

# Colorado Water

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

## WATER ITEMS AND ISSUES . . .

October 1992

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### OCTOBER 1992 - Clean Water Month

President George Bush and the Congress have proclaimed October as Clean Water Month.

In 1972 Congress passed the Federal Water Pollution Control Act Amendments, also known as the Clean Water Act. But protecting water quality is not only a national priority, it is also a local responsibility that begins with each of us.

In the first decade after the Clean Water Act was passed, when the nation's population grew by 11 percent and water use by industry and recreation increased, significant progress was made. It is estimated that:

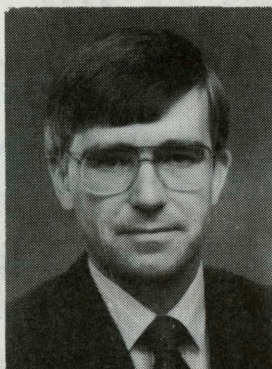
- ✓ 47,000 stream miles improved in quality. That's a distance of about twice around the world.
- ✓ 390,000 acres of lakes improved in quality.
- ✓ 142 million people received secondary or more advanced levels of sewage treatment - a 67 percent increase.

Congress revised and expanded the Clean Water Act in 1977, 1981, and 1987. *The current reauthorization of the Act proposes ecology integrity as a national water quality goal. Find out what this means for Colorado! Attend the 1992 South Platte Conference, DEFINING ECOLOGICAL AND SOCIOLOGICAL INTEGRITY FOR THE SOUTH PLATTE RIVER BASIN. See page 25.*

*Partial Source: 1992: The Year of Clean Water - America's Clean Water Foundation and the Virginia Water*

**Colorado  
State  
University**





## CHANGE!

*Editorial by  
Robert C. Ward*

Change! A very common word this election season. The Colorado Water Resources Research Institute (CWRRI) is changing also. This issue of *Colorado Water* introduces our new logo, which was developed over the past year in an attempt to update and standardize the different designs that have been used on reports, newsletters, conference announcements, and handouts produced through the efforts of CWRRI. In the future, as old supplies are exhausted, all CWRRI publications will utilize the new logo to help water users, water managers, and interested citizens readily recognize the source of the large amount of water information being coordinated and distributed by CWRRI.

The logo highlights the mountains and plains and the movement of water through our state. As this water moves, it mingles with nature and our society in many complex and competing ways. CWRRI's goal is to help water managers and the interested public in Colorado, through its newly "dressed" publications, to understand water's complexity and to provide a more informed basis for decision making about our most important natural resource, water.

The 1992 South Platte Conference, scheduled for October 27-28 in Fort Collins (see page 25) exemplifies this effort by CWRRI. As our ecological values evolve, there are ramifications to the way we manage our water resources. This conference will examine these possible ramifications prior to any formal actions that may be taken to mandate new ecological values within the current water management system. This early examination of an evolving concern for Colorado's water management system will help inform Coloradans before the time for decisionmaking arrives.

Change is never easy! Whether it is a logo or fundamental ecological values, we must confront change with knowledge and understanding of the reasons and ramifications. CWRRI, as Colorado's water resources research institute, is constantly examining the nature of change in our understanding of the science and technology of water management, and, increasingly, in the impact of value changes on water management. The issues and impacts of change can be threatening to some people and it is very important that such threats are understood and accommodated within the process of researching changes in water management. CWRRI strives to make sure that such accommodation is a part of all efforts to better understand changes in water management in Colorado.

## COLORADO WATER

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Robert C. Ward, Director

## CWRRI 1993/94 RESEARCH PRIORITIES

CWRRI's Research Planning Advisory Committee has indicated its collective ranking of research priorities for the 1993/94 research program. When CWRRI issues its Request for Preproposals in December of this year (next *Colorado Water* issue), the following priorities will, tentatively, be listed.

- Drought and runoff forecasting
- Water data collection and management
- Water transfer "costs" and alternatives
- Institutional arrangements for water management
- Conjunctive management of surface and groundwater
- Groundwater quality management
- Best management practices for irrigation
- Wetland management
- Defining "ecological integrity" of western streams
- Water rights administration
- Water education

These research topic areas are being presented now to remind university faculty of the upcoming CWRRI Request for



Preproposals and to give an indication of the priority areas for research. Also, early announcement will give faculty more time to formulate their ideas, establish contacts with Colorado water users and prepare their proposals. In addition, feedback from *Colorado Water* readers on the research priorities is sought. If you have any thoughts or comments on CWRRI's 1993/94 research priorities, please contact Robert Ward at (303) 491-6308.

CWRRI's research program is at the heart of its efforts to connect water expertise of the higher education to the water research needs of Colorado. The more that dialogue can be developed between faculty and water users/managers around CWRRI's research program, the better the program will achieve its goals. Hopefully, this early announcement of research priorities will encourage such dialogue.

In addition to the annual research program, CWRRI is currently working with the Powell Consortium (a consortia of the institutes in the seven Colorado River Basin states) to develop regional water research projects. If this concept is finalized, the first regional topic being proposed is to explore alternatives for water allocation in the western U.S. The goal would be to promote discussion of new conceptual approaches to better meet the growing competition for water.

#### RESEARCH OPPORTUNITIES

The Office of Health and Environmental Research (OHER) of the Office of Energy Research, U.S. Department of Energy, is inviting grant applications to support a new program for global climate change research within the Program for Ecosystem Research: Fundamental Research (PERF). An estimated \$2 million will be available for grant awards during FY1993, contingent upon availability of appropriated funds. Application deadline is January 4, 1993.

The Cooperative State Research Service (CSRS) of the U.S. Department of Agriculture invites applications for competitive grant awards in agricultural, forestry, and related environmental sciences under the National Competitive Research Initiative Grants Program (NRI) for FY1993. Contact your Contracts and Grants Office for information. Deadlines vary according to program area of research proposal.

Contact your Contracts and Grants Office for more information.

#### CWRRI AND CSU GRADUATE STUDENT TO ASSIST WATER CONSERVATION BOARD

Last year's Senate bill 87, the Colorado Water Conservation Board construction fund bill, called on the Board to consult with CWRRI about interbasin transfer of water (Section 11):

"SECTION 11. Out of basin water transfer issues scoping study authorization. (1) The Colorado water conservation board is hereby authorized to undertake a scoping analysis of the statewide consequences of the

transfer of water resources from the basin of origin for use in another basin. In undertaking the analysis the board shall consult with the Colorado water resources research institute and shall determine through public discussion the extent of interest in and support for a subsequent thorough investigation. The scoping process shall consider...the following:

- (a) The determination of the adequacy of current water law to protect the holders of water rights affected by a water transfer;
- (b) The consequences of establishing conditions on the right to sell and transfer water rights;
- (c) The sustainability of agriculture under conditions favoring transfers;
- (d) The economic consequences on the basin of origin when existing water resources provide important recreational and economic benefits in the basin of origin; and
- (e) The validity of distinguishing between consequences resulting from out of basin and intra basin transfers."

This consultation will take the form of a special scoping study conducted by a CWRRI student intern, Maureen Maxwell, working closely with the staff of CWCB in the Department of Natural Resources. Gene Jencsok is heading up the study for the CWCB staff.

Maureen, a graduate student in the Department of Agricultural and Resource Economics, will work under the auspices of the CWRRI and its director, Robert Ward. Her report will describe the basic issues and alternatives that need to be examined in out-of-basin transfer of water. Progress on the study will be presented at the Board's November 9-10 meeting.

Maureen, a native Coloradan, is conducting her thesis on interbasin water transfer issues that have evolved since the Federal Government has reduced its involvement in water projects. She spent approximately ten years working on congressional research efforts in Washington, D.C. before returning to Colorado State University for her graduate studies. *Colorado Water*, Oct. 1991, contains an article authored by Maureen on water transfers. Dr. R. K. Sampath, Department of Agricultural and Resource Economics, is her faculty adviser.

Under consideration by the Water Conservation Board is the possibility of a workshop in late December or early January at which the Board will present interbasin transfer of water issues and discuss them with any interested parties. Those interested in developing legislation on water transfers would be invited to speak. If you have suggestions for the scoping study or want to learn more about it, contact Ms. Maxwell at 303/841-3462 or Gene Jencsok at 303/866-3441.



## **WATER RESEARCH**

### **WATER INSTITUTES WORK WITH DOE TO HELP CLEAN UP WASTE SITES**

The August issue of *Colorado Water* reported that the network of state water institutes will work with the Department of Energy to find ways to clean up chemical and hazardous wastes at its sites throughout the nation. The water institutes of seven states designated as Integrated Demonstration Sites (IDS) by the DOE - Colorado, Idaho, Nevada, New Mexico, South Carolina and Washington - will participate in the program's initial three-year phase. All of the nation's water resources institutes will eventually participate in the program, targeted to complete restoration work by 2019. It will include components on education, assessment of technology effectiveness and technology transfer.

**Education**--A large supply of well-trained and educated environmental scientists and engineers will be needed to develop and implement new environmental restoration technology for DOE sites, but the current and projected pool is inadequate. The institutes will determine educational needs and develop and administer an education program to train scientists, engineers and technicians in environmental restoration/waste management. It will include both on-the-job training for regulatory staff and managers and an academic and training program for students. Another component will be an outreach program designed to increase public awareness and understanding of the problems encountered in environmental restoration and waste management.

**Regulatory Training** - This will involve tailoring university-based education and training programs to the needs of state environmental regulatory personnel. A pilot-scale training and education program will be designed and initially tested in New Mexico and Colorado (Year 2 of the project) including specialized workshops, seminars and conferences; televised classes; internships, and mobil classes for on-site studies. The New Mexico and Colorado Institutes will comprise the team for this component, with the New Mexico Institute having the lead responsibility. The other five institutes will feed information on regulatory processes and needs to the group leader.

**Scientific Education** - A program will be developed in coordination with technical project officers at DOE sites that will provide academic education and research training in environmental restoration work for both undergraduate and graduate students. The program will involve the assignment of student research assistants to integrated demonstration sites on a "pay back" period of service basis. The South Carolina Institute will take the lead on this element of the project, with input from the Washington Institute. Another possibility that will be examined is the desirability of creating major regional training centers.

**Outreach education** - The Institutes will develop an education outreach program to increase public awareness and understanding of the problems involved in environmental restoration/waste management. It will be directed at both adult and youth audiences, and coordinated with the needs of the particular integrated demonstration sites in each state. Citizen input will be sought. The Idaho and Washington Institutes, located only a few miles apart, will coordinate this element of the project.

**Assessment of Technology Effectiveness**--Cleanup efforts at DOE sites are hampered because some programs were implemented at full scale while others were carried through only at the demonstration or pilot scale. Also, data on the sites are incomplete or inconsistent--What were site conditions prior to the cleanup efforts?--What changes in conditions occur during site restoration processes?--What conditions prevail after cleanup activities have been completed? Other problems and concerns, although non-technical, are also important in DOE's restoration efforts:

- \* public perception of the technologies proposed for use
- \* regulatory concerns
- \* environmental/ecological impacts of technologies
- \* worker safety
- \* cost effectiveness

The Nevada Institute will take the lead on this element with the Colorado Institute assisting. The Nevada Institute, through its parent organization, the Desert Research Institute, has extensive experience in hydrogeology related to DOE site work. Colorado State University, with its water resources and hydrology programs, adds considerable strength to this effort.

**Technology Transfer**--The transfer of technologies from federal laboratories to the private sector has been successful, but another storehouse of information - the nation's colleges and universities - may also help DOE meet the environmental restoration goal at ID sites by 2019. The technologies developed at colleges and universities, particularly in the area of groundwater, need to be brought into the technology pool currently available for the environmental restoration program.

To meet this challenge the Ohio Water Resources Center and the Ohio Technology Transfer Organization (OSU/OTTO) together will be responsible for the information infusion/adoption process of this program, with the cooperation of the South Carolina and Idaho Institutes. OSU/OTTO will prepare a database identifying all the technologies known to be applicable to cleaning the environment. Researchers will then compare and analyze the various technologies to learn which are the most applicable in terms of safety, efficiency, effectiveness and economy.



**Administration**--The project will be administered through the National Institutes for Water Resources. The NIWR Executive Committee will serve as a Board of Directors to establish policy and provide project oversight.

Committee members are Dr. Henry Vaux, Chair (California Institute); Dr. Steve Gloss, Chair Elect (Wyoming Institute); Dr. Howard Peavy, Past Chair (Montana Institute); and Dr. Paul Godfrey, Secretary Treasurer (Massachusetts Institute). The committee has designated Dr. Howard Peavy of the Montana

Water Resources Center as project coordinator and DOE liaison for the three-year project.

The legislation that enabled this jointly sponsored project with the Department of Energy and the Water Resources Research Institutes was established by Congress in the 1991 reauthorization of the Water Resources Research Act.

Partial Source: *Water*, Spring 1992 (Ohio Water Center Newsletter)

## PROJECT INCORPORATES REMOTE SENSING AND GIS TO DETERMINE NITROGEN LEACHING TO GROUNDWATERS

by David G. Wagner, Research Associate

A new research project, funded by CWRRI, is designed to use remote sensing techniques and geographic information systems to model the nitrates leached into the aquifers of the Cache La Poudre and South Platte Rivers. The project supports the ongoing research efforts of the Great Plains Systems Research Unit (GPSR), Agricultural Research Service (ARS), USDA based at the Federal Center in downtown Fort Collins.

### Nitrates - What's the Problem?

Feedlots concentrated in the Greeley area generate large amounts of manure which must be disposed of, normally on farmland adjacent to the feedlots. The basin's municipal sewage treatment plants discharge treated sewage containing ammonia or nitrate nitrogen to the South Platte or its tributaries. Much of the nitrogen in the river water - which is diverted from the river and used for irrigation water - could be used by area farmers to supplement inorganic fertilizers and reduce the cost of crop production, but few farmers take advantage of this free fertilizer credit.

Platte River water is diverted and returned to the river about three times before exiting the State of Colorado. Each time the river water is diverted for irrigation, a percentage of the water passes through the soil and leaches soil salts, nitrates and pesticides. This excess, or leachate, returns to the aquifer, thence to the river - or directly to the river through surface return flows - higher in salinity than when diverted. A large area of the aquifer north and south of Greeley now exceeds the U.S. Environmental Protection Agency's recommended drinking water standard of 10 mg/l of nitrate nitrogen. Smaller areas of the aquifer have high levels of over 30 mg/l of nitrate nitrogen. Health-wise, the greatest risk is to pregnant women - the risk of methemoglobinemia in the infant. High nitrate nitrogen concentrations also contribute to eutrophication in lakes and streams; resulting in large increases in algae and lowered river dissolved-oxygen levels.

### Research Goal

The CWRRI-funded project, **Spatial Distribution of Nitrate-Leaching "Hot Spots" and Nitrate Contributions to the**



*Satellite image-based crop map of irrigated and dryland agricultural fields in the Poudre Basin*

**South Platte River Basin Aquifers**, will incorporate crop maps derived from Landsat 5 Thematic Mapper satellite imagery in a geographic information system to extend the ARS NLEAP (Nitrate Leaching and Economic Analysis Package) modeling effort. The objectives of this research will be to:

- 1) develop crop use maps from multitemporal Landsat TM images;
- 2) incorporate crop use, aquifer characteristics, soils, climate, and other geographic data layers within a geographic information system (GIS) to provide data inputs for nitrate leaching estimation via NLEAP; and



- 3) produce maps showing the spatial distribution of Nitrate Leached (NL) and Annual Leaching Risk Potential (ALRP) indices for specified areas within the South Platte River basin.

The Great Plains System Research Unit, Agricultural Research Service, USDA is currently studying the nitrogen leaching potential in a 736 km<sup>2</sup> area overlying the Cache La Poudre and South Platte Rivers on a stretch of the river from Brighton to several miles downstream of the junction of the Cache La Poudre with the South Platte. Water samples from 365 wells were used to generate an estimate of nitrate nitrogen concentration in the groundwater. "Hot spots" showed up with high (greater than 30 mg/l) nitrates.

The NLEAP model is used to model nitrate nitrogen leached from agricultural activities and the resulting nitrate concentration increase in the aquifer waters. A leaching index is computed and estimates of nitrate nitrogen available for leaching (NAL) and annual leaching risk potential (ALRP) are computed. The model uses monthly and event-by-event approaches through the year to compute water and nitrogen budgets for specific fields. Inputs include types of fertilizer applied, soil types, amount of irrigation water, depth to aquifer and weather characteristics to compute the amount of nitrogen leached from the root zone. Present model runs assume corn as the crop, with no crop rotation, and average weather conditions for a growing season for each specific soil type encountered in the study area.

The incorporation of detailed soil survey geographic databases (SSURGO), aquifer characteristics (i.e. depth and transmissivity), and crop use layers into a GIS will allow the identification of the existing combinations of crops, soils, and aquifer characteristics for NLEAP model runs. The crop use layer will be produced from classification of multitemporal 1991 Landsat TM data. The study area will consist of the irrigated agricultural lands within the 1:24,000 USGS 7.5 minute quads

of Gowanda, Milliken, Greeley, and Eaton. The GIS-created maps of Nitrate Leached (NL) and Annual Leaching Risk Potential (ALRP indices) will subsequently be produced in addition to the digital data base for use by other ongoing projects.

**Study Benefits:** The establishment of Nitrogen Leached (NL) and Annual Leaching Risk Potential (ALRP) indices as GIS data layers for agricultural lands would allow nitrate leaching "hot spot" identification and more accurate management of the aquifer water quality in the South Platte River basin. By making farmers and extension agents aware of nitrate leaching "hot spots" on agricultural land, best management practices (BMP) could be proposed to reduce nitrate leaching.

In addition, information will be provided for hydraulic and hydrologic data bases now being developed by water researchers in two other CWRRI projects: **Cooperative Regional Water Management Through a Federated-Distributed Database and Integration of Water Quantity and Quality in River Basin Network Flow Modeling.**

Results from this project are directly applicable to the Sustainable Agriculture Project coordinated by the Central Colorado Water Conservancy District.

Principal Investigator: Dr. Roger Hoffer, Remote Sensing Program, Forest Sciences Department, College of Natural Resources

Research Associate: David G. Wagner, Department of Agricultural and Chemical Engineering

Cooperating Agency: Northern Colorado Water Conservancy District - for NLEAP model validation data from the NCWCD Irrigation Management Service program.

#### FOUR COLORADO BASIN INSTITUTES ANNOUNCE RESEARCH PROGRAMS

Wyoming, Utah, New Mexico and California have selected projects for the 1992-93 fiscal year. Project titles are listed below.

##### WYOMING

The Wyoming Water Center has announced the following projects for the 1992-93 fiscal year.

**A study of in-situ immobilization of heavy metals associated with uranium leach mining**

**A comparison of depth-to-ground-water suitability curves for important riparian plant species in the sub-alpine and montane zones**

**The development and enhancement of a comprehensive statewide water quality database for Wyoming**

**A study of microbial transformations of herbicides known to contaminate groundwater in Wyoming**

**A long-term investigation of conveyance losses in Wyoming streams and rivers**

**Monitoring of the pesticides dicamba and picloram in the soil vadose (unsaturated) zone for groundwater quality protection in Wyoming**

**An assessment of the whole effluent toxicity testing method as a means of regulating waters produced by the oil and gas industry in Wyoming**



Modeling economic impacts and institutional water management alternatives for severe drought and water shortages in the upper Green River Basin

A study of the flushing flow requirements of large rivers to maintain fishery, channel and riparian values

Modeling of surface waters for the Green River Basin of Wyoming using future severe drought considerations

User education and the transfer of technology for water use efficiency and conservation in Wyoming

Severe drought and water shortages in the Upper Green River Basin: modeling economic impacts and institutional alternatives for water management

Assessment of the potential environmental fate and effects of oil-field discharge waters containing radium

#### CALIFORNIA

The California Center has selected the following new projects for 1992-93 in addition to projects that will continue.

Land Surface Fluxes for Agricultural Water Resources

Selection of Native Wetland Plants for Water Treatment of Urban Runoff

#### UTAH

The Utah Water Center has selected four new research projects for its 1992-93 cooperative program:

Studies on the Beneficial Effects of Vegetation in Contaminated Soils

The Decision Support System for Optimal Remediation of Hydrocarbon Contaminated Aquifers

Geochemical Reactions Important for Characterization and Treatment of PCP Contaminated Aquifers

Analysis of Sediment-Storage Change on the Green River and Relation to Operations of Flaming Gorge Dam

#### NEW MEXICO

Seven research projects will be funded for the September 1992-August 1993 fiscal year.

Three-Dimensional Aquifer Parameter Estimation with Laplace Domain Solution (3rd year)

A Hydrothermal Study of Vertical Groundwater Flow Along a Profile Crossing the Rio Grande at the Canutillo Well Field

An Expanded Suite of Tracers for Hydrological Investigations

Wetting Front Instability in the Vadose Zone of New Mexico's Soils

Sewage Sludge Application in Semiarid Grasslands: Effects on Soils, Vegetation and Water Quality

Biodegradation of Trihalomethanes (THMs) and Halogenated Aliphatic Compounds by Groundwater Bacteria

Quantitative Analysis of the Influence of Carbon Amendment on Bioremediation of Cyanide Contaminated Groundwater and Soil

### 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.

Education Development Center - Video Technical Assistance, Marvin E. Jensen, Colorado Inst. Irrigation Management, CSU

Potential Effects of Global Change on Vegetation in the Colorado Rockies, Daniel E. Binkley, Fishery and Wildlife Biology, CSU

Climate Change in the Colorado Rocky Mountains: Bounding Projected Changes, Roger A. Pielke and Timothy G.F. Kittel,

Atmospheric Science, CSU

Test Application of Norm Focus Theory in Wilderness Recreation Management, Michael J. Manfredo, Rec. Resources and Landscape Architecture, CSU

Definition and Delineation of Ecoregions of the Northern Circumpolar Countries, Roger M. Hoffer, Forest Sciences, CSU

Update Outlet Scour, Steven R. Abt, Civil Engineering, CSU

Chinese Pier Scour Equations, Carl F. Nordin, Civil Engineering, CSU

Wildlife Economic Analysis and Research Under the Endangered Species Act, John R. McKean, Richard G. Walsh, and John Kun, Cooperative Fish and Wildlife Research, CSU



- Moisture Movement and Heave Beneath Simulated Foundation Slabs on Expansive Soil**, John D. Nelson, Civil Engineering, CSU
- The Economics of Natural Hazards: An Assessment of Research Needs & Opportunities**, Harold C. Cochrane, Economics, CSU
- Annotated Bibliography on Values & Functions of Artificially Created Wetlands**, Eugene Decker, Fishery & Wildlife Biology, CSU
- Convective Cloud Systems in Climate Models**, David A. Randall, Atmospheric Science, CSU
- Regional Atmospheric Simulations for the Niwot Ridge LTER**, Roger A. Pielke, Atmospheric Science, CSU
- Salinity Assessment of Rangeland Using Rainfall Simulation**, Harold Goetz and Milton J. JR. Trlica, Range Science, CSU
- Reducing Nitrate Leaching through In-Season Soil Nitrate & Leaf Chlorophyll Testing**, Parviz Soltanpour, Dwayne G. Westfall and Reagan M. Waskom, Agronomy, CSU
- Modeling of the Vadose Zone in Soil of the Rocky Flats Plant**, Tissa Illangasekare, Civil, Environmental and Architectural Engineering, U
- Polar Mesospheric Clouds and Their Atmospheric Environment**, Gary Thomas, Laboratory for Atmospheric and Space Physics, Astrophysical, Planetary and Atmospheric Sciences, CU
- Late Quaternary Environments and Climate Change in the Eastern Canadian Arctic, Constructed From Sediment Cores**, Kerstin Williams and John Andrews, Institute of Arctic and Alpine Research, Geological Sciences, CU
- Improvement and Validation of Glacier Dynamics Models: A Collaborative Study**, Tad Pfeffer and Mark Meier, Institute of Arctic and Alpine Research, Geological Sciences, CU
- Alomar: A Cedar Temperature, Wind and Momentum Flux Lidar For Global Change and Dynamics Studies in the Arctic**, David Fritts, Electrical and Computer Engineering, CU
- A Remote Sensing Based Investigation Into The Importance of the Thermocline Doming to Open Ocean Upwelling in the Eastern Tropical Atlantic Ocean**, William Hay, Cooperative Institute for Research in Environmental Sciences, Geological Sciences, CU
- Model-Based Group Decision Support: The Impact of Shared Simulation Models and Tailorable Information Viewing on Group Decision Making Outcomes and Processes**, Rene Reitsma and Ilze Zigurs, CE&A-Advanced Decision Support for Water & Environ Systems, Computer Science, Business & Administration, CU
- Environmental Stress and Isoprene Emissions in Forest Trees**, R. Ray Fall and Russell Monson, Chemistry and Biochemistry, Environmental, Population and Organismic Biology, CU
- Biotic and Abiotic Controls of N<sub>2</sub>O Fluxes From Alpine Ecosystems**, Steven Schmidt, William D. Bowman and Lesley Smith, Environmental, Population and Organismic Biology, Institute of Arctic and Alpine Research, CU
- Design Reliability for Estimating Costs of Pile Foundations Phase 3: Computer Code Implementation and Generalization**, Dan Frangopol and George Goble, Civil, Environmental and Architectural Engineering, CU

## **WATER SUPPLY**

**From the Office of the State Engineer, September 1992--**  
Stream flows remain below normal in most areas except the South Platte basin and the southwest corner of the state. Generally good reservoir storage and summer precipitation events kept irrigators from experiencing even dryer conditions which were feared due to last Spring's very low snowpack.

Statewide reservoir storage was 106 percent of average on September 1. The Dolores and Animas River basins have the highest storage rate at 126 percent of average while the Arkansas basin has the lowest storage rate at 91 percent of average.

The National Weather Service 30-day forecast (September 1) is for above normal temperatures and below normal precipitation over the entire state. The 90-day forecast (September 1) is for below normal temperatures and above normal precipitation.

The Surface Water Supply Index (SWSI) developed by this office and the USDA Soil Conservation Service is used as an indicator of water supply conditions in the major river basins of the state. It is based on streamflow, reservoir storage, and precipitation for the summer period (May through October). During the summer period streamflow is the primary component in all basins except the South Platte basin where reservoir

storage is given the most weight. The following SWSI values were computed for each of the seven basins on September 1, 1992 and reflect conditions during the month of August.

### **SURFACE WATER SUPPLY INDEX**

| Basin                | July 1, 1992<br>SWSI Value | Change From<br>Previous Mo. | Change From<br>Previous Yr. |          |    |    |    |    |
|----------------------|----------------------------|-----------------------------|-----------------------------|----------|----|----|----|----|
| South Platte         | +2.7                       | +1.3                        | -0.3                        |          |    |    |    |    |
| Arkansas             | +1.4                       | +1.3                        | +1.6                        |          |    |    |    |    |
| Rio Grande           | +0.1                       | +0.8                        | +0.2                        |          |    |    |    |    |
| Gunnison             | -0.8                       | -0.2                        | -0.9                        |          |    |    |    |    |
| Colorado             | -0.4                       | +1.6                        | -0.1                        |          |    |    |    |    |
| Yampa/White          | -2.6                       | -1.3                        | -2.7                        |          |    |    |    |    |
| San Juan/<br>Dolores | +1.2                       | +0.9                        | +1.8                        |          |    |    |    |    |
| SCALE                |                            |                             |                             |          |    |    |    |    |
| -4                   | -3                         | -2                          | -1                          | 0        | +1 | +2 | +3 | +4 |
| Severe               | Moderate                   | Near Normal                 | Above Normal                | Abundant |    |    |    |    |
| Drought              | Drought                    | Supply                      | Supply                      | Supply   |    |    |    |    |



## FEATURES

### CAST TASK FORCE LOOKS AT SUSTAINABILITY OF US AGRICULTURE

A review of "Preparing U.S. Agriculture for Global Climate Change,"  
Task Force Report No. 119, Council for Agricultural Science and Technology,  
June 1992

by Jennifer Roberts

Agriculture, more sensitive to climate than any other sector of the U.S. economy, stands a chance of being seriously altered with the likelihood of a global warming of several degrees within the next century. As a response, the Assistant Secretary of Agriculture for Science and Education asked the Council for Agricultural Science and Technology (CAST) to answer the Big Question:

*For a warmer planet with more people, more trade, and more CO<sub>2</sub> in the air, can U.S. farming and forestry prepare within a few decades to sustain more production while emitting less and stashing away more greenhouse gases?*

While the report prepared by a CAST Task Force approaches this question from many directions, initially two prospective scenarios for the future of U.S. agriculture are suggested - a "baseline" scenario and a "surprise" scenario.

#### **BASELINE SCENARIO**

An extension of present trends, the baseline scenario addresses concerns about the extent to which agriculture's natural and human resources will permit it to compete in the rising global market. Factors affecting this ability include changing demand, cropland magnitude, resource availability and improved technology.

In the last several decades, export demand for agricultural products has risen faster than domestic demand. This shift reflects changing U.S. demographics and per capita incomes, where domestic population growth has slowed and percentage of income spent on food has decreased. However, the rest of the world is experiencing rapid population growth and per capita income growth, particularly within the less developed countries (LDCs). Over the next 4 decades the anticipated U.S. population increase is 20 to 25 percent, while the population increase in the rest of the world is estimated at 80 percent.

In 1987, over 50 million acres of land in forests, grassland pasture and range had high-to-medium potential for conversion to crop production under late 1980s economic conditions. Projections by the USDA (1990) of land used for agriculture in 2030 suggest, however, that the potentially available cropland will not be needed over that period. USDA projections show a

30 percent decline in cropland from 1990 to 2030 even though the production of grains and soybeans would increase about 50 percent. This is possible because in the USDA scenario demand for crops rises more slowly than crop yields, which technology raises. The USDA projects continuing decline in irrigated areas such that by 2030 little more than 12 million hectares would be irrigated, a 40 percent decline from the 1980s. Advances in technology, however, could double yields of feedgrains, wheat and soybeans from the 1980s to 2030 and increase animal productivity 60 to 70 percent.

The baseline scenario suggests that land, water, and other resources available to American farmers over the next 40 years and without climate change will be sufficient for them to respond at acceptable social costs to the increases in domestic and foreign demand. However, increasing water scarcity in the West clearly could become an even tighter constraint on agricultural production over the next four decades.

#### **SURPRISE SCENARIO**

The Surprise Scenario involves events that have a low probability of occurrence but a high potential for creating a significantly different future for U.S. agriculture than that depicted in the baseline scenario.

Long-term population growth projections for LDCs are uncertain. Anything between the range of 6.3 billion to 7.9 billion (United Nation's 1989 projections) is consistent with the baseline scenario, so the surprise scenario would be anything outside of this range. The CAST Task Force felt that a slower growth rate is more likely than a higher one for two reasons. First, within LDCs there are changing attitudes toward optimum family size, advances in birth control technologies, and increased investment in family planning. The second reason is a result of the deadly spread of the acquired immune deficiency syndrome (AIDS) virus. If the lower growth rate in the surprise scenario does prevail, it would cause a significantly less buoyant global market for U.S. export of food and fiber compared to the baseline scenario.

Another deviation from the baseline scenario that would impact U.S. agriculture involves agricultural production in other countries. The baseline scenario projects slower growth of grain production in LDCs due to increasing natural resource and environmental constraints and greater difficulty in developing



new technology. If however, LDCs can overcome these obstacles, as a group they would be essentially self-sufficient, drastically depressing the demand for U.S. agricultural output. Secondly, the reform of agriculture in Eastern Europe and the former USSR could have a similar effect. These areas could possibly emerge as net exporters, directly competing with U.S. farmers in world markets.

Baseline scenario projections are based on an increased demand for grains as the U.S. population grows. Current trends show a declining consumption of red meat and an increase in poultry consumption. Cattle and hogs consume more grain per pound of meat produced than poultry, so continuation of these trends would in time tend to depress the demand for grain.

If the demand for alternative energy sources increases it could affect the demand for certain agricultural products. Gasohol is a mixture of ethanol from corn and gasoline that results in less carbon monoxide and hydrocarbon emissions. If a national policy were developed to take advantage of the environmental

advantages of gasohol over gasoline, it would stimulate demand for grain production.

According to the baseline scenario, natural resource and environmental constraints will not greatly impact agricultural production in the next 40 years. However, with increasing concern about the environment, farm management policies could be constrained to the degree where the nation's supply response to rising domestic and foreign demand is limited.

The baseline scenario suggests that from now until 2030, assuming no climate change, that land, water, and other resources will be sufficient to meet domestic demand at acceptable economic and environmental costs. Among the surprises that might confound this scenario, the CAST Task Force believes two are most plausible. Production in other countries could exceed expectations causing a reduced demand for U.S. agricultural products; and slower technological advances and stronger resource and environmental restrictions could hinder the U.S. ability to supply agricultural products.

### LESSONS FROM EXPERIENCE

Task Force members examined the most serious deviations from normal weather in the last century to determine whether farmers only endured extended periods of extreme weather or if they sometimes adapted and prospered. The persistent, dry years of the Dust Bowl represent the most serious deviation from normal weather in the last century, but the drought of the late 1980s was similar in severity and geographical expanse. The Great Plains provide evidence of the adaptability of agriculture to stressful climate. Notwithstanding four droughts and their impacts, wheat growers more than doubled yields. Yields dipped during the droughts, but the upward trend was renewed after each. The tools of adaption included improved varieties, irrigation, and improved soil moisture.

Tools for adapting crop breeding and irrigation are important for fitting farming to a changed climate. Plant breeding will have an integral role, if the climate becomes drier, to raise yields. Plant breeders are also valuable in the battle against insect invasions. Farmers also change the crops and varieties they plant to effectively meet the changing water supply. Examples exist where the introduction of new hybrids more tolerant to heat and drought took less than five years.

Regardless of crop species or variety, water is still the main natural resource and lever by which climate raises and lowers plant growth and farming. Irrigation is the obvious adaptation for coping, but it consumes large amounts of water and pumping groundwater can be expensive. As an example, the area of irrigated land in the West is decreasing, particularly in the Great Plains, largely due to the depletion of the Ogallala aquifer. Transfers of water rights to growing cities and industries in the West is also reducing irrigated land. Water banking is a market-like mechanism that permits water users who have water rights and who may own storage space in reservoirs to rent water that they do not need during a season to others who need the water.

Such seasonal exchanges do not affect established water rights, but enhance the annual distribution of water to cope with local drought, changes in cropping patterns and urban needs.

Water use efficiency (WUE) is a measure of the productivity of water use in agriculture. Evapotranspiration (ET) is the evaporation of water from both foliage and soil. When water supplies are scarce or expensive, optimal use of water consumed to produce a salable crop rather than maximum yield may be the goal. The highest WUE occurs at the highest yield and usually at the highest ET. Increasing storage of water in the soil and increasing the portion of water that is transpired by the crop or that is evaporated from the soil improves WUE. Therefore, minimizing runoff by shaping the land, reducing evaporation from soil by maintaining crop residues on the soil surface, optimizing planting dates, and controlling weed growth all contribute to higher WUEs.

Beyond the physical and biological tools that have adapted farming and forestry to climate, economic tools have also proven useful facilitators of change. Through a long history of innovation and adaptation, U.S. and world agriculture have developed three main economic tools for tempering over both space and time the shocks of shortage or surplus caused by changes in weather. The three tools include the world food market, grain reserves and crop insurance.

The next issue of *Colorado Water* will continue the CAST report summary.

Marvin E. Jensen, Director of the Colorado Institute for Irrigation Management (CIIM), Colorado State University, participated in the CAST Task Force that prepared this report.



## TELLURIDE INSTITUTE SEEKS HOLISTIC APPROACH TOWARD ENVIRONMENT

by Mary DeMartini

Colorado's Telluride Institute began in 1985 to strive toward a sustainable future under the leadership of its President, Pamela Zoline, and the combined efforts of the Institute's officers, board of trustees and staff.

The Institute, a non-profit education, research and arts foundation, is located in the San Juan range of the Rockies at the top of the San Miguel watershed. It has developed with the goal of building "secure human communities on the global, regional and local levels by supporting robust cultures, healthy environments, sound economics and powerful arts." This is an integrated initiative to protect the unique area and, in the words of Wallace Stegner (well-known Western author and Pulitzer Prize winner), "to build a society to match the scenery."

This year, the Institute focuses on critical issues in its own water basin with its publication, "The Citizen's Guide to the Upper San Miguel River." This is a first attempt at assembling the "big picture," in which the basin is viewed as an interdependent system of the mainstem, its tributaries, and its secondary basins. Concerns in the basin that need to be considered are: water quality and quantity; development plans; health of streams, riparian zones and wetlands; needs of fish and wildlife; recreation; local economic and cultural health; and water conservation initiatives.

During July of 1992, the Telluride Institute sponsored an Ideas Festival where issues related to how the regional community can act to protect and preserve the health of the San Miguel River were discussed and debated. These efforts represent a model for thinking globally, acting locally, and for proactive decision-making which relies on the principle of "fresh understanding with which to make fresh and responsible policy."



*Colorado's Telluride Institute lies atop  
the Colorado River Watershed*

The Institute's efforts in the community can serve as an example that will influence the surrounding area and perhaps eventually have a global influence in promoting the protection and wise use of water resources.

### CWRRI TO SURVEY WATER-RELATED ORGANIZATIONS

by Mary DeMartini

To further enhance technology transfer of water-related information, CWRRI is developing a survey that will be sent to Colorado organizations with water-related functions. The Colorado Water Congress has an extensive directory with the addresses of such organizations. CWRRI's intent is to supplement this valuable data with information about organizational involvement in water conferences and water publications, particularly newsletters.

CWRRI's goal is to inform readers about the water organizations in Colorado. Each issue of *Colorado Water* will feature an article about a Colorado water organization.

If you have comments or questions, please contact Mary DeMartini at CWRRI 303/491-6308.

The Telluride Institute is continuing research in the areas of sustainable mountain agriculture and whole river-basin ecology and culture. Also, it coordinates programs in education and research with the Telluride Public Schools and Community. One of these programs is the River Watch, which involves school children and other members of the community in monitoring water quality on the San Miguel River, initiating wetland studies, checking for acid rain damage, and exploring the basin's cultural and social associations.

The questions that the Telluride Institute seeks to answer are applicable everywhere; for example: "How are humans influencing the natural system; and based on a better understanding, how can the regional community act to maximize the health of the system?" Discovering the answers to such complex questions requires a holistic approach. The Telluride Institute believes that a holistic approach that integrates community involvement and education is necessary in order to achieve the most harmonious relationship possible between development and the environment, and to preserve this balance for a sustainable future.



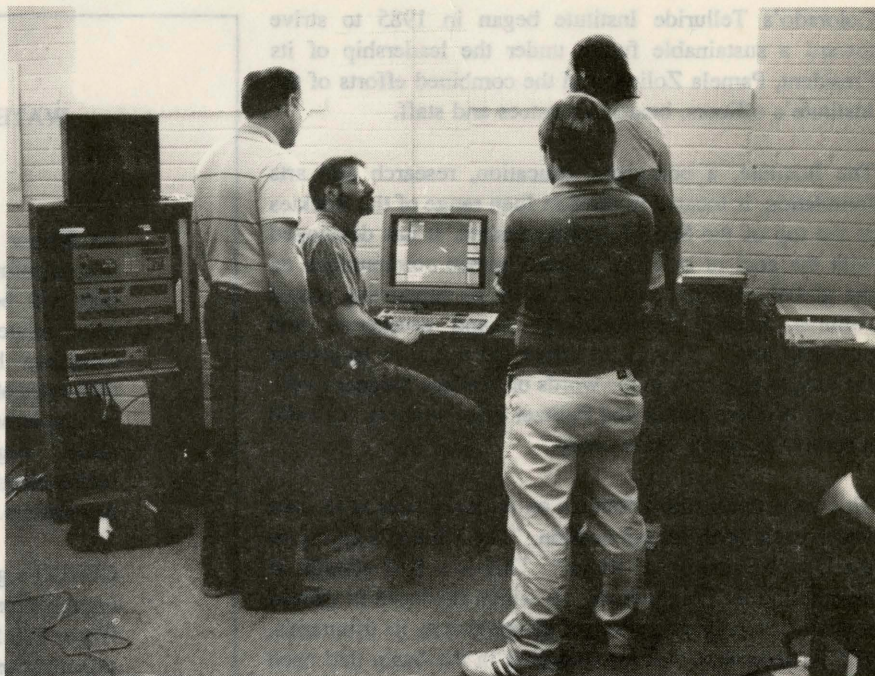
## UNIVERSITY WATER NEWS

### REALIZE YOUR VISION AT COLORADO STATE'S COMPUTER VISUALIZATION LAB

by John Cooley, Manager  
ACNS Advanced Technical Computing  
and  
Nancy Wilson, VECTOR Editor

Did you ever wonder how researchers "see" the results of the calculations that they run on computers? Often, the results of these calculations can be observed more readily in graphical form than in numerical form. Color charts, graphs, still pictures, moving pictures, video tape and audio signals help the researcher see phenomena that are not easily detectable by looking at numerical results.

The Computer Visualization Laboratory (CVL) at Colorado State University provides a variety of tools for generating images and animations from numeric data. Users can also generate images from their imagination, or combine data-driven images with those that are purely artistic.



Roland Schweitzer (second from left), one of the consultants in the Computer Visualization Laboratory (CVL), demonstrates visualization techniques. (Photo courtesy of John Cooley)



Students demonstrate solution to a heat flow problem. The Sun Sparcstation they are using is just one of many advanced graphics workstations in the Lab. (Photo courtesy of John Cooley)

At one end of the scale, users can quickly produce X-Y plots or isometric surface plots for a PostScript printer. At the other end, they may spend weeks or months developing a video production which includes multiple animation sequences, artwork, titles and narration.

Software includes the NCSA Scientific Visualization Suite, the Wavefront Visualizer Series, apE 2.1, NCAR Graphics and Precision Visual's PV-Wave. This powerful combination of commercial and public domain software gives users access to some remarkable imaging and animation capabilities.

Computing hardware includes a Sun SPARCstation, a Sun SPARCserver, two Silicon Graphics Personal Irises, an 80386 PC clone and several color Macintoshes. A Commodore Amiga provides additional video capabilities.

Video equipment is available in the lab, and users can produce desktop presentations with titles and narration on VHS and S-VHS videotape. For broadcast-quality video, the CVL can supply raw RGB component video on a Sony videodisk to



RGB component video on a Sony videodisk to Instructional Services or other post-production facility for inclusion in a professional production. Users can generate color slides through an agreement with the National Center for Atmospheric Research. Shell scripts written by CVL staff members make slide creation straightforward, and the slides are returned in one week.

The CVL is funded and supported by ACNS, and on-campus space is provided by the College of Natural Sciences. The lab is open to all students, faculty and staff. The service is free, except for the cost of materials.

#### DISSERTATION BY CIVIL ENGINEERING GRAD RECEIVES HONORABLE MENTION IN UCOWR COMPETITION

Dr. Ghassan AlQaser's dissertation, "Progressive Failure of an Overtopped Embankment," received Honorable Mention in the annual dissertation competition sponsored by the Universities Council on Water Resources. Dr. James F. Ruff, Professor of Civil Engineering, nominated Dr. AlQaser for the award. He said the model Dr. AlQaser developed, which describes a difficult-to-model physical failure sequence, "...is new and original work in this area. Dr. AlQaser's research is at the forefront of a new challenge in predicting and evaluating future dam safety," said Ruff.

We reported in the August issue of *Colorado Water* that James Booker's dissertation on the Colorado River received the Outstanding Water Resources Dissertation award. At that time we had not received notification that Dr. AlQaser's dissertation had received Honorable Mention. Dr. AlQaser, a native of Iraq, received his Ph.D from the Civil Engineering Department, Colorado State University, in the Fall of 1991.

#### FROM COOPERATIVE EXTENSION

Cornell Cooperative Extension has produced a series of fact sheets on water treatment. These fact sheets are entitled Terminology for On-Site Sewage Treatment Systems, Guidelines for Purchasing Water Treatment Equipment, Lead in Drinking Water, Activated Carbon Treatment of Drinking Water, Reverse Osmosis Treatment of Drinking Water, Chlorination of Drinking Water, Iron and Manganese in Household Water, Hydrogen Sulfide in Household Water and Private Household Water Supplies. Order from: Cornell University Resource Center, 7 BTP, Ithaca, NY 14850. Price \$1 each.

The Colorado Center for Environmental Management seeks nominations for outstanding achievements in Colorado environmental management. The Center is initiating an awards program to recognize excellence in the area of waste minimization, research and development. Open to any individual; nonprofit or professional organization; or local government in Colorado. To receive a nomination request form, contact Margaret Atencio, CCEM, Denver West Center, 1536 Cole Blvd., Bldg. 4, Suite 180, Golden, CO 80401. Phone: 303/237-7013. Deadline: December 1, 1992.

#### COLORADO STATE CHEMISTRY DEPARTMENT RANKS 12TH WORLDWIDE

CSU's Department of Chemistry is the 12th most influential in the world in terms of chemistry research, according to a recent report from *Science Watch*. *Science Watch*, a publication that tracks trends and performance in basic research, conducted a study of articles, reviews, and technical notes published from 1984 to 1990 in chemistry journals. The study evaluated the impact a department's faculty and research associates are having on chemistry by the number of times their published articles are cited in other papers. Colorado State's Chemistry Department ranked ahead of those of such institutions as UC Berkeley, Irvine, and Riverside; Cornell University; Rice University; and Tel Aviv University.

The Chemistry Department was named a Colorado Commission of Higher Education Center of Excellence two years ago and last year was selected as one of the University's "Programs of Research and Scholarly Excellence."

Source: *Ram Page*, Oct. 1992

#### CSU/USDA DEDICATE NSSL EXPANSION

On August 18, university administrators and officials from the U.S. Department of Agriculture dedicated the expansion to the National Seed Storage Laboratory. The lab is the nation's only long-term seed-storage facility. The three-story, 65,000 square-foot addition quadruples the capacity of the facility's deep-freeze seed vaults and provides additional office and research space. The seed lab is known as the Fort Knox of the world's food supply because it is home to 256,000 seed and plant samples from every part of the globe - samples that have been used to develop new food, fiber and industrial products. The lab preserves and makes available to plant scientists the genetic diversity of plants from every continent on Earth.

The original lab opened in 1958. It is funded by the USDA and the Agriculture Research Service, with land donated by Colorado State.

#### FACULTY NEWS

Stephen Flickinger, Professor of Fishery and Wildlife Biology, CSU, has received the Award of Excellence from the Colorado-Wyoming chapter of the American Fisheries Society. Flickinger was recognized for 22 years of research and teaching.

Stephen Mumme, Political Science Professor at CSU, is spending one year at the Center of U.S.-Mexico Studies, University of California - San Diego, on a visiting research fellowship.

Gary McIntire, Chairman of Plant Pathology and Weed Science at CSU, has been reappointed to a three-year term on the board of directors for the Council for Agricultural Science and Technology.



# COLORADO SCHOOL OF MINES

## WATER COURSES AT THE JUNIOR/SENIOR/GRADUATE LEVEL

1992/93

The following courses are offered through Colorado School of Mines' Institute for Ground-Water Research and Education Programs.

| Course No. | Title                                       |
|------------|---|
| CRGN 507   | Applied Mathematics In Chemical Engineering |
| CRGN 508   | Advanced Fluid Mechanics                    |
| CRGN 516   | Transport Phenomena                         |

### Chemical Engineering and Petroleum Refining

|          |   |
|----------|---|
| CRGN 507 | Applied Mathematics In Chemical Engineering |
| CRGN 508 | Advanced Fluid Mechanics                    |
| CRGN 516 | Transport Phenomena                         |

### Chemistry and Geochemistry

|          |  |
|----------|--|
| CHGC 530 | Sedimentary and Environmental Geochemistry             |
| CHGC 540 | Aqueous Geochemistry                                   |
| CHGC 541 | Hydrochemical Systems                                  |
| CHGC 681 | Special Topics in Aqueous and Sedimentary Geochemistry |

### Engineering

|          |                        |
|----------|------------------------|
| EGBN 351 | Fluid Mechanics        |
| EGBN 451 | Hydraulic Problems     |
| EGBN 461 | Soil Mechanics         |
| EGBN 553 | Engineering Hydrology  |
| EGBN 554 | Open Channel Hydrology |

### Environmental Sciences and Engineering

|          |                                |
|----------|--------------------------------|
| ESGN 401 | Fundamentals of Ecology        |
| ESGN 460 | Water Quality                  |
| ESGN 490 | Environmental Law              |
| ESGN 503 | Geocology and Geobotany        |
| ESGN 530 | Reclamation of Disturbed Lands |

### Geology and Geological Engineering

|          |  |
|----------|--|
| GEOL 305 | Introduction to Sedimentary Rocks                                |
| GEOL 309 | Structural Geology   |
| GEOL 314 | Stratigraphy   |
| GEGN 315 | Sedimentology and Stratigraphy                                   |
| GEGN 442 | Geomorphology  |
| GEGN 467 | Hydrogeology   |
| GEGN 468 | Fundamentals of Engineering Geology                              |
| GEGN 470 | Hydrogeology Project Design (water well construction and design) |
| GEGN 481 | Advanced Hydrogeology  |
| GEGN 483 | Mathematical Modeling of Ground-Water Systems                    |
| GEOL 545 | Introduction to Remote Sensing                                   |
| GEGN 570 | Case Histories in Geological Engineering and Hydrogeology        |
| GEGN 575 | Applications of Geographic Information Systems                   |
| GEGN 576 | Engineering Geology and Hydrogeology of North America            |
| GEGN 581 | Advanced Hydrogeology  |
| GEGN 583 | Mathematical Modeling of Ground-Water Systems                    |



|          |  |
|----------|--|
| GEGN 585 | Hydrochemical Evolution and Modeling of Ground-Water Systems         |
| GEGN 669 | Advanced Topics in Hydrogeology Seminar                              |
| GEGN 674 | Waste Facility Design and Remediation                                |
| GEGN 675 | Advanced Topics in Geographic Information Systems                    |
| GEGN 683 | Advanced Ground-Water Modeling                                       |
| GEGN 685 | Developing Conceptual and Numerical Ground-Water Models-Steady-State |
| GEGN 686 | Conceptual and Numerical Ground-Water Models-Transient               |

#### Geophysics

|          |                         |
|----------|-------------------------|
| GPGN 473 | Engineering Geophysics  |
| GPGN 574 | Ground-Water Geophysics |

#### Humanities and Social Sciences

|        |                                  |
|--------|----------------------------------|
| HS 403 | Issues in Environmental Politics |
| HS 4XX | Ground-Water Policy              |

#### Mathematical and Computer Sciences

|          |                    |
|----------|--------------------|
| MAGN 408 | Numerical Analysis |
| MAGN 550 | Numerical Analysis |

#### Mineral Economics

|          |                         |
|----------|-------------------------|
| MEGN 570 | Environmental Economics |
|----------|-------------------------|

#### Petroleum Engineering

|          |                                      |
|----------|--------------------------------------|
| PEGN 308 | Rock Properties                      |
| PEGN 310 | Fluid Properties                     |
| PEGN 311 | Drilling and Development             |
| PEGN 312 | Drilling and Production Lab          |
| PEGN 414 | Well Completion, Testing, and Design |
| PEGN 419 | Subsurface Engineering               |
| PEGN 423 | Petroleum Reservoir Engineering I    |
| PEGN 424 | Petroleum Reservoir Engineering II   |
| PEGN 513 | Reservoir Simulation                 |
| PEGN 606 | Advanced Reservoir Engineering       |
| PEGN 607 | Partial Water Drive Reservoirs       |
| PEGN 608 | Fluid Displacement in Porous Media   |
| PEGN 614 | Reservoir Simulation II              |

### **EDITOR'S IN-BASKET**

#### **CAWCD/MWD PLAN DEMONSTRATION PROJECT ON INTERSTATE UNDERGROUND STORAGE OF UNUSED COLORADO RIVER WATER**

*The following is an overview paper for the Central Arizona Water Conservation District (CAWCD)/Metropolitan Water District (MWD) of Southern California demonstration project for the interstate underground storage of unused Colorado River water. As of Thursday, October 1, the project was approved by both agencies, according to Tim Henley, Chief, Colorado River Management, Arizona Department of Water Resources.*

Colorado River flows over the last six years have been the lowest on record, resulting in a rapid decline in the volume of

water stored in the Colorado River Storage System. For the past three years, Arizona has protested the allowance of California's consumptive use of Colorado River water to exceed its annual entitlement of 4.4 MAF in the face of declining storage volumes. Arizona is concerned that storage in the reservoirs will continue to decline, and continued diversions by California above its annual entitlement would result in more rapid decline. Therefore, Arizona will continue to protest diversions by California above 4.4 MAF which place increased risk of shortage on Arizona and provide benefits only to California.



California argues that the historic record indicates that there is a high probability of Colorado River flows returning to normal, and probably above normal, thus refilling the reservoirs before any shortages occur. Therefore, any water left in the system now which could otherwise be used by California would probably be spilled unused to Mexico in the future.

The Colorado River basin states (Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona and California) along with the US Bureau of Reclamation have agreed to study alternative methods of operating the Colorado River Storage System in an effort to optimize the resource. One of the proposals resulting from this effort calls for a demonstration program to store unused Colorado River water in underground aquifers within Arizona. Such a program could help reduce Arizona's risk of future shortages and, at the same time, make more storage space available in the Colorado River Storage System to reduce or prevent spills in case Colorado River flows exceed normal in the near future.

The currently proposed demonstration program would involve an agreement between the Central Arizona Water Conservation District (CAWCD) and the Metropolitan Water District of Southern California (MWD), the specifics of which are still being negotiated. It is anticipated that under the program MWD would pay the costs to store unused Colorado River water (the proposed demonstration program is 30,000 acre-feet in 1992) pursuant to one or more of CAWCD's groundwater recharge permits. The resulting stored water credits would remain in

storage until there is a declaration of either shortage or surplus conditions on the Colorado River. If a shortage occurs before the Colorado River Storage System refills and spills, then CAWCD would recover the stored water to satisfy CAP demands. If the system refills and spills before a shortage condition occurs, then the stored water would be made available for MWD's use. MWD would use the stored water via an exchange wherein CAWCD would reduce diversions from the Colorado River and recover the stored water from the aquifers for delivery to CAP users, and MWD would increase its diversions from the Colorado River by the same amount.

Some of the potential benefits of participating in such a program include:

- Increased diversion of Colorado River water into Arizona at no additional cost to Arizona.
- Reduced risk and/or severity of future CAP shortages.
- Increased vacant system storage space which may be used to capture additional flows on the Colorado River if they become available.
- Increased water levels in Arizona aquifers.

Another benefit which is difficult to measure is the initiation of a joint effort between "competing" states to optimize the use of Colorado River water supplies to the benefit of both states.

#### JAN VAN SCHILFGAARDE ELEVATED TO ASCE HONORARY MEMBER

Jan van Schilfgaarde, Associate Deputy Administrator of the Agricultural Research Service, Beltsville, MD, was one of seven distinguished civil engineers elevated to the coveted rank of ASCE Honorary Member in recognition of a long and illustrious career in the profession. The event took place in September during the annual convention of the American Society of Civil Engineers in New York. Van Schilfgaarde has achieved national prominence for developing drainage engineering criteria on the transient behavior of water. He was cited for "outstanding contributions to the specialty field of irrigation and drainage engineering as a researcher, educator and administrator." Van Schilfgaarde was formerly Associate Area Director for the USDA/ARS located in Fort Collins.

#### THE DENVER AIRPORT: POLLUTION PREVENTION BY DESIGN

In October of 1993, when passengers first begin flying into America's newest and largest airport, the planning involved will become obvious through the space-age architecture and highly accessible layout. Not so obvious, but every bit as revolutionary, will be the environmental planning that went into the facility - a concept called "pollution prevention by design." Preventing pollution during the design of projects simply makes

more sense in economic and environmental terms than traditional "end-of-the-pipe" or "command-control" strategies. In fact, EPA's regional office in Denver assigned one of its own scientists, David Duster, to help design features that cut traditional pollution associated with large public works projects.

The first obstacle was to overcome the single-focus approach that regulators develop when they work in specific programs such as air, water, waste and toxics. Building pollution prevention into a \$2.7 billion facility on a 53-square-mile parcel of land obviously calls for a "big-picture" view - what the EPA now calls "multi-media."

Air. Water. Waste. These are the three basic pollution problems for any new facility, no matter how carefully planned. The following illustrate just a few of the impact-reducing measures slated:

Installing ultra-low flow toilets throughout DIA should conserve 130 million gallons of water annually, enough to supply the yearly water needs of 1,570 families.

Irrigating, starting in 1999, airport and surrounding development landscaping with reclaimed wastewater (not treated to drinking water levels) from the city of Denver. This is expected to save 542 million gallons annually.



Landscaping with a heavy reliance on the West's own water-stingy plants, especially prairie grasses, will yield water savings in the hundreds of millions of gallons per year.

Source: EPA Journal, May/June 1992

### **WATER FOR PEOPLE NAMES EXECUTIVE DIRECTOR AND PROGRAM DIRECTOR**

WATER For PEOPLE has named Charles C. Johnson, Jr. as executive director. Johnson will manage the organization's programs and volunteer structure. WATER For PEOPLE is a non-profit organization created and sponsored by the American Water Works Association (AWWA). The organization conducts programs to assist less-developed countries increase the quality and availability of local drinking water supplies.

Johnson was president of C. C. Johnson & Malhotra, Inc., a Washington, D.C.-based consulting firm. Prior to that, he was assistant surgeon general of the U.S. Public Health Service and assistant commissioner of Health in New York City. Johnson's international experience includes representing the U.S. Government at the World Health Assembly meetings, the PanAfrican Water Conference, and India's first National Water Survey. A graduate of Purdue University, Johnson sits on the Board of National Sanitation Foundation International and the

Water Science and Technology Board of the National Academy of Sciences. He is past chairman of the National Drinking Water Advisory Council, a Distinguished Engineer, Purdue University, and an AWWA Fuller Awardee.

Paul A. Sobiech has been named project director for the organization's Eastern European Initiative. Under a two-year grant from the U.S. Environmental Protection Agency, WATER For PEOPLE will provide technical assistance to Poland, Hungary, Czechoslovakia, and Bulgaria on drinking water issues. Prior to joining WATER For PEOPLE, Sobiech spent two years as a water resource engineer with the U.S. Peace Corps in Thailand. Sobiech holds a bachelor of science degree in Civil Engineering from Purdue University and a master's degree from the Indiana University School of Public and Environmental Affairs.

WATER For PEOPLE was created as an international assistance program through which water supply professionals from around the world can volunteer their time and expertise. More than 2,500 people from the water supply community have volunteered for the program. The organization is currently conducting four projects including building a gravity-fed distribution system in south central Mexico and rehabilitating a well that supplies 800 households in Guatemala.

Contact WATER For PEOPLE at 6666 West Quincy Avenue, Denver, Colorado 80235, or call (303) 347-6145.

## **SEMINAR SERIES**

### **ENVIRONMENTAL ENGINEERING SEMINAR SERIES-FALL 1992 DEPARTMENT OF CIVIL ENGINEERING COLORADO STATE UNIVERSITY**

Seminars are held in Room 180 of the Lory Student Center from 12:00 noon to 1:00 p.m. Everyone is welcome. Feel free to bring your lunch. Direct questions to either Patrick Mestas or Scott Marnocha at (303)491-5844.

- |             |   |
|-------------|---|
| October 19  | WETLANDS: FORMS, FUNCTIONS AND VALUES, Mr. Kevin P. McBride, PE, Stormwater Quality Coordinator, City of Fort Collins, CO.                                |
| October 26  | NEW PROGRAMS FOR AIR QUALITY, Mr. Dean Gillam, Section Chief, Air Program Branch EPA Region VIII, Denver, CO.   |
| November 2  | TREATABILITY STUDIES UNDER CERCLA, Dr. John Eisenbeis, Environmental Engineer, Camp Dresser and McKee Inc., Denver, CO.                                   |
| November 9  | TOXIC SOLVENT REPLACEMENT: NEXT GENERATION APPROACH, Mr. Walt Burg, Vice President of Research and Development, RECOM Applied Solutions Inc. Boulder, CO. |
| November 16 | CITY OF FORT COLLINS SLUDGE MANAGEMENT PROGRAM, Mr. Tom Gallier, Water and Wastewater Utilities, Fort Collins, CO.  |
| November 30 | HAZARDOUS WASTES STUDIES, Mr. Doyle Tinkey, PE, Regional Manager, CH2M Hill, Denver, CO.  |
| December 7  | WATER QUALITY ASPECTS OF WATER RIGHTS ADMINISTRATION, Ms. Julie Kraus, Water Resource Engineer, State of Colorado Engineering Office, Denver, CO.         |



# **AGRICULTURAL ENGINEERING GRADUATE SEMINAR-FALL 1992** **COLORADO STATE UNIVERSITY**

Seminars begin with refreshments at 3:15 p.m. and end by 4:30. The usual meeting room is 224-226 in the Lory Student Center, but several seminars will be in other locations. Please check the location each week. Interested folks from outside the department are welcome. Please call Jim Loftis at 491-5252 for more details.

- |              |   |
|--------------|---|
| September 18 | APPLICATION OF GROUND WATER MODELS IN CONSULTING, Dr. Catherine Kraeger-Rovey, Water and Environmental Systems Technology, Denver, CO.                                |
| October 2    | DESIGN OF WEATHER STATION NETWORKS FOR IRRIGATION SCHEDULING, Muhammed Ashraf, Agricultural and Chemical Engineering Department, CSU.                                 |
| October 9    | HYDRAULIC CHARACTERISTICS OF FLOW THROUGH SWELLING CLAY SOILS, Ata Ur-Rahman Tariq, Agricultural and chemical Engineering, CSU.                                       |
| October 16   | CONTAMINATION OF SAN LUIS VALLEY GROUND WATER BY NITRATES AND PESTICIDES, Cheryl Miller, Agricultural and Chemical Engineering Department, CSU.                       |
| October 23   | WATER RESOURCES IN KUWAIT, Dr. David McWhorter, Agricultural and Chemical Engineering Department, CSU.  |
| October 30   | WATER RESOURCES DEVELOPMENT IN LESOTHO, Dr Robert Ward, Dir., Colo. Water Resources Research Inst.  |
| November 6   | IRRIGATION ACTIVITIES IN CIVIL ENGINEERING AT COLORADO STATE UNIVERSITY, Dr. Tim Gates, Civil Engineering Department, CSU.  |
| November 13  | BIOLOGICAL MONITORING OF WATER QUALITY IN NEW ZEALAND (tentative), Dr. Christopher Hickey and Dr David Roper, Ecosystems-Water Quality Centre, Hamilton, New Zealand. |
| November 20  | ENVIRONMENTAL APPLICATIONS OF SOIL MICROBIOLOGY, Dr Kenneth Duxtader, Department of Agronomy, CSU.  |
| December 4   | EVALUATION OF SURFACE IRRIGATION SYSTEMS NEAR GREELEY, COLORADO, Henriette Emond, Agricultural and Chemical Engineering Department, CSU.                              |
| December 11  | SOLUTE TRANSPORT UNDER STEADY-STATE SPRINKLER AND TRANSIENT SURFACE IRRIGATION APPLICATIONS, Moshrik Hamdi, Agricultural and Chemical Engineering Department, CSU.    |

## **WATER QUALITY MANAGEMENT 1992 GUEST LECTURE SERIES** **COLORADO STATE UNIVERSITY**

**2:10p.m. in Room C-106 Engineering Building. Contact Robert Ward, 491-6308, for more information.**

- |             |  |
|-------------|--|
| October 15  | OPERATION OF A 303(d) TMDL PERMITTING PROCESS, Bruce Zander, Monitoring and Standards Division, U.S. EPA, Region VIII.   |
| October 22  | CURRENT STATUS OF NONPOINT SOURCE POLLUTION CONTROL IN COLORADO, Greg Parsons, Director, Nonpoint Source Program, Water Quality Control Division, Colorado Department of Health. |
| November 5  | ENFORCING WATER QUALITY REGULATIONS, David Holm, Director, Water Quality Control Division, Colorado Department of Health.  |
| November 12 | FINANCIAL ASSISTANCE FOR POINT AND NONPOINT POLLUTION CONTROL, Richard Long, Chief, Municipal Facilities Branch, U.S. EPA, Region VIII.  |
| November 19 | THE ROLE OF PLANNING IN TODAY'S WATER QUALITY MANAGEMENT PROGRAMS, Lane Wyatt, Manager, Water Quality Program, N.W. Colorado Council of Governments.                             |



**SEMINAR SERIES ON WATER RESOURCES SCIENCE AND ENGINEERING  
DEPARTMENT OF CIVIL ENGINEERING  
COLORADO STATE UNIVERSITY**

Meetings, beginning at 12:10 p.m., are held in Room 208, Lory Student Center. Sponsored by: Hydrologic Science and Engineering Program, Water Resources Planning and Management Program, Groundwater Program, and Watershed Sciences Program. For information contact Jorge A. Ramirez at (303)491-8650/7621/5048.

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|-------------|---|
| October 15  | A STOCHASTIC MODEL FOR GENERATING MONTHLY FLOWS IN THE GUNNISON RIVER BASIN, Aldo Vecchia, US Geological Survey, Denver   |
| October 22  | NITRATES AND PESTICIDE CONTAMINATION IN THE SAN LUIS VALLEY, Deanna Durnford, Agricultural and Chemical Engineering Department, Colorado State University.              |
| October 29  | INFLUENCE OF LANDSCAPE STRUCTURE ON THE HYDROLOGIC CYCLE IN REGIONAL AND GLOBAL CLIMATE, Roger A. Pielke, Department of Atmospheric Sciences, Colorado State University |
| November 5  | EFFECTS OF SPATIAL VARIABILITY IN SOIL HYDROLOGY, Roger E. Smith, USDA-ARS, Fort Collins  |
| November 12 | STORM SEWER SYSTEM DESIGN METHODOLOGY, James Guo, University of Colorado, Denver  |
| November 19 | ANALYSIS OF DROUGHTS IN SOUTHWESTERN SOUTH AMERICA, Bonifacio Fernandez (Visiting Professor), Civil Engineering Department, Colorado State University                   |
| December 3  | ADVANCES IN GEOSCIENCES, Pierre Y. Julien, Civil Engineering Department, Colorado State University  |

**INTERNATIONAL CONNECTIONS  
COLORADO STATE UNIVERSITY**

Joint Tuesday Noon Brown-Bag Lunch Program, Fall 1992. Organizational Representatives for Luncheon Talks: Ann Perry-Barnes, Women in International Development (482-3871); Jack Brooks, Overseas Development Network (225-1768); Robin Cuany, Society for International Development (482-4517). For information about International Programs at Colorado State University, call Martha Denney or Jean Griswold at 491-5917.

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|-------------|--|
| October 20  | SMALL-SCALE IRRIGATION EVALUATION IN ZIMBABWE, Terry Podmore, Department of Agricultural and Chemical Engineering, Colorado State University - ODN Room 166* |
| October 27  | REDISCOVERING ANDEAN CROPS IN ECUADOR AND BOLIVIA: IMPLICATIONS FOR SUBSISTENCE FARMERS, Sarah Ward - WID Room 166*  |
| November 3  | AGRICULTURE AND SEED SUPPLY IN LOWLANDS BOLIVIA, James Echols - Department of Agronomy, Colorado State University - SID Room 164B/C                          |
| November 10 | TREE EFFECTS ON SOIL FERTILITY IN A TRADITIONAL MALAWIAN AGROFORESTRY SYSTEM, Chuck Rhodes - ODN Room 210  |
| November 17 | NEGATIVE EFFECTS OF DEVELOPMENT ON WOMEN IN AFRICAN COUNTRIES, Susan Ford - WID Room 166*  |
| December 1  | FARMING SYSTEMS RESEARCH IN SWAZILAND, Willis Shaner, Department of Mechanical Engineering - SID Room 166*   |
| December 8  | IRRIGATION DEVELOPMENT AND DEMOCRACY IN RURAL NEPAL, John Wilkins-Wells, Department of Agricultural and Resource Economics - ODN Room 166*                   |

\*Room 166 is located near the Atrium; go north and west through the Food Court dining area. Rooms 210 and 208 are upstairs, in the south end of the Student Center.



**FACULTY AND GRADUATE STUDENT SEMINAR - FALL 1992**  
**DEPARTMENT OF AGRONOMY**  
**COLORADO STATE UNIVERSITY**

Meetings are held in Room 212, Shepardson Building, Colorado State University.

- November 12 BUILDING BETTER BARLEY: HAPLOIDS IN CEREAL CROP BREEDING, Duane Johnson, Department of Agronomy.
- November 19 ATMOSPHERIC CARBON DIOXIDE CONSUMPTION DURING PEDOGENESIS, Oliver Chadwick, Soil Scientist, California Institute of Technology - Jet Propulsion Laboratory, Pasadena, CA
- December 3 EFFECTS OF CROPPING SYSTEM, SOIL/SLOPE POSITION AND SOIL DEPTH ON P AVAILABILITY POOLS, Chris Iremonger, Graduate Student, Department of Agronomy
- December 10 AN AUTOMATED FEEDBACK CONTROL SYSTEM FOR SUBSURFACE DRIP IRRIGATION, Grant Cardon, Department of Agronomy.

**GRADUATE-FACULTY SEMINAR**  
**DEPARTMENT OF FISHERY & WILDLIFE BIOLOGY**  
**COLORADO STATE UNIVERSITY**

Meetings held on Fridays, 3:00 p.m. in Room 232 Wagar Building, Colorado State University.

- October 23 WILDLIFE DAMAGE CONTROL AS PART OF THE WILDLIFE PROFESSION, Guy Connolly, USDA/APHIS
- October 30 TOWARD CONSERVATION OF MIDCONTINENT SHOREBIRD MIGRATIONS, Susan Skagen, USFWS
- November 6 DESERT TORTOISE-- HISTORIC DECLINES, POPULATION ECOLOGY, AND CONSERVATION BIOLOGY: A CRITIQUE, Bruce Bury, USFWS
- November 13 DISSOLUTION OF A VERTEBRATE COMMUNITY: EFFECTS OF THE BROWN TREE SNAKE ON GUAM, Gordon Rodda, USFWS
- November 20 A LANDSCAPE-ECOLOGY PERSPECTIVE IN REGIONAL ASSESSMENTS OF AN AVIAN COMMUNITY STRUCTURE, Curt Flather, USFS

**SEMINAR SCHEDULE; FALL 1992**  
**DEPARTMENT OF ENVIRONMENTAL HEALTH**  
**COLORADO STATE UNIVERSITY**

Mondays at Noon, Microbiology Building A108.

- October 26 GENETIC MARKERS FOR POPULATION STUDIES, Nancy DuTeau, Department of Environmental Health, Colorado State University
- November 2 THE BIOAVAILABILITY OF LEAD FROM MINING WASTES, Michael Ruby, PTI Environmental Services, Boulder, CO.
- November 9 ACCURACY OF DEMOGRAPHIC INFORMATION; IMPLICATIONS FOR EPIDEMIOLOGISTS, State Demographer, Denver.



**FALL 1992 SEMINAR SERIES - WATER RESOURCES AND ENVIRONMENTAL ENGINEERING AND CENTER  
FOR ADVANCED DECISION SUPPORT FOR WATER AND ENVIRONMENTAL SYSTEMS (CADSWES)  
UNIVERSITY OF COLORADO AT BOULDER**

**Friday Afternoons at 3:00 p.m., Engineering Center Room CE 0-1. Refreshments are served. For information contact Rob Runkel, CEAE/CADSWES, UCB 428, University of Colorado, Boulder, CO 80309-0428. Phone (303)492-3972.**

- October 16 THE MODULAR HYDROLOGIC MODELING SYSTEM, George Leavesley, Hydrologist, Water Resources Division, US Geological Survey, Denver, Pedro Restrepo, Research Associate, Department of Civil, Environmental & Architectural Engineering, CU Boulder, Center for Advanced Decision Support for Water and Environmental Systems (CADSWES), CU Boulder.
- October 23 CURRENT STATUS OF THE SUPERFUND AND RCRA PROGRAMS, Roger Olson, Camp Dresser & McKee Inc., Denver, CO.
- October 30 ENVIRONMENTAL PROBLEMS OF THE AMAZON REGION: AN INSIDER'S PERSPECTIVE, Vicente Nogueira, Visiting Fulbright Scholar, Environmental Engineering, University of Tennessee; Professor of Civil and Environmental Engineering, University of Amazonas, Manaus Amazonas, Brazil.
- November 6 THE ROLE OF COLLOIDS IN TRACE METAL OCEANIC SCAVENGING, Bruce Honeyman, Department of Environmental Science and Engineering, Colorado School of Mines, Golden, CO.
- November 13 EFFECT OF SOLUTION CHEMISTRY ON THE DETACHMENT OF CLAY COLLOIDS FROM AN IRON-OXIDE COATED SAND, Joe Ryan, Postdoctoral Researcher, Department of Civil, Environmental & Architectural Engineering, CU Boulder
- November 20 PSEUDO-EXPERIMENTS IN REAL ENVIRONMENTAL SYSTEMS: TRACER STUDIES OF THE STREAM-WATERSHED CONTINUUM, Kenneth Bencala, Chemical Engineer, Water Resources Division, US Geological Survey, Menlo Park, CA.
- December 4 OPTIMAL LAYOUT OF BRANCHING GRAVITY-FLOW NETWORKS (OR, CAN A GENETIC ALGORITHM END A FRUSTRATED LIFE IN THE SEWERS?), Jon Liebmann, Visiting Professor, Department of Civil, Environmental & Architectural Engineering, CU Boulder; Professor, Department of Civil Engineering, University of Illinois, Urbana, IL.

**HOT TOPICS - NATURAL RESOURCES LAW CENTER  
UNIVERSITY OF COLORADO AT BOULDER**

**Programs are held at noon at the Hershner Room, One Norwest Bank Center (formerly United Bank Center), Lincoln and 17th Ave. in Denver. For information contact Kathy Taylor at (303)492-1288.**

- October 27 COLORADO OIL AND GAS COMMISSION AND LAND USE DISPUTES. Jeff Welborn, Denver attorney and former chair of the Colorado Oil and Gas Conservation Commission, will moderate a discussion on the responsibilities of the Commission when disputes arise over surface development and mineral development.
- November 16 NATURAL RESOURCES LITIGATION: ETHICAL CONSIDERATIONS IN DISCOVERY. Colorado Supreme Court Justice George Lohr will discuss ethical considerations that arise in discovery. In response, Denver attorney Nancy Gegenheimer will describe the special discovery concerns that arise in natural resources cases. Offers one CLE ethics credit.

**INTERNATIONAL GROUND WATER MODELING CENTER  
COLORADO SCHOOL OF MINES, GOLDEN, COLORADO  
SHORT COURSES**

- October 19-22 PRINCIPLES AND APPLICATIONS OF MODFLOW AND ACCOMPANYING MODELS

**Note: Seminar series usually begin with calendar school year (Last week in August); listings above begin in October.**



## **POSITIONS AVAILABLE**

**Research Assistant, Planning and Management Consultants, Ltd., Carbondale, Illinois**--Planning and Management Consultants, Ltd. (PMCL) is a focused group of engineers, economists and scientists conducting research in a broad range of water planning and management issues. M.S. degree in economics, environmental engineering, or geography and/or experience in related water resources management field; good verbal, written, and statistical skills are essential; qualified analyst with expertise or experience in urban water forecasting and conservation planning. Starting salary negotiable based on qualifications. Full time position with employment benefits. Submit letter of application, resume and transcripts to: Dir. of Research, PMCL, P.O. Box 1316, Carbondale, Illinois 62903.

**Research Associate, Planning and Management Consultants, Ltd., Carbondale, Illinois**--Responsible for managing multiple research projects in urban water resources management. M.S. degree or Ph.D. in economics, statistical mathematics, or water resources planning. Three years of research experience preferred. Candidate must demonstrate excellent communication and computer application skills. Requires considerable independent judgement and creative problem-solving as well as strong project management skills. Starting salary negotiable based on expertise and experience. Full time position with employment benefits. Submit letter of application, resume, and transcripts by October 15, 1992 to same address as above.

**Irrigation Engineering, Soil Conservation Service**--The SCS is looking for 2 graduated or graduating civil engineers for irrigation-related engineering work. One position is located in Grand Junction and the other is in Montrose, Colorado. Desired qualifications: Completed or graduating Civil Engineering student. Contact: George Christy (303) 236-2891 or Sylvia Gillen (303) 659-7004.

**Rural Advice Center Water Supply Hydrologist, RAC Water Supply Task Force, South Africa**--Volunteer needed to focus on emergency relief efforts in order to satisfy the short-term water supply needs of drought stricken communities. Should have a minimum of 5 years experience in the field. In addition, it is recommended that the individual have a significant amount of experience working in developing countries and/or drought relief situations.

The volunteer will need to be able to make rapid assessments of the immediate water supply needs of a given community; to assist in organizing immediate tanker water supply; and ensure medium-term supply needs such as borehole drilling, pump supply and rehabilitation of old equipment.

Salary: Volunteer Overseas Cooperative Assistance will pay all expenses, including those for a spouse if the assignment is over 30 days, but not salary. Contact: Bill Brown 491-6740 or Cristine Nardi, VOCA (202)83-4961.

## **WATER PUBLICATIONS**

**DRINKING WATER - Widening Gap Between Needs and Available Resources Threatens Vital EPA Program**, July 1992. U.S. General Accounting Office, Washington, DC 20548. GAO/RCED-92-184.

**INTERNATIONAL ENVIRONMENT: Strengthening the Implementation of Environmental Agreements**, Aug. 1992. U.S. General Accounting Office, Washington, DC 20548. GAO/RCED-92-188.

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USGS Publications - Available from: US Geological Survey, Book and Open-File Report Sales, Box 25425, Denver, CO 80225.

Compilation of water-quality data for Pueblo Reservoir and the upper Arkansas River basin, Colorado, 1985-87, by P.R. Edelmann, J.A. Scaplo, D.A. Colalancia and B.B. Elson. Prepared in cooperation with the Pueblo Board of Water Works, Fountain Valley Authority, Southeastern Colorado Water Conservancy District, Pueblo West Metropolitan District, St. Charles Mesa Water District, and the U.S. Bureau of Reclamation. 1991. 409 p. OF 91-0506. COLORADO. Microfiche \$5.50; paper copy \$65.25.

Uranium and other elements in Colorado Rocky Mountain wetlands; a reconnaissance study, by D.E. Owen, J.K. Otton, F.A. Hills and R.R. Schumann. B 1992. COLORADO. 1992. 33 p. \$2.25.

Characterization of water quality for streams in the southern Yampa River basin, northwestern Colorado, by R.S. Parker. Prepared in cooperation with the U.S. Bureau of Land Management, 1991. 49 p. WRI 88-4204. COLORADO. Microfiche \$4; paper copy \$8.

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**FLOODPLAIN MANAGEMENT IN THE UNITED STATES: AN ASSESSMENT REPORT**, Vol. 1, Summary Report; and Vol. 2, Full Report. Prepared for the Federal Interagency Floodplain Management Task Force. FIA-18/June 1992. Contact: The Natural Hazards Research and Applications Information Center, University of Colorado at Boulder, Boulder, CO 80309.

**1992 COLORADO LAWS ENACTED OF INTEREST TO WATER USERS**, available from Colorado Water Congress, 1390 Logan St., Ste. 312, Denver, CO 80203; Phone 303/837-0812.

**MANAGING COVER CROPS PROFITABLY**, Sustainable Agriculture Network Handbook Series. Order from: Sustainable Agriculture Publications, Hills Bldg., Rm 12, Univ. of Vermont, Burlington, VT 05405-0082. Cost: \$9.95.



**CUMULATIVE INDEX: GROUND WATER JOURNAL, VOL. 1-29, 1963-1991.** Order from: GeoResource Publishers, P.O. Box 280491, Denver, CO 80228-0491. Price: \$56.00 + \$4 shipping.

**PROCEEDINGS, ANNUAL HAZARDS RESEARCH AND APPLICATIONS WORKSHOP, Boulder, CO.** For information contact: Publications Clerk, Natural Hazards Research and Applications Information Center, IBS #6, Campus Box 482, Univ. of Colorado, Boulder, CO 80309-0482, phone 303/492-6819; FAX 303/492-2151. Abstracts or session summaries can be ordered individually.

#### VIDEOS/DISKS

Rodale Institute and Rooy Media have produced a "Farmer to Farmer" video series made with the help of nearly 200 farmers and other experts. The six videos feature farmers talking about their experience with sustainable agriculture practices for field

crops; rotational grazing; vegetable production; integrated pest management, and high-value marketing. Each video costs \$29.95, or \$149.95 for all six. Order from: Farm Videos, Rooy Media, 7407 Hilltop Drive, Frederick, MD 21702.

A new disk produced by the National Sustainable Agriculture Network features all project summaries by the USDA Sustainable Agriculture Research and Education program for the past three years. IBM compatible. Call or write Dr. Phil Rasmussen, Dept. of Plants, Soils and Biometeorology, Utah State Univ., Logan UT 84322-4820, Phone 801/750-2257.

Video of the session on the Colorado River at the Colorado Water Congress' 34th Annual Convention. Participants were David Robbins, Presiding Officer; Betsy Rieke, Director, Arizona Dept. of Water Resources; and Jerry Zimmerman, Executive Director, Colorado River Board for the State of California. 95 minutes. Contact: Colorado Water Congress, phone 303/837-0812, FAX 303/837-1607.

### **CALLS FOR PAPERS**

**THIRTEENTH ANNUAL "HYDROLOGY DAYS** - March 30-April 2, 1993, Colorado State University. Hydrology Days provides a forum for hydrology professionals and students to get acquainted and share problems, analyses and solutions. Special keynote addresses will be given by recognized hydrologists. Besides general hydrology, there will be several special sessions. Early professional registration is \$120 and early student registration is free. Deadline is January 8, 1993, for two copies (original plus one) of abstract. Deadline to submit the final written paper is February 24, 1993. Contact: Janet Lee Montera, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523, Phone 303/491-7425, FAX 303/491-7727.

**CONSERV93 - The New Water Agenda** - Dec. 12-16, 1993. The only large-scale conference dedicated exclusively to water conservation issues, CONSERV93 will provide a unique forum to address the most challenging water supply problems in North America. Sponsored jointly by the American Water Works Association, the American Society of Civil Engineers and the American Water Resources Association, the CONSERV93 Conference and Exhibition will be held at the Mirage Hotel, December 12-16, 1993, in Las Vegas Nevada. It will feature the latest information on all aspects of water conservation through presentations and discussions by experienced water conservation practitioners. The program is multidimensional, offering a series of technical presentations, workshops, roundtables, panel discussions, software demonstrations, and a product exposition of water conservation-related products and services.

Professionals are encouraged to submit abstracts on all aspects of water conservation including land-use planning, risk-based water management, nontraditional uses, and water use in the recreational/hospitality industries. To receive the formal

guidelines to submit abstracts, contact Rick Harmon at the American Water Works Association, 6666 West Quincy Ave., Denver CO 80235 or call 303/347-6195. Deadline: Dec. 1, 1992.

**FOURTH NATIONAL PESTICIDE CONFERENCE, New Directions in Pesticide Research, Development, Management and Policy** - Richmond, VA. Nov. 1-3, 1993. Submit 300-500 word abstract to: Dr. Diana L. Weigmann, Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, 617 No. Main St., Blacksburg, VA 24060-3397, Phone 703/231-5624.

**6TH SYMPOSIUM ON ARTIFICIAL RECHARGE OF GROUNDWATER, Purpose, Problems and Progress** - May 19-21, 1993, Phoenix, AZ. Submit 200-word abstract to: Technical Committee, 1993 ARGS, Water Resources Research Center, The University of Arizona, 350 N. Campbell Ave., Tucson, AZ 85721. For information call: 602/792-9591. Deadline: October 30, 1992.

**66TH ANNUAL CONFERENCE & EXPOSITION, WATER ENVIRONMENT FEDERATION** - Oct. 3-7, 1993, Anaheim, CA. For information contact: Water Environment Federation, 601 Wythe St., Alexandria, VA 22314-1994, Phone 703/684-2462. Deadline: Jan. 8, 1993.

**JOINT INTERNATIONAL SUMMER MEETING OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS AND THE CANADIAN SOCIETY OF AGRICULTURAL ENGINEERING** - June 20-23, 1993, Spokane, WA. Contact: American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, MI 49085-9659; Phone 616/429-0300.



# **Preliminary Announcement and Call for Papers**

## **AWRA -- COLORADO SECTION presents a symposium on**

### **BASIN PLANNING & MANAGEMENT: WATER QUANTITY AND QUALITY**

**March 5, 1993 -- Denver**

Plan to attend this full-day symposium to examine Colorado water-supply and water-quality issues that need to be addressed on the scale of river or ground-water basins. You are invited to submit an abstract on this general topic or on one of the following subjects:

#### **Water-supply management plans or studies**

Inter-basin Cooperation

Water Exchanges

Structural vs. Non-structural Alternatives

Artificial Ground-Water Recharge

#### **Basin-wide water-quality management plans**

Wasteload Allocation

Non-Point Source Pollution Control

#### **Issues within specific basins**

Conjunctive Use of Surface-Water and Ground-Water

Wetlands preservation

#### **Federal impacts on basin management**

Ecological Integrity

Instream-Flow Release Requirements

Wilderness Water Rights

Presentations will be 20 minutes, including discussion. Final papers will be published in a proceedings available at the symposium. Send your abstract to: Dave Mueller, USGS - WRD, PO Box 25046 - MS415, Lakewood, CO 80225. FAX: (303)236-4912. For additional information, call Dave Mueller (303/236-4882) or Jerry Kenny (303/987-3443).

## **MEETINGS, WORKSHOPS AND SHORT COURSES**

### **THE ENDANGERED SPECIES ACT: ON THE ROAD TO RECOVERY?**

**November 9-10, 1992 - Coeur d'Alene, Idaho**

Join in an exploration of the Endangered Species Act - this conference will examine the nuts and bolts of the ESA, as well as the Act's history, reauthorization and amendment. Will review economic considerations and public involvement, tribal rights and the ESA, and explore ESA case studies in conflicting species management, reintroduction of predators, and much more.

Registration fee is \$80 until Nov. 2, 1992 and \$105 after. Registration forms are available from the Idaho Water Resources Research Institute, 106 Morrill Hall, University of Idaho, Moscow, ID 83843.

For more information contact Peggy Hammel, Idaho Water Resources Research Institute, 208/885-6429.



# THIRD ANNUAL SOUTH PLATTE BASIN CONFERENCE PROGRAM

## Defining Ecological and Sociological Integrity for the South Platte River Basin

October 27 and 28, 1992

Fort Collins University Park Holiday Inn

Tuesday, October 27, 1992

|             |                   |   |   |
|-------------|-------------------|---|---|
| 8:30-8:45   | Opening Remarks   | Robert Ward   | Welcome   |
| 8:45-9:30   | Speaker 1         | Brian Werner  | <i>The Great American Desert: Popular Myth and Water Development Along the South Platte</i>   |
| 9:30-9:50   | Paper 1           | Greg Silksen  | <i>An Ecological History of the South Platte River: Nineteenth Century Observations</i>   |
| 9:50-10:10  | Paper 2           | David Wagner<br>Roger Hoffer<br>Terence Podmore             | <i>Determination of Consumptive Water Use by Irrigated Crops Using Remote Sensing and GIS Techniques</i>                              |
| 10:10-10:30 | Paper 3           | Tim Gates<br>Tom Sanders<br>Terry Podmore                   | <i>Recommended Water Quality Criteria for Agricultural Diversions from the South Platte</i>   |
| 10:30-11:00 | Morning Break 1   | Coffee & Pastries   |   |
| 11:00-11:20 | Paper 4           | Joni Nuttle<br>Ronald French                                | <i>Historical and Current Distribution of Fish in Three Ecological Zones of the South Platte River</i>                                |
| 11:20-11:40 | Paper 5           | Kevin R. Bestgen<br>Kurt D. Fausch                          | <i>The Importance of Understanding the Ecology of Plains Stream Fishes to Future Conservation Efforts</i>                             |
| 11:41-12:00 | Paper 6           | Keith Barker<br>Michael Carter                              | <i>Assessment of Long-Term Bird Population Trends and Changes in Bird Community Composition in the South Platte Basin of Colorado</i> |
| 12:00-12:50 | LUNCH             |   |   |
| 12:50-1:30  | Speaker 2         | Max Dodson  | <i>Achieving Ecological Integrity Through the Federal Clean Water Act</i>   |
| 1:30-1:50   | Paper 7           | Robert C. Averett   | <i>Beyond Biodiversity: Toward a Third Generation of Tools for Ecological Assessment</i>  |
| 1:50-2:10   | Paper 8           | Janet S. Heiny<br>Cathy M. Tate                             | <i>Influence of Stream Habitat Characteristics on Biological Communities in the South Platte River Basin</i>                          |
| 2:10-2:30   | Paper 9           | W. Roth-Nelson<br>Emily Weller                              | <i>Pilot Project for Water Quality Biocriteria Development in the Lower South Platte River Basin, Western High Plains Ecoregion</i>   |
| 2:30-3:15   | Speaker 3         | David Freeman   | <i>The Political Sociology of Defining Ecological Integrity: Why We Never End Up Where We Intend</i>                                  |
| 3:15-3:45   | Afternoon Break 1 | 30 minutes to locate a seat at a table for discussions      |   |
| 3:45-5:00   | Discussion 1      | Facilitated Roundtable Discussions with Beer, Sodas, Snacks |   |



Wednesday, October 28, 1992

|             |                 |   |   |
|-------------|-----------------|---|---|
| 8:30-8:40   | Day 1 Recap     | Robert Ward                                     |   |
| 8:40-9:10   | Speaker 4       | Hal Simpson                                     | (Topic - Ecological Integrity and its Effect on Managing Water Quantity and Water Quality)                                |
| 9:10-9:30   | Paper 10        | Nolan J. Doesken<br>Thomas B. McKee             | Key Climatic Characteristics of the South Platte River Basin in Colorado  |
| 9:30-9:50   | Paper 11        | Lawrence Tunnell                                | How Much Rainfall? A New Approach   |
| 9:50-10:10  | Paper 12        | Ari M. Michelsen<br>Robert A. Young             | Water Right Prices in Northeast Colorado: Changes, Trends, and Influences   |
| 10:10-10:40 | Morning Break 2 | Coffee and Pastries                             |   |
| 10:40-11:00 | Paper 13        | James F. Saunders, III<br>William M. Lewis, Jr. | Water Quality Modeling of the South Platte Below Denver: Opportunities for Improved Understanding of Ecological Processes |
| 11:00-11:20 | Paper 14        | Peter McMahon<br>Kevin Dennehy<br>Ken Lull      | Effect of Ground-Water Discharge on Dissolved-Oxygen Concentrations in the South Platte River at Low Flow                 |
| 11:20-11:40 | Paper 15        | Doug Kemper                                     | Directions in Water Resources Management on the South Platte: A Municipal Perspective                                     |
| 11:41-12:00 | Paper 16        | Mark Tabor                                      | Issues of the Urban River Interface   |
| 12:00-12:45 | Lunch 2         | Dining Room                                     |   |
| 12:45-1:30  | Speaker 5       | Ed Marston                                      | Media and Ecology   |
| 1:30-2:00   | Discussion 2    | Recap of Roundtable Discussions                 |   |

The conference fee of \$60 covers two meals, breaks and conference proceedings. Registration is through the Colorado Water Resources Research Institute. Please call (303) 491-6308 for more information. Sponsors of the 1992 conference include Northern Colorado Water Conservancy District, Colorado Division of Wildlife, U.S. Fish and Wildlife Service, Denver Water Department, U.S. Environmental Protection Agency, U.S. Geological Survey, and the Colorado Water Resources Research Institute.

### COLORADO WATER CONGRESS WORKSHOPS

The Colorado Water Congress has three workshops scheduled for November:

#### WETLANDS PROTECTION & WATER DEVELOPMENT

Nov. 5, 1992, Holiday Inn-Northglenn, I-25 & 120th Ave., Northglenn, CO.

#### WHAT YOU SHOULD KNOW ABOUT THE LEGISLATIVE PROCESS: THE LAW, THE RULES & THE PRACTICES

Nov. 6, 1992, CWC Conference Room, Suite 312, 1390 Logan St., Denver, CO.

#### A REVIEW OF FEDERAL ENVIRONMENTAL LAWS IMPACTING WATER INTERESTS

Nov. 12, 1992, CWC Conference Room, Suite 312, 1390 Logan St., Denver, CO.

For information contact the Colorado Water Congress, 1390 Logan St., Suite 312, Denver, Colorado 80203, Phone: 837-0812.



## AGRICULTURAL WATER QUALITY: THE NEW RULES OF THE GAME

Oct. 23, 1992

Ramkota Inn, 701 8th Street  
Greeley, Colorado

Public concern over contamination of water resources has focused on the agricultural sector, which has been identified as a contributor to nonpoint source pollution. Mirroring public concern, significant changes in Colorado law and regulations have been enacted which will impact agricultural operations.

New confined livestock regulations and new rules for handling agricultural chemicals will affect farmers, feedlot operators, agricultural chemical dealers and applicators. Colorado State University Cooperative Extension and the Agricultural Section of the Colorado State Bar Association are sponsoring this conference to present views on how these regulations will impact agriculture.

Representatives from the legal community, regulating agencies, and farm commodity groups will discuss and explore the new laws, their implementation, and voluntary approaches to addressing water quality concerns. This one-day conference will be an opportunity to learn more about the new laws and interact with the implementing agencies. For information contact: Cooperative Extension, Colorado State University, 303/491-6281.

## WASTEWATER TREATMENT WITH ADVANCED INTEGRATED WASTEWATER POND SYSTEMS AND CONSTRUCTED WETLANDS

Short Course - Oct. 27-30, 1992

Ramada Inn  
Fort Collins, Colorado

Conventional designs for wastewater treatment facilities in the U.S. under Public Law 92-520 and successive federal, state and local laws have cost American communities billions of dollars in capital costs and operating costs. This Short Course introduces Advanced Integrated Wastewater Pond Systems (AIWPS) and Constructed Wetlands, as appropriate alternative technologies aimed at helping to control costs while improving the environment at the same time.

The course objective is to introduce and provide information about how to design, operate and maintain simple, low-cost wastewater treatment systems that are highly effective and dependable in meeting EPA and other regulatory standards. Hand-out materials will provide a step-by-step basis to aid in planning, designing, building, operating and maintaining a new AIWPS - and for expanding, rehabilitating and/or rebuilding existing wastewater treatment systems by incorporating an AIWP System and/or a constructed wetlands.

For information contact: Dr. Maurice L. Albertson, Civil Engr. Dept., CSU; Phone: 303/491-5753 or FAX 303/491-7727.

## **WATER NEWS DIGEST**

### WATER PROJECTS

#### Suburbs Get OK to Sue EPA Over Two Forks

Suburban backers of Two Forks Dam have won the first legal skirmish in their battle to overturn the EPA's veto of the controversial water project. U.S. District Judge Richard Matsch ruled that eight suburban water providers have legal standing to sue over the EPA's November 1990 rejection of Two Forks. EPA had argued that the suburbs could not sue because they didn't own any of the water rights to the dam. The Denver Water Board, which has declined joining the lawsuit, owns all the water rights to Two Forks. The federal judge ruled that the suburbs "have shown a legitimate and recognizable claim that Denver has a legal obligation to go forward with the project if a permit is issued."

Denver Post 10/6/92

#### Fish Study Diverts Water Project

The Animas-La Plata water project is on hold because of lawsuits and the endangered Colorado Squawfish. The project originally included two reservoirs, three major pumping plants

and a 157-mile network of pipes and canals, but has been modified over the years. Leonard Burch, Southern Ute tribal Chairman, is frustrated by the continuing delays caused by the Endangered Species Act. A "jeopardy opinion" was issued in May 1990 on the eve of the groundbreaking ceremonies for the project by the U.S. Fish and Wildlife Service, which found that construction of Animas-La Plata was likely to jeopardize the squawfish. The agency also said it could find no method to both build the project and save the squawfish.

Grand Junction Daily Sentinel 9/10/92

#### Animas-La Plata Anasazi Dig Halted

A federal judge sided with the Sierra Club Legal Defense Fund and ordered a temporary halt to planned excavation of archaeological sites at the Animas La Plata water project in Colorado's Four Corners area. U.S. District Judge Zita Weinshienk issued the injunction against the U.S. Bureau of Reclamation. The bureau is currently preparing environmental studies of the area. Until those studies are finished, the judge ordered the bureau not to do any digging at the archaeological sites. The action was the latest round in the Defense Fund's



lawsuit that claims the Animas-La Plata project has not complied with environmental protection laws. The bureau had agreed to postpone construction work while it conducted the studies. Then it decided to go ahead with a survey of archaeological sites and awarded a \$7.7 million contract to Northern Arizona University to oversee the work.

*Montrose Daily Press* 9/18/92

## WATER EXPORTS/TRANSFERS

### Federal Legislation May Affect Proposed Water Exports

The House of Representatives has approved a bill that would prohibit any company from exporting water from the San Luis Valley unless the Interior secretary determines it won't harm the nearby Great Sand Dunes National Monument, the Closed Basin water project and wildlife refuges. The AWDI provision, first introduced by Senator Tim Wirth, is part of an omnibus water bill now before the Senate. Opponents of provisions affecting California's Central Valley Project are trying to kill the entire bill with a filibuster.

Source: *Denver Post* 10/7/92

### Some California Farmers Offer Water Rights

U.S. Water News reports that a number of San Joaquin Valley farmers have approached the Metropolitan Water District of Southern California about buying their land for attendant water rights. The farmers are from the southwestern edges of the Valley where some farmers who grow water-intensive field crops have grown weary of dealing with the economy and the drought.

Source: *U.S. Water News*, October 1992

## HYDROPOWER

### Western Governors Support Hydropower Legislation

Twenty-nine state governors sent a letter September 17 to House and Senate conferees supporting Title XXXI of HR 776, specifically Section 3104 to "prohibit FERC from licensing new private hydroelectric projects on outstanding river reaches when a state...has recognized the importance of specific reaches...and protected them through enactment of...state statute." The governors also supported Section 3103 prohibiting "private hydropower license holders from exercising their derivative power of condemnation for the construction of projects on lands owned by states and local governments and managed as public parts, for recreation purposes, or as wildlife refuges."

The letter was endorsed by nearly every Western States Water Council member state.

Source: *Western States Water*, Sept. 25, 1992

## Delta County Authorizes Hydro Projects

The Delta City Council unanimously approved a bill authorizing a Durango firm to construct two small hydro-electric projects on Grand Mesa using city water. Cool Water, Inc., of Durango, hopes to have construction of the projects completed later this fall and plans to spend \$1.5 million to construct the electric generating station along a city water pipeline. Cool Water will pay the city 7.5 percent of the revenue from generated power which it will sell to Tri-State Generation and Transmission Assn. Inc., of Thornton, Colo. To operate the hydropower projects, Delta will lease water it owns on the Grand Mesa to Cool Water, which will build two hydroplants along the pipeline route. The agreement is expected to help protect Delta's water rights on the Grand Mesa, as well as offset the city's electrical rates.

*Montrose Daily Press* 8/18/92

### Irrigators Get Funds To Repair Sinkholes

Paonia irrigators have won the help of the state to finance an engineering study aimed at repairing huge sinkholes in the abutments of Beaver Creek Reservoir. Sinkholes started appearing in 1964, six years after the 113-foot-high dam was built eight miles southeast of Paonia, the result of building the dam on a coal seam. This year the state engineer allowed the reservoir to store only 1/3 of its capacity due to the increased size of the holes. Repair costs could climb as high as \$300,000. The Colorado Water Conservation Board will provide \$42,000 toward the study and immediate repair costs.

*Grand Junction Daily Sentinel* 9/18/92

## WILDLIFE

### Endangered Squawfish Get New Homes At Horsethief

Horsethief Canyon State Wildlife Area officially has become home to 8,000 endangered Colorado squawfish, as a partnership of state and federal agencies dedicated a system of six man-made ponds to save the species from extinction. The \$280,000 project was undertaken by the Recovery Program for the Endangered Fishes of the Upper Colorado. The ponds will also become home to several other species of endangered Colorado fish, including razorback suckers, humpback chubs and bonytail chubs. A \$200,000 congressional appropriation for drought relief paid for most of the project. The Division of Wildlife contributed \$30,000 for pond development, and the Denver Water Department and several water conservancy districts donated \$50,000 to help cover the costs of raising the squawfish in Fort Collins.

*Grand Junction Daily Sentinel* 8/28/92

### Feds Eyeing Redlands Water

The US Fish and Wildlife Service has considered buying the power component of the Redlands Water and Power Co. water



rights in the Gunnison River to protect endangered fish species. The estimated cost is \$19 million. The agency is also considering a fish ladder over the Redlands diversion dam on the Gunnison River just upstream from the U.S. Department of Energy Grand Junction Projects Office. The Fish and Wildlife Service is looking at ways of protecting endangered fish in the Gunnison and Colorado rivers through the Colorado River Fishery Project. One goal of the recovery program is to allow endangered fish such as the Colorado squawfish to get upstream from the Redlands. The fish ladder may be at the top of the list of alternatives, but it is uncertain whether endangered fish would make use of it. If the Redlands dam ladder proves successful, it might be used at other dams such as the Government Highline Dam at Camio on the Colorado River.

*Grand Junction Daily Sentinel 9/6/92*

## NATIVE AMERICAN WATER

### Ten Tribes Propose Leasing Water Rights Downstream

Ten Indian tribes with water rights in the Colorado River Basin have negotiated with the seven states of the Colorado River Basin to lease some of their water downstream. Indian tribes weren't involved in the negotiations of the 1922 Colorado River Compact, or its revision in 1948. Most of the tribes are not presently utilizing all of their Colorado River water and believe they can help California and other water-short states by ensuring sufficient water is available. The tribes have proposed that each tribe quantify, with the assistance of the states, the amount of water they have available to lease. Then the states would determine how much water they need and under what terms they would agree to lease it.

*Grand Junction Daily Sentinel 9/4/92*

## WATER QUALITY

### Toxic Chemicals Found in Boulder Wells

Five wells in homes north of Boulder have levels of a toxic chemical exceeding state groundwater standards. Residents of those homes will join three other households now using bottled water supplied by Centerline Circuits Inc. Centerline Circuits, a Longmont company, operated in the area between 1968 and 1979, and used a solvent (TCA) which is known to eventually break down into chemicals which include DCE, the contaminant found in the wells. Officials believe the households may have to agree to be annexed by the city of Boulder in order to obtain city water.

*Grand Junction Daily Sentinel 9/6/92*

### Possible Fines For Sewage Spill

Grand Junction and Mesa County could be fined as much as \$20,000 for dumping 1.5 million gallons of raw sewage this

spring into the Colorado River from the Persigo Wastewater Treatment plant. The 1.5 million gallons represents .05 percent of the total flow in the river at that period. City officials told the health department that at 7 p.m. May 14 a raw sewage pump shut down. Sewage could not flow in the normal fashion so it filled and overflowed a wet well and then flowed down a storm sewer into Persigo Wash. Under normal conditions an alarm is triggered causing an auto-dialer to establish telephone contact with the plant operator. The plant operator didn't discover the spill until arriving at work at 6 a.m. May 15. The Water Quality Control Commission will decide by mid-October whether to fine the city.

*Grand Junction Daily Sentinel 9/13/92*

### Sewage Checks Stepped Up

Recent discoveries of dead fish down-stream from Cripple Creek have caused Division of Wildlife officials to survey the stream segment south of town. No live fish were found in that area, and officials are unsure if sewage is to blame. Construction activity caused by the advent of gambling also has muddied the water. Samples taken Aug. 7 showed that the stream had high levels of untreated fecal bacteria and that the town's sewage treatment plant has, at times, poured more sewage into the stream than its permit allows. The crush of gamblers in Cripple Creek has forced the town to take in more sewage than its plant was designed to handle. The violations could draw fines and other penalties as severe as a ban on new construction.

*Colorado Springs Gazette Telegraph 9/1/92*

### Trout Kill Investigated

Officials are trying to determine what killed more than 1,000 trout in the Big Thompson River west of Loveland. The fish kill occurred in the same area where 975 trout died in October 1990. No cause was determined in the earlier kill. Loveland draws its drinking water from the river. The source of water was shut off on first report of the kill.

*Colorado Springs Gazette Telegraph 8/30/92*

### Raw Sewage Overflows Into Fountain Creek

About 1.5 million gallons of raw sewage spewed into Fountain Creek after a sewage line broke, forcing the city to shut down its wastewater pumps. Dennis Cafaro, city wastewater director, says the sewage poses no health threat to humans or to aquatic life in the creek. However, a senior fishery biologist with the Colorado Division of Wildlife said it could be at least a week before any effects from the spill can be detected. The division will monitor Fountain Creek from Colorado springs to Pueblo. Fountain Creek flows into the Arkansas River in Pueblo. Sewage flows to the pump station by gravity, and from there it must be pumped to the treatment plant. When the pumps were shut down, sewage still flowed into the pump station and there



was nowhere to send it except into the creek. City water officials have not determined what caused the break in the line.

Colorado Springs *Gazette Telegraph* 9/16/92

### Colorado Gambling Towns Flooded With Extra Sewage

Colorado Health Department officials say that sewage plants in Cripple Creek, Black Hawk and Central City are filled to capacity and probably are violating state pollution discharge limits. A test in Cripple Creek showed the local sewage plant was discharging partially treated effluent that was three times dirtier than the state standard. The Black Hawk-Central City Sanitation District is considering sewage plant expansions that will cost at least \$1 million.

Grand Junction *Daily Sentinel* 8/20/92

## WILDERNESS

### Wilderness Bill Clears House

The House voted to set aside another 670,900 acres in Colorado as federally protected wilderness despite objections by Coloradans and other Western lawmakers to a provision that would give the federal government water rights in the 22 designated areas. The Senate passed a virtually identical bill last year but with no implied or expressed reservation of water for what would be the new areas to be protected from virtually all commercial or recreational development. However, House Interior Chairman George Miller, D-Calif., and the chairman of its parks subcommittee, Rep. Bruce Vento, D-Minn., insisted on language giving the federal government some water rights. Vento said the provision would make federal rights secondary to the existing water rights now held by Colorado and downstream users--Wyoming, New Mexico, Arizona, Utah, Nevada, California and Mexico. Ben Nighthorse Campbell, D-Colo., allowed Vento and Miller to amend the bill in a last ditch effort to get it signed into law but with the hope that lawmakers will agree on a compromise closer to the Senate version.

Montrose *Daily Press* 9/15/92

## PEOPLE

### Campbell, Considine Agree on Water Issues

U.S. Senate candidates Ben Nighthorse Campbell and Terry Considine appeared before the Colorado Water Congress and showed they agree on several water issues. Campbell has sided with the Water Congress on several issues. He favors the \$680 million Animas-La Plata water project. His bill on Colorado wilderness does not contain special water rights for wilderness. He also has vigorously pursued funding for a handful of other small water projects in his congressional district. Considine did not criticize much of Campbell's record on water issues, other

than to mention his opponent's one-time opposition to Denver's Two Forks project.

Grand Junction *Daily Sentinel* 8/30/92

### Attorney Takes Water Board Seat

Bill Brown, a Fort Collins attorney who specializes in water issues, has been appointed to the board of directors of the Northern Colorado Water Conservancy District. He replaces John Moore, a Larimer County farmer who held a board seat for 32 years. Brown will represent Larimer County. Brown is lead counsel for the Big Thompson Water Users Association. His firm represents dozens of water users throughout the region. Brown was appointed to the seat by Larimer County District Court Judge John David-Sullivan.

Fort Collins *Coloradoan* 9/22/92

## CONSERVATION

### Glenwood Considers Protecting River

Glenwood Springs city officials want to stop decades of dumping that has, in spots, destroyed the lush vegetation that overhangs the Roaring Fork River as it flows through town. City officials are also debating how to control riverbank development in a way that balances property rights and river protection. At one location, a culvert runs storm drainage into the river from a subdivision. In another, the bank is littered with huge chunks of broken-up concrete blocks and asphalt rubble.

Grand Junction *Daily Sentinel* 9/15/92

## RECREATION

### Forest Service To Hold Series of Meetings On Picket Wire Canyonlands

The U.S. Forest Service, which received an 11,500-acre tract along the Purgatoire River last year from the Army, held a series of open houses from Sept. 21 to 26. There was an informal presentation on the canyon and specialists were available to answer questions. The Forest Service also will accept written and oral comments on how the area should be managed. The canyonlands contain the world's longest continuous dinosaur tracks, ancient petroglyphs etched into rock, and remnants of an Hispanic culture from the last century. Congressional legislation authorizing the transfer called for the "long-term conservation of resources for public enjoyment and education as well as scientific endeavors," and rules out commercial ventures such as mineral leasing, water projects, or timber sales. It may take a year before the plan is complete and environmental studies begin.

Colorado Springs *Gazette Telegraph* 9/24/92



### Ramah Reservoir May Get Second Life

The Ramah Reservoir in eastern El Paso county was originally a state park with a pavilion, picnic tables, camp trailer hookups, and running water for showers and toilets. Now the 100-acre parcel of land and water is waist-deep in weeds and brush. The reservoir supports only a small fish population, and litter dots the shoreline. The dam was built in 1963 by the state Department of Agriculture to control flood water. But major floods rarely occur, and the small springs in the area are often not enough to maintain the lake, which has been known to go dry in some years. This inconsistency prompted the Division of Parks and Recreation to give the land to the Division of Wildlife in the late 1970s, turning it from a well-maintained park into an unmaintained state wildlife area. The El Paso County Farm Bureau is one of several groups that have banded together to find a way to turn the reservoir into a park again. Proponents feel a park would enhance economic development in an area where farming, the primary industry, is declining.

Colorado Springs *Gazette Telegraph* 9/7/92

### WATER ALLOCATION

#### Judge Blocks Water Diversion

A state water judge has blocked a decision allowing the Aspen Skiing Co. to divert water from Snowmass Creek for snow-making, while a lawsuit challenging the decision is settled. District Judge Robert Kinsley of Denver issued a temporary restraining order blocking the Colorado Water Conservation Board's decision to reduce minimum streamflows in the creek. Two Aspen-area environmental groups sued the board, saying the reduction could damage the creek. The Colorado Water Conservation Board voted to reduce the minimum flow in Snowmass Creek during the winter from 12 cubic feet per second (cfs) to 7 cfs.

Montrose *Daily Press* 9/29/92

### MISCELLANEOUS

#### Gunnison Flow Patterns Set

During September, flows through the Black Canyon of the Gunnison National Monument and the Gunnison Gorge should

average around 600 cubic feet per second (cfs); however, for one to three days in September-early October flows of 300 cfs may occur to facilitate research studies by the National Park Service. Flows will be lowered to around 500 cfs for the October through December period. The flows are regulated by the upstream Wayne N. Aspinall Unit which consists of Blue Mesa, Morrow Point, and Crystal Reservoirs. The flows follow a spring runoff that was only 68 percent of normal. It is anticipated that Blue Mesa Reservoir will be drawn down to an elevation of 7,490 feet (29 feet below capacity) by December.

Montrose *Daily Press* 9/8/92

#### State Seeks Computer to Log Water

Colorado is stepping into the computer age to shore up arguments in anticipation of potential court battles over the state's share of Colorado River water. Both Gov. Roy Romer and the state legislature, in dealings with California and Kansas, found that data on use of Colorado River water within the state is not readily available. Litigation with Kansas over Arkansas River water has cost Colorado taxpayers \$10 million. Most of that money was spent collecting data. The State Legislature last year allocated \$90,000 for a feasibility study to determine if such a compilation is possible. The computer system, at a taxpayer price tag of \$3 million, would catalog water use in even the smallest farms and ditches in the state. The state engineer is developing the project with the Colorado Water Conservation Board. The firm of Dames & Moore is serving as project coordinator. The Legislature will decide in December if the project should be funded.

Grand Junction *Daily Sentinel* 9/11/92

#### Nature Conservancy Opens Field Office

The Associated Press reports that The Nature Conservancy has opened a field office in Steamboat Springs. Mark Burget of The Conservancy said the group wants to preserve forests near the Yampa River, the last major undammed river in the Colorado River Basin.

Source: *Grand Junction Daily Sentinel*, 9/30/92

### MEETING CALENDAR

- |            |  |
|------------|--|
| Oct. 14-16 | <b>WATERSHED RESOURCES - BALANCING ENVIRONMENTAL, SOCIAL, POLITICAL &amp; ECONOMIC FACTORS IN LARGE BASINS</b> , Portland, OR. Contact: College of Forestry, Beavy Hall 202, Oregon State University, Corvallis, OR 97331; Phone 503/737-2329. |
| Oct. 16-18 | <b>ETHICS FOR THE NEW WEST - AN AGENDA FOR SHARING OUR COMMON GROUND</b> , Steamboat Springs, CO. Contact: Environment 2000, P.O. Box 774822, Steamboat Springs, CO 80477, 303/870-7575.   |
| Oct. 22-23 | <b>TOTAL QUALITY ENVIRONMENTAL MANAGEMENT</b> - 6th annual Colorado Hazardous Waste Management Society Conference and Exhibition, Denver, CO.  |



- Oct. 23 **AGRICULTURAL WATER QUALITY: THE NEW RULES OF THE GAME**, Greeley, CO. Contact: Cooperative Extension, Colorado State University, Administration Bldg., Fort Collins, CO, 80523, Phone: 303/491-6281.
- Oct. 30 **1992 ANNUAL WATER LAW AND POLICY CONFERENCE: MOVING WATER IN COLORADO**, University of Denver College of Law. Contact: Institute for Advanced Legal Studies, University of Denver College of Law, 7039 E. 18th Ave., Denver, CO 80220, Phone 303/871-6118.
- Oct. 30-31 **NONPOINT SOURCE WATER POLLUTION: CAUSES, CONSEQUENCES AND CURES** - Contact: NCALRI, School of Law, University of Arkansas, Fayetteville, AR 72701, Phone: 501/575-7646, FAX 501/575-5380.
- Nov. 1-5 **28TH ANNUAL AWRA INTERNATIONAL CONFERENCE & SYMPOSIUM ON MANAGING WATER RESOURCES DURING GLOBAL CHANGE**, Reno, NV. Contact: AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; Phone 301/493-8600.
- Nov. 11-13 **COLORADO NATURAL HAZARDS MITIGATION COUNCIL Fall Meetings and Workshops**, Durango, CO. Contact: Bob Kistner at 303/273-1779; FAX 303/273-1795.
- Nov. 15-19 **19TH ANNUAL AWWA WATER QUALITY TECHNICAL CONFERENCE AND EXHIBITION**, Toronto, Canada. Contact the AWWA at 303/794-7711.
- Jan. 6-8 **1993 ANNUAL MEETING OF FOUR STATES IRRIGATION COUNCIL**, Fort Collins, CO. Contact: Rich Johansen at 402/466-9517.
- Feb. 4-6 **MANAGING RIPARIAN AREAS: COMMON THREADS AND SHARED BENEFITS**, Albuquerque, NM. Contact: Water Resources Research Center, University of Arizona, 350 N. Campbell, Tucson, AZ 85721, 602/792-9591.

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