.

RSVP your attendance by August 15, 1994 by calling Reagan Waskom at CSU Cooperative Extension, 303/491-6201.

QUENCHING THE URBAN GIANT

Mark Your Calendar!

July 20-22, 1994

19TH ANNUAL COLORADO WATER WORKSHOP

Western State College
Gunnison, Colorado

Join experts in western water issues for the 19th Annual Colorado Water Workshop, scheduled for July 20-22 at Western State College in Gunnison. Participants will discuss the challenge of providing water for the West's agrowing urban population. How much additional storage is needed? Can cooperation and conservation reduce the demand for new supplies? Will farms and rural communities dry up to quench the cities? How will bypass requirements, endangered species needs and other environmental concerns affect municipal supplies? Speakers from Colorado, other western states and Washington, D.C. will share their perspectives and experiences.

Western State College will offer one undergraduate or graduate credit for the three-day conference. CLE credits will also be available. The registration fee, which includes meals, is \$210. A limited number of **partial scholarships are available**. Inexpensive dorm rooms also are available. For more information or to register, please call Lucy High at (303)943-7156 or Carol Oyster at 943-2090.

SHORT COURSES

Water Resources Development and Environmental Protection: Problems, Issues and Solutions, June 27-July 1 1994, Colorado State University, Fort Collins, CO--Focuses on the complicated relationships and controversies between water resources development, characteristics of the hydrologic cycle at a particular location, and environmental quality and protection. Topics include effects of water resources development, conservation, control and protection on the resulting environmental quality and the need for environmental protection. It addresses given characteristics of hydrologic formation and humans' attempt to control various aspects of the hydrologic cycle. The course helps participants develop an understanding of the complex and extraordinary interdependence of environmental quality, protection and improvement and various types of water resources developments. For additional information, please contact Vujica Yevjevich or Thomas G. Sanders, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone 303/491-5448; FAX 303/491-7727.

Practical Modeling of Three-Dimensional Contaminant Transport and Remediation Designs Using Modular Flow and Transport Models MODFLOW AND MT3D International Ground Water Modeling Center, Colorado School of Mines--Intended to familiarize participants with fundamental concepts and numerical methods underlying contaminant transport simulation. The course will provide an in-depth introduction to the MT3D transport model. Computer sessions will give participants hands-on experience in using MODFLOW and MT3D. They will cover the entire simulation process, from preparation of input files to the presentation of results from MODFLOW and MT3D. Case studies will be presented to illustrate the keys to the successful application of MODFLOW/MT3D in modeling remedial actions and plume movement. For course content information contact Paul K.M. van der Heijde, Director; for logistical information contact Program Assistant Mary Pigman; International Ground Water Modeling Center, Colorado School of Mines, Golden, CO 80401-1887, Phone 303/273-3103, FAX 303/273-3278.

MEETINGS

Storm Water Management Modeling, Quantity and Quality, 3-Day EPA SWMM Workshop, June 27-29, 1994, University of Colorado, Boulder, CO--For technical information contact: Professor James P. Heaney, Campus Box 421, University of Colorado, Boulder, CO 80309. Phone 303/492-3276, FAX 303/492-1347; E-Mail: Heaney@CADSWES.Colorado.edu.

RMWPCA Seminar, July 14, 1994, Boulder, CO--A seminar on Principles and Practice of Nitrogen and Phosphorus Removal from Wastewater conducted by the Rocky Mountain Water Pollution Control Association. Call Norman Henderson, City of Broomfield 303/466-5185 for details.

Annual RMSAWWA/RMWPCA Conference Update, Crested Butte, CO, Sept. 11-14, 1994--The 67th Annual Meeting of the Rocky Mountain Section of the American Water Works Association and the 57th Annual meeting of the Rocky Mountain Water Pollution Control Association. Specialty workshops are scheduled for **Watershed Management Approaches, Diversity on the Workplace, and Arsenic in Drinking Water Supplies**. Contact the Conference Coordinator, Mark Van Nostrand (303) 825-5999 or the Registration Coordinator, Lavonne Atkins (303) 727-8990.

CALLS FOR PAPERS

Water in the 21st Century: Conservation, Demand, and Supply, April 23-26, 1995, Salt Lake City, UT--Deadline: August 29, 1994. Submit 3 copies of 250-word abstract to: J. Paul Riley, Professor Emeritus, Utah State University, Logan, UT 84322-4110, Phone 801/750-2783, FAX 801/750-1185; or: Lloyd H. Austin, Div. of Water Resources, 1636 W. North Temple, Suite 310, Salt Lake City, UT 84116, Phone 801/583-7257 or FAX 801/538-7279.

Water Resources at Risk, 1995 Annual Meeting, American Institute of Hydrology, May 14-18, 1995, Denver, CO--Deadline: August 31, 1994. AIH invites all interested persons to submit abstracts to be considered for presentations as papers or posters. The conference will feature sessions on subjects of current concern in hydrology, general sessions, poster sessions, short courses and field trips. The proceedings will be available at the meeting. Field trips will visit Rocky Mountain Arsenal, Rocky Flats, Rocky Mountain National Park, and the historic mining sites at Leadville, Minturn and Idaho Springs. A post-symposium tour will visit the Carlin Trend mine dewatering site in Nevada. Among the symposia are: Stan Lohman Memorial Symposium on Ground Water; Robert C. Averett Memorial Symposium on Water Quality/Riparian Studies; Luna B. Leopold Symposium on Interdisciplinary Hydrology; and IMWA Symposium on Mining Hydrology and Reclamation.

Contact: James R. Kunkel or Timothy D. Steele, Coordination Committee Co-Chairs, Advanced Sciences, Inc., 405 Urban St., Suite 401, Lakewood, CO 80228. Phone 303/980-0036; FAX 303/980-1206.

Water Resources and Environmental Hazards: Emphasis on Hydrologic and Cultural Insight in the Pacific Rim, June 25-28, 1995, Honolulu, Oahu, Hawaii--Deadline: Oct. 28, 1994. Submit three copies of 250-word abstract to: Raymond

1994 GROUNDWATER MODELING CONFERENCE

AUGUST 10-13, 1994

Colorado State University
Fort Collins, Colorado

Sponsored By
Groundwater/Environmental
Hydrology Program
Department of Civil Engineering
Colorado State University

In Cooperation With
International Ground Water
Modeling Center
Colorado School of Mines

The 1994 Conference will feature
keynote addresses, computer
demonstrations, commercial software
demonstrations and informal
discussions.

For More Information Contact

Office of Conference Services
Attention: Ms. Beverly Williams
Colorado State University
Fort Collins, CO 80523 USA
Telephone 303-491-6222
Fax 303-491-0667

Herrmann, Symposium Technical Program Chairperson, National Biological Survey, Colorado State University, Fort Collins, CO 80523, Phone 303/491-7825.

Water Environment Federation 68th Annual Conference (Oct. 21-25, 1995) & Exposition (Oct. 23-25, 1995), Miami Beach, FL. Deadline: Dec. 16, 1994. Submit Abstracts to: Water Environment Federation, Attn: Conference Program, 601 Wythe Street, Alexandria, VA 22314-1994. Phone 800/444-2933. Fax submissions cannot be accepted for consideration.

1995 National Conference of the American Water Resources Association, Nov. 5-9, 1995, Houston, Texas and Reconvened Conference Nov. 10-12, 1995, Cancun, Mexico--Submit three copies of 200-word abstract to the appropriate conference or symposium technical program chairperson. For the National Conference, submit abstracts to: John S. Grounds III, General

Chairperson, Bechtel, 3000 Post Oak, Houston, TX 77252-2166. Phone 713/235-4921.

For National Symposium on Water Management in Urban Areas, submit abstracts to: Mark L. Loethen, Symposium Chairperson, Pate Engineers, Inc., 13408 Northwest Freeway, Suite 160, Houston, TX 77040.

For National Symposium on Advances in Model Use and Development in Water Resources, submit abstracts to: Theodore G. Cleveland, Symposium Chairperson, Dept. of Civil and Environmental Engr., University of Houston, Houston, TX 77204-4791.

For National Symposium on North American Water Resources, submit abstracts to: Jerry R. Rogers, Symposium Chairperson, Dept. of Civil and Environmental Engr., University of Houston, Houston, TX 77204-4791.

**SECOND ANNOUNCEMENT AND CALL FOR PAPERS
INTEGRATED WATERSHED MANAGEMENT IN THE SOUTH PLATTE BASIN:
STATUS AND PRACTICAL IMPLEMENTATION**

October 26-27, 1994

Ramkota Inn, Greeley, Colorado

The fifth annual **South Platte Forum** will explore the practical implementation issues associated with an integrated approach to watershed management in the South Platte Basin. You are invited to submit a one-page abstract to the organizing committee for a planned 15-minute presentation. Abstracts are due by July 1, 1994. Authors whose papers are selected for presentation will be notified by August 1, 1994. The abstracts should be one page or shorter in length, and be submitted both in hard copy and Wordperfect or ASCII format on disk. All submitted abstracts will be published in the conference proceedings, to be distributed during the Forum. Topics of interest include:

- o Implementing an integrated watershed management approach
- o Status of research and regulatory activity in the basin
- o Available resource information and research needs
- o Legal implementation issues
- o Competing uses and conflict resolution
- o Public participation and education issues
- o Agricultural, municipal, and environmental needs and management issues

Submit materials to: Colorado Water Resources Research Institute
410 University Services Building
Colorado State University
Fort Collins, CO 80523
Attention: Kathleen C. Klein, Coordinator
Phone: (303)491-6308 FAX: (303)491-2293

Contact: Gene Schleiger
Northern Colorado Water Conservancy District
P.O. Box 679
Loveland, CO 80539
Phone: (303)667-2437 Fax: (303)663-6907

Sponsored By: Colorado Division of Wildlife, Colorado Water Resources Research Institute, Northern Colorado Water Conservancy District, Denver Water, US Geological Survey, US Environmental Protection Agency, and US Fish and Wildlife Service

SUBDIVIDING THE WEST

October 13, 1994 - Colorado State University
Room 228, Lory Student Center, 8 am, Admission Free

A one-day forum exploring societal and environmental implications of unprecedented population growth in the American West.

Program

- 0800-0810 **Welcome and Purpose of Forum - Dr. Richard Knight, Colorado State University**
- 0810-8040 **Rural Sprawl and Rural Communities-Dr. Edward Marston, Publisher, High Country News**
- 0840-0920 **Shifts in the Sources of Environmental Change- Dr. Thompson Hobbs, Colorado Division of Wildlife**
- 0920-1000 **Development of the Forest Fringe - Dr. William Riebsame, University of Colorado**
- 1000-1030 **Refreshments - Room 2224-6**
- 1030-1110 **Environmental Effects of Rural Subdivisions - Dr. Richard Knight, Colorado State University**
- 1110-1150 **Wilderness, Wildlife, and Development - Dr. Peter Landres, USDA Forest Service Aldo Leopold Research Institute**
- 1150-1300 **Lunch**
- 1300-1340 **The Last Cash Crop: Thoughts on Subdividing Agricultural Lands - Dr. George Wallace, Colorado State University**
- 1340-1600 **Panel - "Saving the West"- Moderated by Chris Pague, Director, Colorado Natural Heritage Program**

For Further Information Contact: Dr. Richard Knight (303-491-6714) or Dr. Thompson Hobbs (303-491-2836).
Sponsored by The CSU Chapter of the Society for Conservation Biology & Colorado Division of Wildlife.

Great Plains Agricultural Council

WORKSHOP ON COMPUTER APPLICATIONS IN WATER MANAGEMENT

May 23-25, 1995 -- Fort Collins, Colorado

The purpose of this workshop is to familiarize state and local mid-level water resource managers in the Great Plains with computer models, information exchange networks, and computer-assisted automation technology available for analysis and solution of complex water quantity and quality issues. While examples will relate to Great Plains water management issues, the workshop will also be of interest to water managers from other regions. Invited presenters will illustrate the use and limitations of computer models for field to basin scale by way of four or five test cases. In addition, a Resource Fair will feature poster and computer

demonstrations and commercial exhibits related to the theme. All presentations will be documented in the proceedings. The Organizing Task Force invites your participation in these activities. If you would like to attend the workshop or make a presentation at the Resource Fair, please send your name, professional affiliation and address by September 1, 1994 to L. R. Ahuja, USDA-ARS, P.O. Box E, Fort Collins, CO 80511; Phone: 303/490-8300; FAX 303/490-8310. More detailed information and pre-registration materials will be sent later.

COLORADO WATER CONGRESS 1994 COLORADO WATER LAW SEMINAR

September 29-30, 1994

Holiday Inn-Northglenn, I-25 & 120th Avenue, Northglenn, Colorado

In recognition of the contributions made by Larry D. Simpson, the CWC Board of Directors has established the Larry D. Simpson Engineering Scholarship. It will be awarded to either an engineering student or a non-partner of a Colorado engineering firm. The recipient will receive a full scholarship to the seminar. Filing deadline is July 1, 1994. Contact Colorado Water Congress, 303/837-0812 for information.

CALENDAR

- July 12-15 SUSTAINING THE ECOLOGICAL INTEGRITY OF LARGE FLOODPLAIN RIVERS: APPLICATION OF ECOLOGICAL KNOWLEDGE, LaCross, WI. Contact: Dr. K.S. Lubinski, US Fish & Wildlife Serv., Environ. Mgmt. Tech. Ctr., 575 Lester Ave., Onalaska, WI 54650.
- July 11-13 1994 ROCKY MOUNTAIN SYMPOSIUM ON ENVIRONMENTAL ISSUES IN OIL AND GAS OPERATIONS, Golden, CO. Contact: Office of Special Programs and Continuing Education (SPACE), Colorado School of Mines, Golden, CO 80401. Phone 303/273-3321; FAX 303/273-3314.
- July 17-22 ASCE 2ND INTERNATIONAL GROUNDWATER SYMPOSIUM, Orlando, FL. Contact: David Pyne, CH2M Hill, P.O. Box 147009, Gainesville, FL 32614-7009. Phone 904/331-2442.
- July 20-22 QUENCHING THE URBAN GIANT, 19th Annual COLORADO WATER WORKSHOP. Contact: Lucy High at 303/943-7156.
- July 28-29 HIGH ALTITUDE REVEGETATION SUMMER FIELD TOUR. Contact: Gary Thor, Soil & Crop Science Department, Colorado State University, Fort Collins, CO 80523. Phone 303/491-7296.
- Aug. 2-5 ANNUAL MEETING, UNIVERSITIES COUNCIL ON WATER RESOURCES, Big Sky, MT. Contact: UCOWR, 4543 Faner Hall, Southern Illinois University, Carbondale, IL 62901. Phone 618/536-7571.
- Aug. 7-12 STORMWATER NPDES RELATED MONITORING NEEDS, Crested Butte, CO. Contact: Barbara Hickernell, 345 E. 47th St., New York, NY 10017. Phone 212/705-7836.
- Sept. 9-10 1994 INDIAN WATER RIGHTS CONFERENCE, Stanford, CA. Contact: Ann Robinson, Stanford Law School, Stanford, CA, 94305. Phone 415/723-2575.
- Sept. 11-14 11TH ANNUAL CONFERENCE OF ASDSO (ASSOCIATION OF STATE DAM SAFETY OFFICIALS, INC.), Boston, MA. Contact ASDSO at Phone 606/257-5146.
- Sept. 26-28 ROCKY MOUNTAIN GROUNDWATER CONFERENCE, Las Vegas, NV. Contact: Paul Seaber, Desert Research Institute, P.O. Box 19040, Las Vegas, NV 89132-0040. Phone 702/895-0487.
- Sept. 28-30 WATERSHEDS '94 EXPO, Bellevue, WA. Contact: Andrea Lindsay, EPA, 206/553-1896 or toll-free 1-800/424-4EPA.
- Oct. 19-21 GREAT PLAINS ANIMAL WASTE CONFERENCE ON CONFINED ANIMAL PRODUCTION AND WATER QUALITY, Denver, CO. Contact: Reagan Wascom, Department of Agronomy, Colorado State University, Fort Collins, CO 80523. Phone: 303/491-6103.
- Nov. 6-10 AWRA NATIONAL SYMPOSIUMS ON WATER QUALITY AND NATIONAL WATER QUALITY ASSESSMENT (NAWQA), Chicago, IL. Contact AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192. Phone 301/493-8600; FAX 301/493-5844.

Colorado Water Resources Research Institute
410 University Services Center
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