

Colorado Water

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

💧 WATER ITEMS AND ISSUES . . .

February 1997

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The Colorado Section of the
American Water Resources Association
announces a second symposium on
**WATERSHED PLANNING
AND MANAGEMENT**
March 14, 1997 . . . see page 31

*Eric Wilkinson, Manager of the Northern
Colorado Water Conservancy District,
receiving award from Bureau of
Reclamation Commissioner Eluid
Martinez – see page 25*



REAUTHORIZATION REQUEST

Editorial by Robert C. Ward, Director

The Colorado Water Resources Research Institute (CWRRRI) is authorized by both Congress and the Colorado Legislature. This is unusual for a university center or institute, and in my opinion, reflects the importance of the interface between higher education and water management. CWRRRI, by seeking reauthorization at both the federal and state level, welcomes the continued accountability, oversight and approval involved in the reauthorization process.

The national water institute program was reauthorized by Congress in May, 1996. Colorado legislative authorization for CWRRRI expires on July 1, 1997. House Bill No. 97-1218, introduced by Rep. Steve Johnson of Fort Collins, provides for the reauthorization of CWRRRI until 2007. The bill also establishes a new advisory committee for CWRRRI. During the 1997 session of the Colorado Legislature, CWRRRI will seek the support of the entire Colorado water community in its efforts to obtain reauthorization.

CWRRRI seeks legislative reauthorization because:

- The interface between higher education and water users/managers is important to the state. Legislative authorization of CWRRRI provides the basis for this interface and collaborative efforts.
- Legislative authorization raises the visibility of CWRRRI to a level, within Colorado, that attracts the cooperation of both water users/managers and higher-education faculty.
- Authorization provides a vehicle to form a representative, advisory committee with authority and power to utilize higher education's water expertise to the benefit of Colorado.
- Authorization provides the Director of CWRRRI with real-world relevancy to work closely with water users/managers (a university center/institute that is accountable to the public via the authorization process).

A reauthorized CWRRRI will operate with a formally established and operated "advisory" committee. Quotations are used because the committee will be more of a partner in establishing research and education priorities as well as in the actual conduct of future water research projects. This model has been tested by CWRRRI over the past three years and has proven to greatly enhance faculty and water manager interaction. It also results in the ready acceptance

and utilization of research results for water management decisionmaking.

CWRRRI has used its limited resources to address prioritized water resources issues in Colorado. It has served as a vehicle to focus the efforts of the water community and university researchers. The Institute activities also serve as a vehicle to train students in the complexities of water resources management. Your support to reauthorize CWRRRI will allow continuation of this important effort.

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January 1997

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Robert C. Ward, Director



RESEARCH OPPORTUNITIES

The Fund for Rural America guidelines for proposal preparation and submission are now available on the USDA homepage. To access the 23-page document, use the following URL:

<http://www.usda.gov/whatsnew.htm>

**WATER RESOURCES COMPETITIVE GRANTS PROGRAM, WESTERN REGION**

CWRRI Deadline: March 17, 1997

Editor's note: The State Water Institutes Program will operate for Fiscal Year 1997 as it did in FY1996 — with a Regional Water Resources Competitive Grants Program. The issuance of RFAs under this program is the responsibility of a "lead" Water Resources Research Institute or Center in each of four geographic areas of the United States. The lead institute for the Western Region is the Wyoming Water Resources Center. Here is information as it was received from the Wyoming Water Resources Center.

This Request for Applications (RFA) is issued as part of the programs under the Water Resources Research Act (P.L. 104-147) administered by the U.S. Department of the Interior through the Water Resources Division of the U.S. Geological Survey.

ELIGIBILITY: Awards are available only to Water Research Institutes or Centers in the Western Region (AK, AZ, CA, CO, ID, NM, NV, OK, OR, TX, UT, WA, WY) established at a college or university pursuant to the provisions of Section 104 of the Water Resources Research Act and 30 CFR Part 401.

Investigators not a part of the aforementioned Institutes or Centers must submit their application through an Institute or Center at the University where said Institutes or Centers are located (in Colorado, the Colorado Water Resources Research Institute at Colorado State University). All applications must be submitted to the lead institute **BY AN ELIGIBLE INSTITUTE OR CENTER** in the Western Region. All proposals under this solicitation must involve substantive collaboration among at least two or more states in the Western Region. Applications involving only investigators from a single state will not be considered.

FUNDS: Approximately \$800,000 for the Western Region. Proposed projects should be 1-3 years in duration and not request total federal funds exceeding \$350,000 per project. **EACH INSTITUTE'S APPLICANTS SHALL MATCH EACH FEDERAL DOLLAR PROVIDED TO SUPPORT EACH PROPOSED PROJECT WITH NOT LESS THAN TWO NON-FEDERAL DOLLARS.**

Research proposals submitted under this RFA are generally intended to address water resources problems of regional or multi-state significance. Illustrative examples of research topics are:

Ecosystem Approaches to Managing Riparian Areas in the Western United States
Reassessing Salinity Management Policy
Improving Decisions for Managing Major River Systems in the Western United States



Impacts of Incremental Institutional Reforms for Drought Management of Western Water Resources
 River Basin Level Nonpoint Source Pollution Control
 Native American Water Rights Issues
 Water Quality Impacts of Confined Animal Production Activities
 Water Conservation and Artificial Recharge of Aquifers
 Water Quality Problems Associated with Oil and Natural Gas Exploration and Development
 Institutional Infrastructure Changes for Holistic Water Management
 Impacts of Air Pollution on Recharge and Quality of Surface Water and Ground Water Supplies
 Evaluating Conservation Programs
 Flood Frequency Forecasting
 Effects of Urbanization on Floods and Water Quality
 Water Reuse
 Hydroclimatic Variation

CWRRI APPLICATION DUE DATE: March 17, 1997.

SUBMIT TO: ROBERT C. WARD, DIRECTOR
 COLORADO WATER RESOURCES RESEARCH INSTITUTE
 410N UNIVERSITY SERVICES CENTER
 COLORADO STATE UNIVERSITY
 FORT COLLINS, CO 80523

Proposals will be processed by CWRRI and CSU's Office of Sponsored Programs for submission to the lead institute for the Western Region, the Wyoming Water Resources Center. The Wyoming Center will coordinate proposal evaluation by: (1) written peer reviews (at least 3 qualified scientists or managers in the area of the proposed research) and (2) a selection panel consisting of 5 or more Institute directors from the Western Region and at least one USGS employee as an ex officio member. The following criteria will be used: 20 points — relevance and importance; 50 points — scientific merit; 10 points — feasibility; 10 points — technology transfer; and 10 points — qualifications of the investigators and budget (is it reasonable and adequate?).

AWARDS: All awards will have a preferred start date of September 1, 1997 and must start no later than September 30, 1997. COMPLETE INSTRUCTIONS ARE AVAILABLE ON THE WORLDWIDE WEB AT <http://www.wwrc.uwyo.edu/>. OR CONTACT CWRRI OR YOUR CONTRACTS AND GRANTS OFFICE.

ENVIRONMENTAL JUSTICE REGIONAL PROGRAM

In its 1992 report, Environmental Equity: Reducing Risk for All Communities, the Environmental Protection Agency found that minority and low-income populations may experience higher than average exposure to toxic pollutants than the general population. The Office of Environmental Justice (OEJ) was established in 1992 to...implement environmental awareness and training programs for affected residents, and to work with these groups to devise strategies for environmental improvement. EPA has established four types of grant program resources to address environmental justice issues:

FY 97 SMALL GRANTS PROGRAM APPLICATION GUIDANCE: APPLICATIONS DUE MARCH 7, 1997 to Patricia Denham (8ENF-EJ), USEPA, 999 18th Street, Suite 500, Denver, Colorado, 80202-2466. If you have questions, contact Patricia Denham at 1-800/227-8917 or 303/312-6557; or Nancy Reish at 1-800/227-8917 or 303-312-6070.

FY 97 COMMUNITY/UNIVERSITY PARTNERSHIP GRANTS PROGRAM APPLICATION GUIDANCE: COMPLETED APPLICATIONS DUE MARCH 7, 1997 TO USEPA, OFFICE OF ENVIRONMENTAL JUSTICE, MAILCODE 2201-A, ENVIRONMENTAL JUSTICE COMMUNITY/UNIVERSITY PARTNERSHIP GRANTS, 401 M STREET S.W., WASHINGTON, D.C., 20460. If you have questions, contact Mustafa Ali at 202/564-2606 or Danny Gogal at 202/546-2576.



WATER RESEARCH



SIMULATION OF NITRATES IN A REGIONAL SUBSURFACE SYSTEM: LINKING SURFACE MANAGEMENT WITH GROUNDWATER QUALITY

by Freeman Smith

Where irrigation areas are in direct hydraulic communication with aquifers, spatially and temporally varying nitrate concentrations in groundwater occur. A better understanding of the relationship between land surface management and these variable nitrate concentrations was needed to address contamination concerns. For his dissertation research, graduate research assistant Maurice Hall developed a physical/chemical-based modeling methodology to simulate the spatial/temporal distribution of nitrate in groundwater and help clarify the connection between land surface management and groundwater quality. Hall developed the methodology with available knowledge of agricultural practices, soils, aquifer properties, and current modeling software.

The region chosen to develop and test the modeling methodology was a 14,000 ha predominantly irrigated agricultural area of the South Platte River alluvial aquifer in eastern Colorado. The complexities of the hydrologic system and the vagaries of the agricultural information presented great challenges for simplifying the system to a level commensurate with the information available while maintaining the detail necessary to simulate spatial/temporal variability with acceptable agreement to observed nitrate concentrations in the groundwater.

Hall's research approach was to synthesize knowledge of agricultural practices, soils, and aquifer properties and to create geographical information system databases to interface three existing models, listed below, with the Geographic Resource Analysis Support System (GRASS):

- the Nitrate Leaching and Economic Analysis Package (NLEAP);
- the Modular Three-Dimensional Finite Difference Groundwater Flow Model (MODFLOW); and
- the Modular Transport in Three Dimensions (MT3D) model.

Nitrate leaching simulations were conducted on an event-by-event basis to capture the pulse-leaching characteristic of irrigated systems. For the groundwater flow and transport simulations, the delta-time output resolution of the simulation was four months (irrigation) and eight months (non-irrigation) with a time horizon of 60 years. The delta-space output resolution was 28.5 m x 28.5 m for the leaching simulations, and 285 m x 285 m for the groundwater simulations. The space horizon was 14,000 ha. Obviously, since each model used different time and space steps during solution, a problem Hall solved was the time/space weighting/averaging required for the three models to share information.

The challenge was not using the models and the GIS independently, but creating the spatial/temporal databases for input information required for each model and creating the dynamic interfaces of the driving variables that were shared among the models. By strategically simplifying the complexity of the system, retaining the essential characteristics of the system behavior, and carefully making conservative assumptions, he was clearly successful in simulating the spatial/temporal variation of nitrate concentration in the aquifer.

Input information came from many sources, including: prior investigations, maps, questionnaires, remotely sensed imagery, interviews and field observations. Soil types (40), crops (8), crop rotations (15), irrigation practices (2) and fertilization types (2) had to be simplified to a representative set of 185 unique combinations. Information about sources of nitrate input from land application of animal wastes was particularly difficult to quantify.

Aquifer properties were based on prior studies and careful adjustment. Pumping rates from 221 wells were nonexistent and had to be synthesized from related information and reasonable assumptions. For model validation, nitrate concentration in groundwater from 71 wells had to be interpolated with caution. Hall's challenge was to successfully formulate, integrate and spatially distribute disparate existing information. The validation of his simulation



provided acceptable agreement with the (observed) spatial distribution of nitrate in the aquifer. In addition, his results included (unobserved) scenarios of the development and persistence of nitrate concentration "hot spots" through time and also how changing agricultural (manuring) and pumping practices could reduce nitrate concentrations in the groundwater.

The validated modeling system provides mechanistic support for a number of previously offered hypotheses and offers clarification on some heretofore misunderstood aspects of the system behavior. Important findings and conclusions of the work support the following:

- denitrification is not a major factor in determining the overall nitrate concentration in the aquifer;
- application of animal wastes is the primary management factor contributing to the areas of most extreme nitrate concentrations;
- disruption of regional groundwater flow by intense pumping allows buildup of isolated "islands" of high nitrate concentrations;
- significant improvement of nitrate concentrations in groundwater is likely to lag behind implementation of improved management by 20 to 30 years; and
- even with drastic management improvements, nitrate concentrations in large areas of the aquifer are likely to remain above the recommended maximum contaminant level (for drinking water) for more than 50 years.

Maurice Hall was awarded a U.S. Department of Agriculture National Needs Fellowship for his doctoral program at Colorado State University. Freeman Smith, Department of Earth Resources, Colorado State University, was Hall's adviser. His co-adviser was Marvin Shaffer, a USDA/Agricultural Research Service scientist. Hall was a graduate research assistant on the CWRRI project "Use of GIS Modeling Techniques as a Planning Tool for Establishment of Wetlands as Nitrate and Pesticide Removal Facilities," which was conducted in cooperation with the USDA/Agricultural Research Service. Hall is currently an Assistant Professor in the Department of Geology at Radford University, Radford, Virginia.



DECISION SUPPORT SYSTEM PLANNED FOR REGIONAL WATER QUANTITY/QUALITY EVALUATION OF BEST MANAGEMENT PRACTICES IN IRRIGATED AGRICULTURE

by Laurie Schmidt

A joint research team has been granted funding by the Colorado State University Agricultural Experiment Station to expand the existing MODSIMQ, an integrated water quantity/quality river basin management model, to include a decision support system (DSS). MODSIMQ, a model previously developed in a project at Colorado State University supported by the Agricultural Experiment Station, has the ability to optimally allocate water based on administrative priorities, water rights, or other factors such as economic evaluation. However, it is currently lacking a DSS that would allow for the simultaneous assessment of water quantity/quality impacts and analysis of the effects of improved irrigation practices on total river flows, water quality, and water rights.

Roughly 95 percent of all water usage in the state of Colorado stems from irrigated crop production, with 3.2 million acres currently under irrigation. Although much of the water used in irrigation eventually returns to the river to be available to downstream users, these return flows can have adverse effects on water quality in streams and alluvial aquifers. Inefficient irrigation methods can result in the transportation of salts, pesticides, nutrients, and sediments into water supplies.

By far one of the most serious threats to water quality is soil salinization caused by poor water management practices. Rising saline water tables can also seriously damage formerly productive lands. Repeated diversion and reuse of irrigation drainage





John Labadie explains his recently funded project at Arkansas Valley Forum, Jan. 23

results in on-site and downstream salinity degradation in most river basins.

Farmers and water managers in Colorado's Arkansas River Valley are currently facing severe problems related to salinization. According to Jim Valliant, Regional Irrigation Specialist, Arkansas River Basin, Cooperative Extension, the Arkansas River Valley is experiencing significant yield loss in some areas and complete loss of the land for crop production in other areas due to saline high water tables. "This yield and land loss is due, in my opinion, to the irrigation water management in the river, on the canals and in the fields," he said.

Policy makers and administrators alike are struggling to find solutions to water quality and quantity problems that are effective, profitable, and socially acceptable. A more environmentally-sensitive public is demanding improvements in the conservation of water quality and quantity. However, in order for a policy to be effective, all impacts of the policy must be predicted before it is instituted. These impacts must be assessed at both the local scale and the regional, or basin wide, scale. Analyzing complex river basins such as the Arkansas River Valley requires a comprehensive river basin flow and water rights simulation model.

The purpose of the current research is to improve on certain key features of MODSIMQ in order to develop a comprehensive DSS. The proposed DSS will be applied to the Arkansas River Valley and will serve as a demonstration case study. This application will allow evaluation of a wide range of water management strategies, with full inclusion of complex water rights, exchanges, river administration, and interstate compact agreements.

The interdisciplinary investigation will be led by four investigators from Colorado State University: John Labadie, water resources engineer; Tim Gates, civil engineer specializing in irrigation and water management; Israel Broner, agricultural engineer; and Grant Cardon, crop and soil scientist. These scientists and engineers will work cooperatively to guide the research of M.S. and Ph.D-level graduate research assistants. In addition, water user organizations such as the Southeast Colorado Water Conservation District and the Natural Resources Conservation Service will be involved in the technology transfer portion of the project

The proposed research includes the following tasks:

- Extend MODSIMQ into a comprehensive DSS, including the development of an object-oriented graphical user interface and data base management tools
- Fine tune and calibrate MODSIMQ to simulate the lower Arkansas River system in Colorado
- Establish typical irrigation efficiencies for different irrigation methods and practices in the Arkansas River Basin
- Correlate water table depth, aquifer salinity, and soil-water salinity with estimates of the impacts of agricultural water conservation practices on agricultural producers and other water users throughout the Arkansas River Basin

The products of the research should be useful to the Southeast Water Conservation District, the Colorado Division of Water Resources, the Arkansas Valley Coordinating Committee, the U.S. Bureau of Reclamation, the Natural Resources Conservation Service, and various well user associations and municipalities in the Arkansas River Valley.



Valliant expressed his confidence in the project, saying, "I have had an opportunity to work with the decision support systems in irrigation and nutrient management, and I am

excited about the potential that the Integrated River Basin Water Quantity/Quality Model offers for more effective management of river basin waters."

Previous research that led to the development of MODSIMQ was funded through the Colorado Water Resources Research Institute through U.S. Geological Survey Grant 14-08-0001-G2008/2.



GASP BOARD APPROVES PARTICIPATION IN SOUTH PLATTE MODEL EVALUATION PROJECT

The board of directors of the Groundwater Appropriators of the South Platte (GASP) met on January 7, 1997 in Ft. Morgan. In addition to the GASP board members, John Altenhofen and Brad Wind (Northern Colorado Water Conservancy District), and Robert Ward and Luis Garcia from Colorado State University attended. Along with other business, Brad Wind presented some preliminary calculations of pumping depletions in the last four reaches of the South Platte, and Luis Garcia presented preliminary GIS well location data.

Jack Odor, John Altenhofen, Brad Wind, and Luis Garcia have been participating in a joint data and tool development effort with representatives from the State Engineer's Office, the Central Colorado Water Conservancy District, and the Colorado Division of Water Resources.



Brad Wind, Luis Garcia and Jack Odor following the GASP Board meeting in Fort Morgan

This group was formed to coordinate data development efforts and evaluate analysis tools that can be used to better manage water use in the basin. Analysis tools for organizing and verifying data in a common and maintainable environment and tools for computing water balances and consumptive use were identified as part of this process.

At the GASP meeting, John Altenhofen and Luis Garcia presented new proposals for computer tools that are required for these efforts; specifically, the purchase of satellite images for water district 64 (used for determining preliminary field boundaries and crop types) and efforts toward analysis tool development. The board approved the participation of GASP in both efforts.





WATER RESEARCH AWARDS

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

Colorado State University, Fort Collins, CO 80523

- Survey of Western States Sediment Standards, John D. Stednick, Earth Resources. Sponsor: Colorado Dept. of Public Health & Environment.
- *Cutthroat Trout Genetics, Robert P. Ellis, Microbiology. Sponsor: Colorado Division of Wildlife.
- Upper South Platte River Basin - Classification of Riparian Areas, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources.
- Summit County Wetlands/Riparian Area Inventory, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources.
- *Reclamation Plan for Summitville Super Fund Site, Edward F. Redente, Rangeland Ecosystem Science. Sponsor: Colorado Dept of Public Health & Environment.
- *Summitville Mine Site CERCLA Investigation—Livestock & Waterfowl Risk Management, William A. Alldredge, Fishery & Wildlife Biology. Sponsor: Colorado Dept Public Health & Environment.
- *Stress Factors in Whirling Disease, Eric P. Bergersen, Cooperative Fish & Wildlife Research. Sponsor: Colorado Division of Wildlife.
- *Evaluation of the Acid-buffering Capacity & Metal Mobility of Southwest San Luis Valley..., Grant E. Cardon, Soil & Crop Sciences. Sponsor: Colorado Dept Public Health & Environment.
- *Population Genetics of Colorado Fishes, Robert P. Ellis, Microbiology. Sponsor: Colorado Division of Wildlife.
- Developing a Classification of Colorado Wetlands for Use in Functional Evaluation, David J. Cooper, Fishery & Wildlife Biology. Sponsor: Colorado Department of Natural Resources.
- Ecological Modeling in Support of County Decision Making (GIS), N. Thompson Hobbs, Natural Resource Ecology Lab. Sponsor: Colorado Division of Wildlife.
- *Arkansas River Water Quality, John D. Stednick, Earth Resources. Sponsor: Colorado Division of Wildlife.
- Lab Analysis to Determine the Extent of Whirling Disease in Colorado, Stephen A. Flickinger, Fishery & Wildlife Biology. Sponsor: Colorado Division of Wildlife.
- Aquatic Toxicology Research, John D. Stednick, Earth Resources. Sponsor: Colorado Division of Wildlife.
- *Methodologies for Design of Soil Covers for Waste Disposal Sites, Steven R. Abt, Civil Engineering. Sponsor: Nuclear Regulatory Commission.
- Flow Prediction for Crater Lake National Park, Jose D. Salas, Civil Engineering. Sponsor: DOI-NPS-National Park Service.
- *Stream Water Quality Modeling Technology Development, Luis Garcia, Chemical & Bioresource Engineering. Sponsor: DOI Bureau of Reclamation.
- Effects of Four Electrofishing Currents on Captive Subadult Colorado Squawfish, Robert T. Muth, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.
- Partitioning of Ecosystem Respiration & Vectors of Water Loss: An Analysis Using S13C..., Eugene F. Kelly, Soil & Crop Sciences. Sponsor: National Aeronautics & Space Admin.
- Water Vapor in the Climate System, Graeme L. Stephens, Atmospheric Science. Sponsor: National Aeronautics & Space Admin.
- *Upgrading Cropflex to Windows, Israel Broner, Chemical & Bioresource Engineering. Sponsor: USDA-Agricultural Conservation Program.
- Quantifying the Change in Greenhouse Gas Emissions Due to Natural Resource Conservation..., Keith H. Paustian, Natural Resource Ecology Lab. Sponsor: USDA-NRCS-Natural Resources Conservation Service.
- *The National Atmospheric Deposition Program (NRSP-3), David M. Swift, Natural Resource Ecology Lab. Sponsor: USDA-CSRS-Coop. States Research Service.
- *Nitrogen Management Under Conservation Tillage in a Furrow-Irrigated Cropping System..., Calvin H. Pearson, Western Slope - Fruita. Sponsor: Centro Intern. De Agricultura Tropical.
- Coping with Prolonged & Severe Drought in the Rio Grande River Basin, Marshall Frasier, Agricultural & Resource Economics. Sponsor: New Mexico State University/USGS.
- *Interdisciplinary Approaches to Identification & Mitigation of NPS Water Quality Impacts, John D. Stednick, Earth Resources. Sponsor: University of Wyoming.
- Karst Hydrology in the Humid Tropical Environments, John D. Stednick, Earth Resources. Sponsor: National Science Foundation.
- Land Use & Climate Change Impacts on Carbon Fluxes (LUCCI), Dennis Ojima, Natural Resource Ecology Lab. Sponsor: University of Nebraska..



- Application of Statistical Dynamical Water Balance Model to Regional Scale..., Jorge A. Ramirez, Civil Engineering. Sponsor: Tulane University.
- *Colorado State-wide Riparian Inventory & Classification, Christopher A. Pague, Fishery & Wildlife Biology. Sponsor: DOI-Bureau of Reclamation.
- *Water Blend Basin Model, Steve Abt, Civil Engineering. Sponsor: Denver Water.
- *Sediment at Westlake Lake, James F. Ruff, Civil Engineering. Sponsor: Ventura County, California.
- *National Atmospheric Deposition Program - 1996-1997, David M. Swift, Natural Resource Ecology Lab. Various "Non-Profit" Sponsors.
- Mercury Deposition Network: A Subnetwork of the National Atmospheric Deposition Program, David M. Swift, Natural Resource Ecology Lab. Various "Non-Profit" Sponsors.
- *Validating Alternative Manure Management Systems, Reagan M. Waskom, Soil & Crop Sciences. Sponsor: American Farm Bureau Research Foundation.
- *Application of Sewage Sludge to Dryland Wheat, Kenneth A. Barbarick, Soil & Crop Sciences. Sponsor: City of Littleton.
- Development of an Integrated System of Flow Forecasting for the Maule R. Basin, Chile, Gustavo E. Diaz, Civil Engineering. Sponsor: Catholic University of Chile.
- Riparian Ecological Classification, Larry R. Rittenhouse, Rangeland Ecosystem Science. Sponsor: USDA-USFS-Forest Research.
- Range of Natural Variability Report of Playa Lakes, Larry Rittenhouse, Rangeland Ecosystem Science. Sponsor: USDA-USFS-Forest Research.
- *Developing Incidence Functions for Colorado River Cutthroat Trout: Determining the Risk..., Kurt D. Fausch, Fishery & Wildlife Biology. Sponsor: USDA-USFS-Rocky Mtn. Experiment Station.
- *Integrated Model for Optimization of Water Allocations, Gustavo E. Diaz, Civil Engineering. Sponsor: USDA-USFS-Rocky Mtn. Experiment Station.

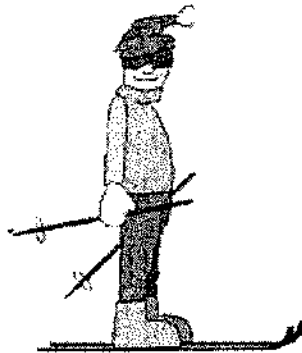
The University of Colorado, Boulder, CO 80309

- Land and Land-Use Change in the Climate-Sensitive High Plains: An Automated Approach with LANDSAT, Alexander Goetz, Cooperative Institute for Research in Environmental Sciences (CIRES). Sponsor: National Aeronautics & Space Admin. (NASA).
- Satellite Remote Sensing of Ecosystem Structural and Functional Change in Spatially Heterogeneous Regions, Carol Wessman, CIRES. Sponsor: NASA.
- El Nino Prediction Using Hueristic Algorithms, Peter Webster, Program in Atmospheric and Oceanic Sciences. Sponsor: NASA.
- Climate Change Vulnerability and Adaptation: Methodology Development, Application and Transfer, Kenneth Strzepek, Civil Engineering. Sponsor: Environmental Protection Agency (EPA).
- *Moving from Project to Area Management: A Series of Workshops for Bureau of Reclamation Area Managers, Elizabeth Rieke, Natural Resources Law Center. Sponsor: Bureau of Reclamation (USBR).
- *Calfed Bay Project, Elizabeth Rieke, Natural Resources Law Center. Sponsor: USBR.
- *Predicting Sediment Delivery and Stratigraphy on Marginal Slopes and Shelf Basins, James Syvitski, Institute of Arctic and Alpine Research. Sponsor: Department of the Navy.
- Agricultural Impacts of Global Agriculture: Integration of Remote Sensing and Biogeochemical Models for Trace Gas Assessments, William Emery, Aerospace Engineering. Sponsor: University of New Hampshire.
- Salt, Faults and Minibasins: Geometry, Evolution and Interaction, Mark Rowan, Geological Sciences. Sponsor: Various Oil Companies.
- Provide an Examination of Selected Watershed Management Case Studies Drawn from Initiatives Identified in the Watershed Source Book, Elizabeth Rieke, Natural Resources Law Center. Sponsor: Western Water Policy Review Commission.
- *Regional Atmosphere/Forest Exchange and Concentration of Carbon Dioxide, Peter Bakwin, CIRES. Sponsor: Tulane University.
- *The Influence of Elevated CO(2) and Climate Warming on Forest Non-Methane Hydrocarbon Emissions..., Russell Monson, Environmental, Population and Organismic Biology. Sponsor: Tulane University.
- *Effects of Climate Change in the Colorado Alpine: Ecosystem Response to Altered Snowpack and Rainfall Regimes, Timothy Seastedt, Institute of Arctic and Alpine Research. Sponsor: National Science Foundation.
- *Biodiversity of Open Space Grasslands at a Suburban/Agricultural Interface, Carl Bock, Environmental, Population and Organismic Biology. Sponsor: National Biological Survey.
- *Carbon Balance in Global Arid and Semiarid Lands, Carol Wessman, CIRES. Sponsor: Colorado State University.
- *TVA PRYSM Maintenance, Edith Zagona, CADSWES. Sponsor: Tennessee Valley Authority.

*Supplement to existing award.



WATER SUPPLY



Colorado has received generous amounts of snow so far this winter. The Natural Resources Conservation Service reports that the statewide snowpack averaged 160 percent of normal as of January 1. All seven major river basins in the state show above average snowpack, resulting in positive SWSI numbers in all seven basins. If the snowpack during the remaining portion of the winter maintains an above average value, 1997's water supply outlook for the southern mountains should be much better than last year's supply. Last year Colorado's southern mountains received well below normal snowpack which caused reduced spring runoff and summer stream flows, adversely impacting irrigators in that area.

Lower elevation reservoirs in the South Platte and Arkansas basins, and the reservoirs in the San Juan/Dolores basin which were depleted last summer, continue to be filled during the winter months. In contrast, the higher elevation reservoirs in the Colorado basin are being lowered to prepare for containing next spring's runoff.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA/SCS is used as an indicator of mountain-based 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-October).

During the summer period streamflow is the primary component in all basins except the South Platte, where reservoir storage is given the most weight. The following SWSI values were computed for each of the seven basins for January 1, 1997 and reflect conditions during the month of December.

Basin	Jan. 1, 1997 SWSI Value	Change From Previous Yr.	Change From Previous Yr.
South Platte	2.6	+1.1	-0.3
Arkansas	2.9	+1.3	+3.4
Rio Grande	2.0	-1.1	+5.5
Gunnison	3.7	+0.8	+6.0
Colorado	3.3	+0.7	+1.3
Yampa/White	3.1	-0.3	+3.8
San Juan/Dolores	2.3	-0.9	+5.0

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



CWRRI extends best wishes to its student interns Cindy Brady and Julie Eyre, who graduated in December. Cindy, from Steamboat Springs, and Julie, from Pagosa Springs, were Merit Work Study students at CWRRI for three years. They are both Chemical Engineering majors.

Liz Rewey and Laurie Schmidt began working part-time at CWRRI in January and have contributed to the February newsletter. Liz is an English major, and Laurie is working toward a Masters degree in Technical Journalism.



WATER PUBLICATIONS

CWRRI PUBLICATIONS

The following reports are available from the Cooperative Extension Resource Center, General Services Building, Colorado State University, Fort Collins, CO 80523. Phone 970/491-6198, FAX 970/491-2961.

Arkansas River Basin Water Forum, "A River of Dreams and Realities," Proceedings of the 1996 Arkansas River Basin Water Forum, January 3-4, 1996. Information Series No. 85. Price: TBA.

"Real World" INFILTRATION, Proceedings of the USDA-ARS Workshop, Pingree Park, Colorado, July 22-25, 1996. Information Series No. 86. Price: TBA.

U.S. GEOLOGICAL SURVEY REPORTS

Contact the U.S. Geological Survey, Earth Science Information Center, Open-File Reports Section, Box 25286, Mail Stop 517, Denver Federal Center, Denver, CO 80225 or call 303/236-7476.

Detailed Study of Selenium and Other Constituents in Water, Bottom Sediment, Soil, Alfalfa, and Biota Associated with Irrigation Drainage in the Uncompahgre Project Area and in the Grand Valley, West-Central Colorado, 1991-93, 1996, by David L. Butler, Winfield G. Wright, and Kathleen C. Stewart, U.S. Geological Survey; Barbara Campbell Osmundson and Richard P. Krueger, U. S. Fish and Wildlife Service; and Daniel W. Crabtree, Bureau of Reclamation. Water-Resources Investigations Report 96-4138.

Assessment of Metal Transport into and out of Terrace Reservoir, Conejos County, Colorado, April 1994 Through March 1995, 1996, by Sheryl Ferguson and Patrick Edelmann. Supersedes Interim Report Published in June 1996. Water-Resources Investigations Report 96-4151.

Water-Quality Assessment of the Rio Grande Valley, Colorado, New Mexico, and Texas-Shallow Ground-Water Quality of a Land-Use Area in the San Luis Valley, South-Central Colorado, 1993, 1996, by Scott K. Anderholm. Water-Resources Investigations Report 96-4144.

Trend Analysis of Selected Water-Quality Data Associated with Salinity-Control Projects in the Grand Valley, in the Lower Gunnison River Basin, and at Meeker Dome, Western Colorado, 1996, by David L. Butler. Water-Resources Investigations Report 95-4274.

OTHER WATER REPORTS

High Plains States Ground-water Demonstration

Program Interim Report, October 1996, by the U.S.

Bureau of Reclamation in cooperation with the U.S. Geological Survey, the Environmental Protection Agency, and the States of Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, Oklahoma, Oregon, South Dakota, Texas, Utah, and Washington.



In Colorado, the project involves the deep well injection (1,500 feet) of Denver Water Department potable surface water from Denver's transmountain supplies into the Arapahoe Aquifer via the sponsor's (Willows Water District) production well. The monitoring plan provides detailed information on the monitoring strategy, sampling locations, and other water quality and quantity aspects of the project. The project uses a Class V injection well as defined by EPA. Principal criteria monitored at the injection site are:

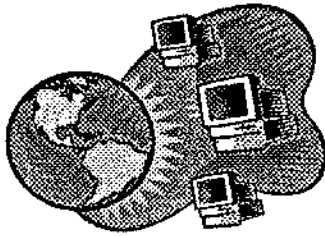
- injection flow rate
- injection run durations and the associated duration of pump cycles
- water level changes from injection and pumping with related evaluation of aquifer and well hydraulic characteristics
- sand production at the monitoring well due to injection
- comprehensive water quality monitoring of both the source water at the wellhead and the water pumped from a nearby monitoring well to evaluate water quality entering the well and aquifer and monitoring the subsequent chemical compatibility of the source water and the aquifer water.

Since both the injected water (treated Denver Water Board surface water) and the receiving aquifer (Arapahoe) have been used as public water supplies for many years, long-term primary and secondary drinking water analyses are available for both water sources. Groundwater quality data from 1981-1988 indicate that water quality is good near the proposed recharge site and meets primary and secondary drinking water standards. Baseline water quality data are being collected for both injected water and native groundwater.

The 1996 injection season commenced on February 21, 1996, and five injection runs/pump cycles have been conducted to date, with approximately 1,252 acre-feet of water injected.

For additional information contact Mr. Larry Tandeski, GP-2010, Bureau of Reclamation, Great Plains Region, PO Box 36900, Billings MT 59107-6900; Phone 406/247-7633.





WET SPOTS ON THE WEB

Find-Water Related Information Quickly and Easily!

by Liz Rewey

National Watershed Network— New partners include the Texas Hill Country Biopreserve, Consumnes River, CA, and the Cache River Biopreserve of Illinois. To apply to this network, contact their site

<http://ianrwww.unl.edu/ianr/pwp/>
<http://www.ctic.purdue.edu/kyw/kyw.html>

The Platte Watershed Program— This database pulls together more than 1,500 publications, reports and academic studies related to the Platte River Basin. Users can access bibliographic information from these sources.

<http://ianrwww.unl.edu/ianr/pwp/>

Tools for Drinking Water Protection— This interactive web site from the League of Women Voters offers information and registration for the March 19, 1997 interactive satellite video workshop of the same name.

<http://www.drinkingwater.org>

ELIPS (The Electronic Library of Interior Policies)— Provides instant access to Dept. of the Interior policies, replacing outdated paper distribution practices. This page also automatically tracks all changes, updates any references to those policies in existing material, updates the Table of Contents, and moves updated information to a retrievable archive.

<http://elips.doi.gov/>

Waterwiser - The Water Efficiency Clearinghouse— The Conservation Committee of the American Water Works Association established this clearinghouse to disseminate information about both urban and agricultural irrigation, as well as other aspects of urban water efficiency.

<http://www.waterwiser.org>

Nonpoint Education for Municipal Officials— NEMO is available on the Internet through the Cooperative Extension System at the University of Connecticut.

<http://www.lib.uconn.edu/CANR/ces/nemo/>

The Environmental Protection Agency has established a national hotline system for reporting or obtaining information about **waterborne cryptosporidiosis**: 1-800-424-8802. The Centers for Disease Control and Prevention has a web site offering information on cryptosporidiosis also:

<http://www.cdc.gov/ncidod/diseases/cryptosporidiosis/htm>

U.S. Geological Survey— "Water Use in the United States" is available to planners, managers, policy makers, and the general public. Topics on the site include a description of the USGS National Water-Use Information Program, a fact sheet describing water use in the United States, and the complete text of the report "Estimated Use of Water in the United States in 1990," USGS Circular 1081.

<http://h2o.usgs.gov/public/watuse/index.html>

Pollution Online— From the makers of Water Online comes a site for professionals in the pollution equipment and pollution control industry.

<http://www.pollutiononline.com/>

National Watershed Award Winners— Four voluntary, nongovernmental partnerships have been named National Watershed Award Winners for their outstanding efforts to protect the water quality of America's watersheds. See the Terrene Institute's website.

<http://www.terrene.org/index.htm>



Hardship Grants Program— Copies of the guidelines for rural communities are available from the State Revolving Fund Program at their website:

<http://www.epa.gov/OWM/hardship.html>

National Small Flows Clearinghouse — The NSFC has a new web site which includes information about NSFC services and related projects, products catalog, "Wastewater Trivia," and links to other wastewater-related organizations.

<http://www.estd.wvu.edu/nsfc/>

The following contributions to Wet Spots are taken from the National Small Flows Clearinghouse Newsletter

The American Public Works Association— The APWA is a volunteer association of public and private sector professionals in solid water and water treatment. Their site explains water supply, stormwater management, early days of flood control, dams, and wastewater, and how water is purified.

<http://www.fileshop.com/apwa/main.html>

U.S. Environmental Protection Agency Office of Wetlands, Oceans, and Watersheds— This web page houses many hyper-links to related water information.

<http://www.epa.gov/OWOW/>

Environmental Protection Agency Online— This electronic magazine allows users to find current activities at laboratories and universities across the country, submit articles and search back issues of Environmental Protection and four other news-letters. It also offers a forum where users can post comments and submit articles.

<http://www.eponline.com/>

The WETnet— This "virtual" water resource allows users to search for information on water resource projects in three ways - by a person's name, by study area, or by key word. This page also has links to federal and state agencies and general environmental pages.

<http://ingis.acn.purdue.edu:9999/wetnet.html>

Your Home Septic System— This page originates in Florida and speaks for itself!

<http://hammock.ifas.ufl.edu/txt/fairs/16824>

Mississippi State University's Cooperative Extension Service— Septic tank owners can find a helpful guide at this site, while finding out if they are at high, medium or low risk for problems.

<http://aac.msstate.edu/pubs/pub1869.htm>

Water-Wastewater Web— is a good starting point on the search for information about wastewater!

<http://www.w-ww.com>

Water and Wastewater Treatment— Investigate UCLA's Center for Clean Technology and its information about water treatment at:

<http://cct.seas.ucla.edu/cct.ww.html>





Colorado School of Mines
VAN TUYL LECTURE SERIES
 SPRING SEMESTER 1997

- March 27 **Large- and Small-scale Structural and Geochemical Controls on Gold Deposition in Sedimentary Rock Hosted Deposits**
 Sam Romberger, Department of Geology and Geological Engineering, CSM
- April 3 To Be Announced
- April 10 To Be Announced
- April 17 **Evaluating the Petroleum System of the Northern Gulf of Mexico Through Integrated Analysis**
 Paul Welmer, University of Colorado, Boulder, Colorado
- April 24 **Water, Microbes and Rocks: The Geochemical Ecology of Contaminated Groundwater**
 Phil Bennett, University of Texas at Austin, Henry Darcy Distinguished Lecturer
- May 1 **Prediction of Carbonate Reservoir Heterogeneities from the Integration of Stratigraphic, Seismic, and Log Data**
 Gregorie Eberli, University of Miami, Miami, Florida, AAPG Distinguished Lecturer

*All lectures begin at 4:30 p.m. and are held in room 108 of Berthoud Hall (unless otherwise noted)
 Refreshments are served at 4:00 p.m.*



Colorado State University
EARTH RESOURCES SEMINAR SERIES
 Spring Semester 1997

- February 28 **Hydrology and Ecology of the Taylor Dry Valleys, Antarctica**
 Diane McKnight, USGS
- April 18 **Flooding Along the Amazon River**
 Leal Mertes, University of California at Santa Barbara
- April 25 **Water, Microbes, and Rocks: The Geochemical Ecology of Contaminated Ground Water**
 Philip Bennette, University of Texas, Association of Ground Water
 Scientists & Engineers, 1997 Henry Darcy Distinguished Lecturer

All lectures begin at 4:00 p.m. and are held in Room 316 in the Natural Resources Building





Colorado State University
ENVIRONMENTAL ENGINEERING SEMINAR SERIES - Spring Semester 1997

- February 24 Subject TBA -- Tom Norman, Senior Project Manager, Stewart Environmental Consultants, Inc., Fort Collins, CO
- March 3 Subject TBA -- David Neenan, President, The Neenan Company, Fort Collins, CO
- March 17 **Damage Assessment of Yosemite for a 100+ Year Flood**
- March 24 & 31 TBA
- April 14 **Remediation of Mine Waste Using Engineering Evaluation/Cost Analysis Process at the California Gulch Superfund Site, Lake County, CO**
 Phil Leonhardt, Engineer, Shepherd Miller, Inc., Fort Collins, CO
- April 14 Subject TBA
 Curtis Palin, Professional Engineer, Earth Engineering Consultants, Fort Collins, CO
- April 21 **Environmental Aspects of Mine Closures**
 David Morrey, Director of Environmental Services, Golder Associates, Golden, CO
- April 28 **Groundwater Modeling at a Texas Uranium Site**
 Lyle Davis, Manager, WESTEC, Fort Collins, CO
- May 5 Subject TBA -- Len Joeris, Department Manager, Site Assessment and Remediation, Fort Collins, CO

All seminars will be held on Mondays from 12:00 to 1:00 p.m. in the Student Senate Chambers, Lory Student Center, with the exception of 4/28. Meet in the University Club, Cherokee Park, 2nd floor of the Lory Student Center for this seminar.



Colorado State University
NATURAL RESOURCE AND AGRICULTURAL ECONOMICS -- Lunch Time Seminar Series - Spring 1997

- March 5 **Agriculture's Roles in the General Economy: A Social Accounting Matrix Analysis of South Africa's Western Cape** -- Jerry Eckert, Colorado State University
- March 26 **A Social Accounting Matrix Approach to Evaluate Integrated Hog Operations in Eastern Colorado**
 Eric Scorson and Ed Sparling, Colorado State University
- April 2 **A Biophysical Approach to Valuing Biodiversity: the Argentina Case**
 Vilma Carande-Kulis, Colorado State University
- April 9 **A Computable General Equilibrium Model of the Fort Collins Economy: Results**
 Steve Byers, Steve Davies and Harvey Cutler, Colorado State University
- April 16 **Efficiency of Binary Logit Estimation Using Paired Comparison Data**
 Randy Rosenberger, U.S. Forest Service
- April 23 **Estimating the Demand for Grazed Forages**
 Tom Bartlett, Colorado State University; Larry Van Tassell, University of Wyoming

WEDNESDAYS -- 12:10 to 1:00 p.m., Animal Science Building





University of Colorado Law School
HOT TOPICS IN NATURAL RESOURCES -- Spring Semester 1997

March 31 **DIVESTITURE OF FEDERAL WATER PROJECTS**

The transfer of federal assets and responsibilities to state, local, and private interests is a highly significant emerging trend in natural resources law and policy. Jack Garner, head of the Bureau of Reclamation's "title transfer management team" will provide a summary of the major issues associated with the divestiture of Bureau of Reclamation facilities and an overview of cases throughout the West including the Collbran project in western Colorado - where title transfers are being contemplated. Lawyer and consultant Bruce Driver will discuss some of the relevant legal, political, and philosophical issues raised by these cases and similar experiments in federal divestiture.

May 2 **MINERAL DEVELOPMENT IN FEDERAL PROTECTED AREAS**

Gary Bryner, Professor of Political Science at Brigham Young University and the Natural Resources Law Center's El Paso Energy Corporation Law Fellow, will present his research findings regarding mineral development in federal protected areas. Recent actions taken by the Clinton administration to block proposed mining activities near Yellowstone National Park and in the Grand Staircase-Escalante region of southern Utah highlight this extremely controversial and dynamic area of public policy.

All lectures begin at 12:00 Noon and are held at: Holland & Hart, 555 17th Street, 32nd Floor, Denver. Box lunches are provided.



FEATURES



**WATER AND NASULGC: CHALLENGE AND OPPORTUNITY
TAKE HOLD OR NOT?**

The following edited excerpts are based upon a presentation by Theodore L. Hullar at the 109th Annual Meeting of the National Association of State Universities and Land-Grant Colleges (NASULGC), Commission on Food, Environment and Renewable Resources (CFERR), November 18, 1996. Hullar was Professor and Chancellor (1987-1994), University of California, Davis, California. His current address is Environmental Toxicology, University of California, Davis, CA 95616-8588.

Water is central to all life. The issue before higher education is whether or not more attention and emphasis ought to be given to research, education, extension, and outreach for addressing water resources issues across the nation and throughout the world. The ideal of state universities helping citizens is a strong and appropriate paradigm for universities involving themselves in water either on an interest-specific basis or through long-term institutional commitment.

Water issues abound throughout the nation and around the world. They can be summarized into six major groups:

- water availability, scarcity and allocation—including fragmented institutional responsibilities, changing expectations and needs, and international conflict;
- water and agriculture—which provides the preponderance of the pervasive problem of non-point source pollution;
- water and health—a continuing international challenge but a sharp, re-emerging problem in the U.S.;
- groundwater quality and quantity—especially in understanding its variability, pollution control and quality restoration, and ground-surface water relationships;
- ecology and environment of aquatic systems and the ecosystem services they provide—including environmental quality as a new claimant on water; and
- landscapes and watersheds as appropriate units for study—including the land-water edge and policy-landscape disconnection.



In addition, the research and application/extension environment can usefully be redeveloped to make the connections stronger, including better coordination of federal water resources activities.

A five-part program suggested for CFERR and NASULGC is as follows:

- commit to more emphasis and attention on water resources;
- work together, create a one-year task force, focus on program, and report to NASULGC in 1997;
- develop vision and direction, strategic plan, and mechanisms for coordination, and work at the federal level for greater coordination and articulation of water resources programs;
- on program, select systemic germinal issues, encourage a coordinated, unified strategic and problem-solving focus for such issues, and work to increase opportunities for international work; and
- harness the totality and develop long-term commitment of higher education for work in water resources.

STATE WATER INSTITUTE PROGRAM

The State Water Resources Research Institute Program is the federally-authorized approach for encouraging and assisting water resources research at our universities. The budget situation of the institutes is not positive. Ten years ago, the program authorized under the Water Resources Research Act received appropriations of about \$10 million. This has fallen to only \$4.5 million this year, divided into \$20,000 for each of the 54 institutes with the remainder being distributed through a regional competitive grants program (four regions). There is quite extraordinary leveraging of these funds. A 2:1 non-federal/federal match is required, but in practice there is much more leveraging. In FY1994, for example, the direct federal appropriation for the federal base support was approximately \$5.6 million. The Institutes leveraged these funds into almost \$65 million, an 11.6-fold increase, with 3 of every 11 dollars coming from the federal government and 8 coming from non-federal sources, including state appropriations.

Given the centrality of water for all our states and the commonality of water issues across the country, the institutes approach is sensible and valued, especially as it provides a major opportunity for state-federal partnership water resources research. But there are troubling aspects to what should be an exceptionally positive partnership. During the past ten years the federal government systematically recommended reduction and/or elimination of funding for programs authorized under the Act, including base funds for the institutes themselves (despite an avowed positive federal governmental emphasis on relationships with the states!). At best, this is a disappointing record of neglect, hopefully unintended. This neglectful approach detracts substantially from the nation's research capacity for water, the interest of our universities in water resources research, and university partnerships with federal agencies. Institute leaders are currently hopeful that a more positive climate will ensue after reauthorization of the Act in 1996. On some campuses, even in the arid west, institutes are being marginalized.

We must find the means to harness the totality of our higher-education system, both within and outside our agricultural and natural resource units, so we can address collectively the nation's water resources issues. First steps in doing this are to:

- understand the scope, meaning, complexity and rationale for embedding water resources into the institutionwide fabric of our universities and colleges;
- commit ourselves institutionally to this goal; and
- develop practical, inclusive empowering means for harnessing all our faculty and staff water programs.

The goal of all this, taken together, is to have water resources programs throughout our institutions that will be ongoing, have full institutional support, transcend specific individual and temporal interests, and give fullest flower to the higher education ideal.

If there is magic on this planet, it is in water.

L. Eiseley

The Flow of the River

in The Immense Journey





WATER NEWS DIGEST

WWPRAC MEETS IN SAN DIEGO

The fourth meeting of the Western Water Policy Review Advisory Commission was held in San Diego, November 21-22, 1996. This meeting was held in conjunction with the Western States Water Council meeting and was mainly for the purpose of receiving presentations from the Council and other researchers regarding the status of water resources and physical and social factors currently impacting water management in the western states.

RIVER BASIN STUDIES: Excellent progress is being made in the Commission's river basin studies. Your input is valuable and may be directed to the researchers listed below:

Colorado River Basin

Mr. Dale Pontius
c/o SWCA, INC
Environmental Consultants
Tucson, AZ 85701
(520) 824-3469

Columbia River Basin

Mr. John Volkman
323 Middle Crest Road
Lake Oswego, OR 97401
(503) 636-7393

Platte River Basin

Mr. Leo Eisel
McLaughlin Water Engineers, LTD
2420 Alcott Street
Denver, CO 80211
(303) 458-5550

Sacramento-San Joaquin River

Ms. Sue McClurg
Water Education Foundation
717 K Street, Suite 517
Sacramento, CA 95814
(916) 444-6240

Truckee-Carson River Basin

Mr. Jeremy Pratt
Clearwater Consulting
5817 Petaluma Hill Road
Santa Rosa, CA 95404
(707) 586-2427

Upper Rio Grande River Basin

Mr. Erie Niemi
ECONorthwest
99 West 10th, Suite 400
Eugene, OR 97401
(541) 687-0051

WATERSHED STUDY: The Commission has contracted with the Natural Resources Law Center at the University of Colorado to study and report on local watershed groups and initiatives in the west. Under the leadership of Principal Investigator Betsy Rieke, the study will examine selected watershed initiatives drawn from each of the river basins already under investigation. The Center will present a report to the Commission in a meeting to be scheduled in the spring, with a final report due June 30, 1997.

WEBSITE: The Commission will soon have a Website linked to the Department of the Interior's site. It will provide direct access to documents of public interest and will be used as a means of posting documents for public review and comment. It will not replace any existing means of contact, but will provide additional access.

RESOURCES AVAILABLE THROUGH THE COMMISSION OFFICE: Readers are welcome to contact the Commission Office (303) 236-6211 for a variety of information, including copies of meeting minutes and other materials which are the Commission's official records.

Western Water Policy Review Advisory Commission Newsletter 12/20/1996

WESTERN GOVERNORS MEET

The Western Governors' Association mid-winter meeting was held on November 21-22, in San Antonio, Texas. The governors created a task force to examine the massive restructuring of the western electric power industry and to ensure consumers have a reliable source of electricity. They also approved a strategy to move forward with the Western Governors [Virtual] University. They also adopted long-term recommendations for managing drought and approved a response action plan for addressing effects on agriculture, wildlife and forest health, and water resources. Governor Johnson, the lead governor on drought, and others were pleased with the progress to date and directed WGA staff to prepare an implementation strategy outlining future steps. The drought management plan recommends the following: (1) the development of a national drought policy that integrates the actions and responsibilities of all levels of government; (2) institution of a specific drought contingency plan by each state; (3) establishment of a regional drought policy and coordinating council to help states develop plans and raise drought awareness at the federal level; (4) establishment of a federal interagency coordinating group with a designated lead agency to assess the federal role and work with state and regional agencies; (5) inclusion of water policy as an essential element of any national discussion; and (6) federal funding to support the National Drought Mitigation Center in Lincoln, Nebraska as a clearinghouse for drought preparedness, planning, and mitigation information, and as a regional/national climate monitoring system and database on drought response resources.

Western States Water Newsletter December 1996



WATER SUPPLY AND DEVELOPMENT

Lower Colorado River Drying Up as Diversions Increase, Researchers Say

Almost 30 million acre feet of water a year once flowed into the Colorado River delta in the Gulf of California. But now, not a single drop of fresh water reaches the delta most years, and the situation will only get worse as seven states and Mexico use up their legal allocations, says a study released December 13. On the 19th, southern California was told by the federal government to cut back substantially on its dependence on its major water source — the Colorado River. U.S. Interior Secretary Bruce Babbitt gave California a year to develop a conservation plan or face the prospect of immediate cutbacks. For years California has taken more than its lawful portion of Colorado water because the other six states dependent on the river didn't use their allocated share. However, that situation is changing as the population of the West surges. The consensus among Upper Basin states has been that their right to develop their share of water when the need arises should be protected, and that the Lower Basin states should learn to live within their allocations.

Ft. Collins *Coloradoan* (Associated Press) 12/14/96, 1/6/97;
Denver Post (Associated Press) 12/20/96

Concerns Over River Operations Documented

In a letter dated December 9, 1996, six Colorado River Basin states' representatives documented their concerns over Colorado River operations and water use in California. The letter was addressed to Dave Kennedy, Director, California Department of Water Resources and Jerry Zimmerman, Executive Director of the Colorado River Board of California. Under the "Law of the River," California is entitled to the use of 4.4 million acre-feet (maf) of water annually, but may also divert additional amounts of water that either flow downstream unused by the other basin states or that are declared to be "surplus" by the Secretary of the Interior. Up until 1991, California regularly diverted for use as much as 5.3 maf per year, utilizing Nevada's and Arizona's unused entitlements. In 1991, faced with the sixth year of a severe drought, for the first time Lower Basin mainstem uses were projected to exceed the Lower Division states' combined 7.5 maf entitlement. California sought and the U. S. Department of Interior declared a surplus condition allowing the Metropolitan Water District of Southern California to continue to divert enough water from Lake Havasu to keep its 1.2 maf Colorado River aqueduct full.

Since 1992, Lower Basin water uses have increased dramatically. Nevada's use has increased from 175,000 maf to 245,000 maf. Arizona's water use is up from 1.8 maf to 2.6 maf. The other basin states are concerned that California agencies appear to assume that the Secretary of Interior will continue to approve surplus declarations for the foreseeable future, allowing continued use in California in excess of 4.4 maf. . . despite the reduction in unused entitlements in Arizona and Nevada, and increasing water use in the Upper Basin. According to the letter, the state representatives "are available to engage in serious discussions toward the

development of multiple year surplus and shortage criteria that will meet, for an interim period only, at least part of the demand for surplus water in the Lower Basin, and will allow for more secure water planning. . . "

The other states specifically added, "We are interested in moving forward with the steps necessary to implement the interstate storage component of the Arizona Water Bank."

Western States Water 12/27/96

Wyoming Water Official Offers Water Planning Proposal

Mike Besson, Wyoming Water Development Office director, wants the state legislature to fund the Wyoming Water Planning Proposal, released in early October. The proposal calls for updated information on streamflow, groundwater flow, domestic/municipal usage, and irrigated acreage. Besson's office estimates that implementing the plan will cost about \$525,000 per year, with two new employees working in the State Engineer's Office and six new workers taking on the plan in the Water Development Office.

The proposal's first 13 pages are devoted to exploring the characteristics and problems of the seven drainage basins in Wyoming, covering growth in the area, ESA impacts, and projected demands for more water in the basin. In the second section, the Development Office staff assessed the information relating to water planning available in the state, with the Wyoming Water Resources Center and its Water Resources Data System's 30 million records on the state's water resources. Once existing data sources are filtered, new research may be needed. In its conclusions and recommendations, the proposal alludes to the importance of a water planning effort to the state in court cases like *Nebraska vs. Wyoming*. If the Wyoming legislature agrees, the process to a cohesive approach to developing and defending Wyoming's water could begin just after the legislative session in 1997. The first plan to be completed covers the legally complex Green River/Little Snake Basin.

The Statewide Water Planning Proposal names water marketing as one of the two "most contentious issues facing water management professionals." The resolution passed by Utah's legislature to look into how to lease about 300,000 acre-feet of its allocation of Colorado River water brought a flurry of cautionary letters fired back and forth among government offices in the four member states of the Upper Colorado River Basin (Wyoming, Colorado, Utah and New Mexico).

Private industry has noted the potential for big money in water markets too, but so far has been unable to break through the legal and logistical barriers, e.g., the Colorado-based proposed leasing of 300,000-500,000 acre-feet from the Upper Basin to deliver it to the San Diego County Water Authority. And, in 1990, the Resource Conservation Group asked that Upper Basin states postpone their use of water for 5-40 years to create a temporary pool of water for sale to downstream states. This made state



governments nervous for creating a precedent that might open the door to one-on-one contracts.

Jeff Fassett, Wyoming State Engineer, Besson and others in Wyoming government are keenly interested in what Wyoming residents think of water marketing overall. With input on water marketing, they can begin to balance the state's needs against the echoes of John Wesley Powell's, "The great values of this region [will] ultimately be measured by you in acre-feet."

Wyoming Hydrogram, Wyoming Water Resources Center, December 1996

Arizona Water Banking

Under a law enacted in 1996, the Arizona Water Banking Authority may buy otherwise unused Colorado River water, within the limit of Arizona's entitlement, and bank the water utilizing recharge and conjunctive use opportunities in order to augment Arizona's water supplies, avoid future shortages, benefit Arizona water users, and otherwise meet state water management objectives.

Within Arizona's active ground water management areas (AMAs), some 750,000 of water have been "stored" or "banked" underground over the past few years. Thousands of acre-feet of Colorado River water and local surface waters have also been directly recharged. The Authority was not created to own or operate any facilities, rather it was designed to contract for the use of public and private facilities to store water for both instate and interstate purposes.

Arizona would not undertake any interstate water banking activities until all other water uses within consumptive use were less than 2.8 maf entitlement. The state could divert additional Colorado River water, under the Law of the River, for interstate banking purposes utilizing some type of contractual agreement. However, changes in the current law would be necessary to allow another state's unused apportionment to be banked underground in Arizona, and used later by exchange. Arizona and other states object to any scheme allowing such conservation savings to be banked in Lake Mead. They view this as a threat to fulfillment of their own Colorado River entitlements.

Western States Water Newsletter December 1996

Cabin Owners Told to Keep Pumps Out of River

Colorado's State Engineer examined upstream users along the Big Thompson and found hundreds of illegal diversions, including pumps. Farmers downstream have noted in recent years that they have been unable to take their share of the water because it isn't there. The Big Thompson flows into the South Platte, a river with more claims than water. A similar shortfall in the Arkansas River kept Colorado and Kansas in court for more than a decade, a battle which Colorado lost.

Grand Junction Daily Sentinel (Associated Press) 1/5/97

Arkansas River Water Agreement In Sight

Colorado and Kansas officials say they are close to an agreement on replenishment of Arkansas River water lost to well use in Colorado. The replenishment involves storing water in a reservoir for later release to Kansas. Two Colorado irrigation companies seeking to escape limits on how much water they can divert from an Arkansas River tributary lost a Supreme Court appeal on November 18. As a result of this decision against Colorado, users of high-capacity wells in the Arkansas Valley must buy water and send it downriver to Kansas to make up for what their wells soak up. Kansas had argued in its lawsuit that the hundreds of wells drilled after the 1949 Arkansas River Compact take water that should flow to Kansas.

Colorado Springs Gazette Telegraph (Associated Press) 12/12/96;
Grand Junction Daily Sentinel (Associated Press) 12/18/96

Agency Denies Nebraska Permit for Dam on Platte

As expected, federal wildlife officials yesterday turned thumbs down on relicensing plans for a huge Nebraska dam on the Platte River unless more water and land is reserved for rare animals downstream. The U.S. Fish and Wildlife Service's biological opinion for Kingsley Dam and related hydro-power projects adds new urgency to negotiations among three states on multimillion-dollar water conservation and habitat improvements for endangered birds and fishes. In essence, Fish and Wildlife decided that a federal Energy Regulatory Commission scheme for relicensing the dam near Ogallala, Nebraska, doesn't do enough to ensure better stream flows and habitat for three rare bird species - whooping cranes, least terns, and piping plovers - and an endangered fish, the pallid sturgeon. Fish and Wildlife offered the dam's owners and users two options: (1) a series of costly fixes to improve conditions for the animals, and (2) adjusting the license into basin-wide restrictions that Colorado, Wyoming and Nebraska can work out.

The Denver Post 12/4/96

South Platte Endangered Species Talks Continue

Department of Natural Resources Executive Director Jim Lochhead and Assistant Director Doug Robotham continue to meet with officials from Nebraska and Wyoming to devise an endangered species protection program that will restore riparian habitats and favorable river flow regimes in the central Platte River of Nebraska. The program will function as the required endangered species mitigation for all water projects in the Platte River Basin. The parties are now discussing how to allocate responsibilities and pay for the program. Currently, costs for such a program are projected to be about \$75 million over a 15-year period, of which Colorado could likely be responsible for \$15 to \$20 million. The General Assembly last year authorized the Division of Water Resources and the Colorado Water Conservation Board to analyze how the State of Colorado might participate financially in such a program.

Natural Resources News January 1997



Denver/South Platte Basin Study Begins

The Division of Water Resources and the Colorado Water Conservation Board have begun work on a technical study of groundwater management in the Denver Basin and the South Platte River Basin. The General Assembly authorized the study in Senate Bill 96-74, which also established a special legislative committee to oversee the study and make recommendations to the legislature. SB 96-74 was initiated in response to concerns raised by the Colorado Farm Bureau and Senator Don Ament about the impacts of groundwater-based development in the Denver metro area, particularly in Douglas County, on water rights and water availability downstream in the South Platte River. The study will also address participation of the state in efforts to recover endangered and threatened species in the Platte River Basin.

Natural Resources News January 1997

Early Snowpack Levels Are Highest in 13 Years

Snowpack throughout Colorado is much deeper than average, easing fears in the south of another year of drought. The January 1, 1997, snow survey yielded significant readings for what is the first 40 percent of the winter's total snow accumulation. Satellite readings showed a bountiful snowpack on Grand Mesa. Snowpack in the Rio Grande, San Juan and Dolores basins is about five times deeper than a year ago. Above the Poudre River, snowpack measured at 114 percent of average. However, the Poudre is one of just two locations in the state with January measurements below 1996.

Grand Junction *Daily Sentinel* 1/3/97; Ft. Collins *Coloradoan* 1/8/97

Capacity of Water Plant is Being Doubled

To expand the water supply facility for Cedaredge, the State of Colorado will purchase a one million gallon water tank to allow for continuing population growth. The working capacity of Cedaredge's new water treatment plant will be about four million gallons a day - double the present capacity of about two million.

The Delta County Independent 1/9/97

WATER QUALITY

Salty Water Could Muddy Court Case

After years of conflict over the amount of water in the Arkansas River, the declining quality of that water threatens to become a Colorado-Kansas dispute, too. A new study by a Kansas Geological Survey water specialist indicates that salty flows from Colorado's part of the heavily-used river have begun to foul the Ogallala Aquifer, the immense groundwater pool that supplies western Kansas farms and communities. Donald O. Whittemore, the Kansas agency's chief of geohydrology, blamed heavy irrigation and water storage practices in Colorado, as well as 1995's heavy snowmelt from the Colorado Rockies in which sulfate levels were as high as 700 parts per million, more than

½ times the recommended 250 ppm level for drinking water sources.

The Denver Post 1/2/96

Gravel Pit Uses and Recycles City's Water

Pulling up to 600 tons of sand and gravel out of a pit every hour, the new plant at the Fountain gravel pit is impressive. Moreover, the new plant cleans its gravel using a hydrant that draws water straight from the city's supply. Although the plant is the city's largest water consumer, the company reuses roughly 80 percent of the water it takes from the city, thanks to a unique system of ponds. The gravel plant uses 75 million to 100 million gallons of water each year, roughly one-sixth of the city's total use.

2

The Colorado Springs Gazette Telegraph 11/21/96

Wells Contaminated, Says New Mexico Agency

LOS ALAMOS, N.M. - A state environmental report says radioactive contaminants have seeped hundreds of feet down into the main source of well water for ranches and towns on the Pajarito Plateau of northern New Mexico. New Mexico's Department of Energy Oversight Bureau geologists reported that they found traces of plutonium, americium, strontium, and uranium, apparently from Los Alamos National Laboratory, from 1994 to 1995 in test wells as deep as 1,500 feet into the main aquifer beneath Los Alamos. The levels of contaminants are very small and well below federal drinking water standards, so the contaminants do not appear to threaten human health.

The Denver Post (Associated Press) 1/1/97

Former Gold Mine Manager Moves to Dismiss EPA Claim for Damages

An attorney for Robert Friedland wants a judge to dismiss a lawsuit that would force the former Summitville gold mine manager to pay for a \$120-million environmental cleanup at the site. The U.S. Attorney and the Environmental Protection Agency have filed a civil suit under the Superfund law, claiming Friedland personally made decisions on mining, financing, pollution control and operations that led to the contamination at the mine near Del Norte. Water loaded with cyanide and heavy metals virtually sterilized 17 miles of the Alamosa River below the mine in 1992, prompting an EPA takeover.

Colorado Springs Gazette Telegraph (Associated Press) 1/10/97

FISH RECOVERY PROGRAMS

Trout Restoration Planned for Park

The National Park Service plans to reintroduce native species into several streams and rivers in Yellowstone National Park. The program is targeted primarily at restoring populations of fluvial Arctic grayling and westslope cutthroat trout. Without efforts to



restore their populations, the two species face the threat of decline. In November, the discovery of a major spawning ground helped the park's campaign to eradicate lake trout. The discovery allowed biologists to gill net large numbers of the predatory fish, including more of the larger, more voracious specimens that prey most heavily on the native cutthroat trout. Biologists say unchecked populations of lake trout could wipe out the cutthroat, a major element of the food chain in the park.

The *Denver Post* (Associated Press) 1/10/97; The Grand Junction *Daily Sentinel* 11/17/96

Whirling Disease Hits Missouri River

CRAIG, Mont. — Tests show a tenfold increase in the percentage of yearling rainbow trout infected with whirling disease on a stretch of the Missouri River that offers blue-ribbon trout fishing. According to a state fisheries manager in Great Falls, 22 percent of the rainbows tested were infected. The disease, which draws its name from the tail-chasing motion it causes in fish, can be fatal. The disease is native to Europe, but was accidentally introduced in the United States in a 1958 shipment of frozen fish. It has been detected in at least 20 states. The disorder is blamed for a 90 percent reduction in rainbow numbers on southwestern Montana's upper Madison River.

Grand Junction *Daily Sentinel* (Associated Press) 1/4/97

ENVIRONMENT

River Sediment Cleanup Plan Developed

The Colorado Division of Wildlife and North Poudre Irrigation Company have devised a plan to cleanse the North Fork of the Poudre River of sediment released from Halligan Reservoir. The release in late-September of more than 12,000 cubic yards of sediment killed more than 4,000 wild trout. It occurred when the irrigation company drained the reservoir to inspect its headgates. The cleanup plan was devised by Hydrosphere Resource Consultants of Boulder after studying 34 years of flow data at Halligan Reservoir.

The plan calls for gradually increasing the flows for 20 days starting in mid-March until 100 cubic feet per second (cfs) is reached, then maintaining flows at between 100 cfs and 140 cfs for about a month to maximize sediment removal. The plan would allow 6,000 acre-feet of water to move from Halligan Reservoir into the irrigation company's Livermore Main prior to the irrigation season, which typically starts May 1. The release would ensure that senior water rights downstream are not violated.

Ft. Collins *Coloradoan* 12/9/96

Feds to Clamp Down on Wetland Regulations

The Clinton administration has decided to tighten wetland regulations, phasing out a popular permit that enabled developers to bypass environmental reviews when draining small swamps and marshes, The New York Times reported today. The permit,

known as Nation-wide Permit 26, allows owners to bypass the usually required environmental impact review and obtain quick approval from the Army Corps of Engineers to drain up to 10 acres of wetlands. Environmentalists have complained that the expedited process has led to the destruction of thousands of wetlands which help purify water, prevent flooding, and protect wildlife.

Ft. Collins *Coloradoan* (The Associated Press) 12/11/96

Governments Spend Billions on Projects Harming Environment

A study released by Worldwatch Institute, an independent environmental advocacy group, estimates subsidies cost governments and consumers more than \$500 billion a year — and a violated environment. The report advocates more selective use of subsidies, reserving them particularly for the poor. Examples of misguided subsidies include those for the global fishing fleet that have helped produce enough boats, hooks and nets to catch twice the available fish, contributing to overfishing and destruction of fisheries.

Colorado Springs *Gazette Telegraph* (Associated Press) 12/8/96

FEDERAL WATER RIGHTS

Campbell Drops Plan for Canyon Park Status

Senator Ben Nighthorse Campbell said he won't resume his decade-long quest toward making the Black Canyon of the Gunnison National Monument a national park until environmentalists, water users and business interests can agree on federal water rights and other issues. Campbell seeks a plan to protect the Gunnison River without threatening alternative uses of the water for agriculture or generating hydropower. The Paonia-based Western Slope Environmental Resources Council said redesignation is possible, but only after the National Park Service quantifies its water right in the Gunnison River and the government further protects the river and Gunnison Gorge.

Grand Junction *Daily Sentinel* 1/8/97

CONSERVATION

California Recommends MOU for Water Conservation

In November, the California Department of Water Resources (CDWR) and an oversight committee recommended a Memorandum of Understanding (MOU) Regarding Efficient Water Management Practices (EWMPs) by Agricultural Water Suppliers. The MOU was prepared pursuant to the terms of Assembly Bill 3616, the Agricultural Efficient Water Management Act of 1990 and is strongly supported by Gov. Pete Wilson. The MOU would take effect only if at least 15 agricultural water suppliers representing two million acres of irrigated land sign it. It requires each signatory district to develop, adopt and imple-



ment a water management plan with EWMPs and take steps to implement the plan.

Western States Water 12/13/96

3.2 Billion Gallons Seep Away

Every year, the Denver Water Department loses more than 3.2 billion gallons of water that seeps from the High Line Canal, enough water to supply all the department's customers for three weeks of average winter use. If the seepage were stopped next summer, it would represent a one-time savings of \$44 million at current market price. However, there's a big benefit to the canal's seepage. The canal's vegetation supports many species of wildlife, including fox, bobcat, muskrat, coyote, eagles, hawks, falcons and ducks. In addition, the historic canal has become a mecca for outdoor adventure. Hikers, bikers, birders, skiers and horseback riders find bucolic getaways along its entire length, even in urban neighborhoods. According to water officials, any change in the canal's operations would probably take five to seven years to complete.

The Denver Post 1/8/97

RIVER PRESERVATION

A River Worth Protecting

The Cache La Poudre River Corridor project to preserve open space and public access along northern Colorado's scenic waterway still faces many significant hurdles. Senator Hank Brown's bill created an opportunity to preserve, in the public's interest, a delicate and irreplaceable 40-mile river corridor. It presents a new way for the federal government to help local communities coordinate policies and preserve open space. Rather than have the federal government condemn the land, Brown's measure would have private property owners voluntarily swap their riverside holdings for surplus federal parcels. According to Brown's office, there are hundreds of acres available for such land swaps throughout Colorado.

The Denver Post 12/1/96

MISCELLANEOUS

Land-use Change Another Factor in Climate Shifts

Colorado State University atmospheric science professor Roger Pielke says land use change is an important contributor to atmospheric change. As examples, he cited deforestation in the Amazon and eastern United States and prairie destruction along the Front Range and in eastern Colorado. In Colorado, cropland and urban lawns have replaced much of the native, short-grass prairie. In summer, farmers and homeowners irrigate these areas, according to Pielke. That creates pockets of cooler, moister air that feed into weather patterns over the mountains, increasing the frequency and intensity of thunderstorms moving over the eastern

plains. "You have a supply of water to the atmosphere. . . that is not there in the natural system," he said. "We're providing for more storms along the eastern side of the mountains, more cloudiness and cooler temperatures." In winter, these land-use changes mean new snow-melt patterns, Pielke explained. In areas where native grasses poke through even deep snow cover, the ground tends to warm up fairly quickly, melting the snow. However, in areas stripped of native grasses, snow completely blankets the ground and reflects the sun's light, keeping temperatures cooler. These areas also tend to trap air pollution longer.

Ft. Collins Coloradoan 1/13/97

Grand Junction Chamber Adopts Water Policy

At their December meeting, the Chamber Board of Directors adopted a legislative policy on water. The policy will be used to monitor water-related legislation during the upcoming session of the state General Assembly. Under this new policy, the Chamber supports the following: (1) the protection of the State's prior appropriation doctrine, (2) preservation of Colorado's water entitlements under interstate compact, (3) programs and educational information which promote the efficient use and storage of water for future needs, (4) the principle of "no material injury" to existing water rights from its basin of origin, (5) compensatory storage for any water removed from the Western Slope, and (6) realistic programs designed to control further pollution or contamination of Colorado water resources.

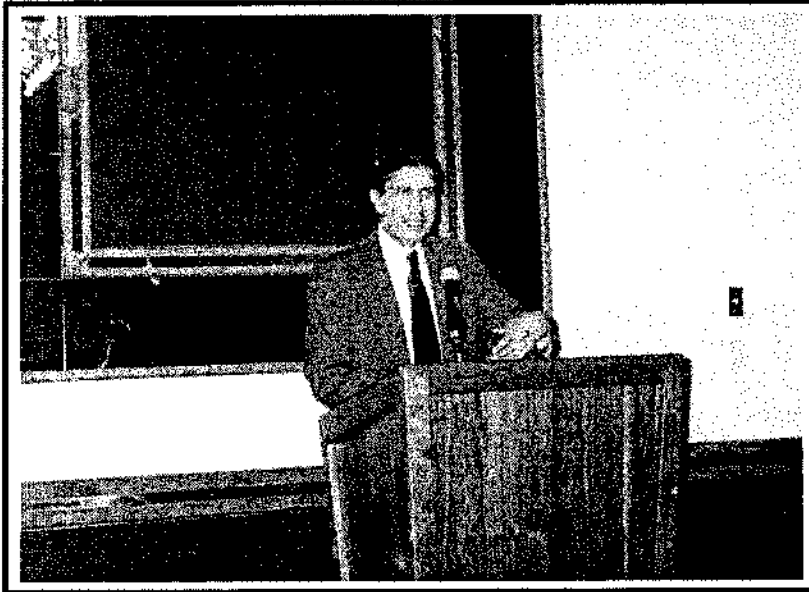
Grand Junction Daily Sentinel 12/31/96

Boulder Firm's Space Gear Guarantees Clean Water

It would cost \$144 million to shuttle into space a one-year drinking-water supply for six astronauts, according to officials at Sievers Instruments Inc., a Boulder-based manufacturer of scientific instrumentation and subsidiary of Ionic Inc. Such costs put a premium on recycling the water already available to astronauts. The payload on the January 13 scheduled launch of the space shuttle Atlantis included sophisticated equipment that the Boulder company made to test the quality of that recycled water.

The Denver Post 1/12/97



MEETING BRIEFS
**FOUR STATES IRRIGATION COUNCIL
HOLDS 46TH ANNUAL MEETING**


USBR Commissioner Eluid Martinez addressing the Four States Irrigation Council

"A question of values" describes the theme of the 46th annual meeting of the Four States Irrigation Council. Both economic and environmental values of water projects were examined during the three-day meeting held January 8-10 at the University Park Holiday Inn in Fort Collins.

Eluid Martinez, Commissioner of the U.S. Bureau of Reclamation, was the keynote speaker. Commissioner Martinez discussed a number of issues surrounding the Bureau's development of water conservation rules. He emphasized that the rules recognize that "one size" does not fit all projects. Water conservation plans need to fit the needs of each irrigation district. He acknowledged that the movement of states to recognize water conservation within the administration of water rights is helping mesh Bureau rules with state law. The new rules include an "upward movement" of acreage threshold for required reporting from 80 acres to 240 acres. The rules, which will be effective January 1, 1998, are written in lay language, and workshops are being developed to facilitate their implementation.

During his address to the Council, Commissioner Martinez presented the 1996 Bureau of Reclamation Water Conservation Award to the Northern Colorado Water Conservancy District. Northern manager, Eric Wilkinson, accepted the award on behalf of the District staff and Board of Directors. Northern

was recognized for a program which has been in operation for ten years to teach farmers more efficient irrigation methods. Nearly 400 farmers who receive Colorado-Big Thompson Project water have participated in the project, motivated by the increased profits that result from reduced fertilizer use, minimum soil erosion, and improved crop quality and yield.

In 1993, Northern expanded its water conservation education program to include urban landscape water uses. Over 850 acres of urban turf grass (golf courses, city parks and building landscapes) are now monitored.

Larry MacDonnell, an attorney and consultant from Boulder, discussed the original need for water to make the arid west livable, and noted how successfully this had been met. He then described the emerging environmental problems that require us to consider other values of society. He pointed out the necessity of balancing all our water needs to ensure that existence in the west is sustainable.

Steve Reese, Manager of the Arkansas Headwaters Recreation Area, described the efforts to integrate new rafting uses of water with traditional uses and existing water rights in the Arkansas. This water-based economic activity in the Upper Arkansas brings \$16 million annually to the local economy. Its development was carefully integrated into existing uses via agreements and arrangements developed through the discussions of many water users and managers in the valley.

Ralph Morgenweck, Director of Region VI, U.S. Fish and Wildlife Service, noted that many western water projects have unintended ecological costs as well as benefits. Through careful evaluation of these problems and benefits, and judicious negotiation of existing water uses and rights, operations of some water projects are being modified to enhance ecosystem health while having a minimal negative impact on existing water uses. He noted that the U.S. Fish and Wildlife Service and a number of the water users/managers have adopted attitudes which now encourage the discovery of these win-win solutions.

As always, the 46th annual Four States Irrigation Council meeting provided an excellent opportunity to update one's understanding of current water problems, concerns, and solutions.





“REAL WORLD” USDA/ARS WORKSHOP LOOKS AT INFILTRATION OF WATER INTO SOILS

In today's agriculture, infiltration of water into soils plays a dominant role in almost all important natural resource problems or issues, such as runoff, erosion, irrigation, water conservation, groundwater and surface water quality, and global environmental change. Research during the last half-century has established a fundamental theory of infiltration into soils at a given point, but attempts to apply this theory on a field scale have had limited success, primarily because of the large spatial and temporal variability of governing parameters on a field scale. Major hurdles are in approximating, measuring, and quantifying the large and complex patterns of spatial and temporal variabilities and implementing them in a model for field-scale infiltration. Also, very little research has been

conducted on characterizing the effects of land use and management practices on the temporal and spatial variabilities, and these effects are often more important than the natural variabilities in a given area.

At the suggestion of ARS (USD/Agricultural Research Service) National Program Staff, the ARS Workshop on “Real World” Infiltration was held at Pingree Park, Colorado, July 22-25, 1996. The vision of the Workshop's planning committee was to have a strategic plan for a coordinated ARS infiltration research effort that will accommodate large spatial and temporal variabilities of relevant soil properties at different scales. The following Specific Goals were delineated:

- Review and analyze the knowledge gained from past experimental studies on infiltration at plot, field and small watershed scales, separately for crop and rangelands. Assess how parameter variabilities were determined and incorporated in modeling.
- Analyze old and explore new concepts for identifying and quantifying spatial variability and patterns of relevant soil infiltration parameters of crop and rangelands, and develop feasible experimental methods of determining these variabilities at different scales.
- Analyze, identify, and quantify temporal variability of relevant soil infiltration parameters of crop and rangelands and practically feasible experimental methods of determining these variabilities at different scales.
- Explore possibilities of new scale-dependent infiltration equations that may indirectly account for large variabilities in relevant infiltration parameters, and provide a framework for incorporating spatial and temporal variabili-

Teams were organized before the workshop to prepare written reports on state-of-the-science and future research needs pertaining to the Specific Goals, and the reports were distributed to participants prior to the meeting.

Workshop Day 1 – A charge was given to the participants by National Program Leaders, followed by presentations by the Specific Goals teams. In the evening, Vijay Gupta, University of Colorado, Boulder, gave an invited talk on the potential use of Cascade Theory in simple and multi-fractal scaling of infiltration for different spatial scales.

Workshop Day 2 – Eight Cross-Goal Interest groups, listed below, discussed, modified, added and ranked the research needs identified by the Specific Goal teams according to the groups' assigned subjects:

- | | |
|-----------------|---|
| Group 1: | Mechanical/management/tillage effects — process knowledge, space-time-causal factor relationships, modeling |
| Group 2: | Experimental methods/measurements for field-scale quantification of spatial and temporal variabilities |
| Group 3: | Biological effects – roots, canopy, worms, ...process knowledge, space-time-causal factor relationships, modeling |



- Group 4:** Physical effects – freezing-thawing, hydrophobicity, swelling-shrinking
- Group 5:** Parameterization/estimation
- Group 6:** Stochastic statistical characterizations and modeling
- Group 7:** Spatial characterization needs for precision farming
- Group 8:** Special topics: Minimum data set, methodologies, amending infiltration, and some general items.

Each group leader presented his group's conclusions to the entire workshop in the afternoon. In the evening, the National Program Leaders and Natural Resource Conservation Service cooperators gave their opinions on the prioritized research needs.

Workshop Day 3 – Participants suggested to National Program Leaders that they appoint a small committee to take the prioritized list of research needs and develop them into a strategic plan for a coordinated ARS research program on infiltration. The 12 highest-ranked needs, not in any order of priority, are as follows:

- Develop consolidated database of existing plot and watershed infiltration data. Similarities and differences in data sets need to be identified and documented. Need one FTP site for all data.
- Revise Hydrology Handbook and include a data collection protocol – minimum data set, appropriate methodology and data format.
- Examine relationships between correlation scales and measurement scales to minimize the effect of the method (or size of the measurement) on the resulting analysis.
- Incorporate terrain attributes into relationships for surface soil attributes, soil hydraulic properties and soil textures to obtain regional-scale prediction equations.
- Test multifractal techniques for modeling spatial dependence of properties/processes including methods to incorporate parameter variability into parameter estimation.
- Develop improved predictive models which include seasonally varying infiltration rates due to plant growth and worm activity, shrink/swell, and systematic small-scale spatial variability such as crop-row position effects.
- Conduct a comprehensive review and evaluation of existing data and creation of new data to quantify/estimate the temporal/spatial character of seal/crust as influenced by distributed residue cover, soil type, wetting/drying and crops.
- Measure and quantify spatial variability of infiltration parameters between plant bases and interspaces as a function of soil type, grazing intensity and other factors.
- Quantify the changes in infiltration behavior from changes in soil parameters as a result of mechanical modifications, including modeling the aggregate behavior of an area containing internal infiltration variability, with application to “management” modeling.
- Improve knowledge of disaggregation statistics and rainfall intensity distributions.



- At larger scales (e.g., 10 ha+), modeling a really variable infiltration should not be done independently of the surface runoff, which has considerable organized and random heterogeneity itself, nor should it be modeled without consideration of small-scale rainfall rate heterogeneities.
- Describe the mean and variance of soil water stored in the root zone as a function of size of the area to help in decision support for precision farming.

The complete workshop proceedings, "Real World" Infiltration, is available from the Cooperative Extension Resource Center (see page 12).

The proceedings of the first workshop held by USDA/ARS in 1995, Computer Applications in Water Management, Information Series No. 79, is also available.

VIDEOCONFERENCES



**The League of Women Voters Education Fund presents:
TOOLS FOR DRINKING WATER PROTECTION
— A community call to action - live via satellite
March 19, 1997 – 2:30 - 4:00 p.m. ET on PBS**

Citizens and decisionmakers will get the practical planning and management tools they need to create successful water protection programs. Plus, participants will have access to the country's top water quality experts via phone, fax and the Internet! Topics:

- How to make land use decisions and identify permitted and prohibited uses within drinking water source areas
- How to organize public education and awareness efforts, including how to involve citizens
- How to establish and maintain monitoring programs within sensitive areas to monitor water quality
- How to involve a broad range of local decisionmakers in preparing contingency plans in case of contaminant release or other emergency
- How to build leadership and secure funding for land use planning, public education, water quality monitoring and contingency planning

PBS Adult Learning Satellite Service will distribute the videoconference via satellite transmission and provide a set of promotional and print materials that can be duplicated for use with the videoconference. For information on how to receive a videoconference license call 1-800-257-2578. Visit the Tools for Drinking Water Protection Web site at www.drinkingwater.org. To submit your license request electronically, visit the PBS Adult Learning Service Web site at www.pbs.org/als/programs/vc/water.





The University of Wisconsin Cooperative Extension presents

**COMMUNITY WATER EDUCATION FOR YOUTH:
FOCUS ON WATERSHEDS**

A live, satellite videoconference on May 1, 1997. 12:45-3 pm CDT

A professional development opportunity to strengthen your ability to design and deliver youth water education programs that can make a difference in your community.

If you are interested in this event and having a local conference location, please call Chris Bridges at the Colorado Office of Water Conservation at 866-3441. If there is enough interest, they may sponsor a Denver/Boulder conference site.

CALLS FOR PAPERS



**FIRST FEDERAL INTERAGENCY HYDROLOGIC MODELING CONFERENCE
Las Vegas, Nevada - April 19-23, 1998**

**Theme: Bridging the Gap Between Technology
and Implementation of Surface Water Quantity and Quality Models in the Next Century.**

BACKGROUND: The Subcommittee on Hydrology (SOH), Interagency Advisory Committee on Water Data, held the Federal Inter-agency Workshop on Hydrologic Modeling Demands for the '90s in Fort Collins Colorado in 1993. This highly successful workshop was limited to federal participants. Subsequent to that workshop, the SOH has decided to open this conference to all interested parties and to include models addressing surface water quality and quantity issues. The conference will follow a mixed set of formats including formal presentations, mini-workshops and model demonstrations.

TOPICS: About 100 papers and 60 demonstrations incorporating results of recent research and technology development and/or applications will be solicited for presentation on the following subjects:

- Extreme Events
- Precipitation, Floods
- Snowmelt, Droughts
- Paleohydrology
- Operational Models
 - Real-time Water Control, Reservoir
 - Environmental, Sustainable Water Resources
- Environmental Models
- Decision Support Systems
- Major River Systems
- Hydrological and Ecological Interaction
- River Reach Transport
- Non-point Source and Fate
- Remote Sensing and GIS Applications
- Watershed Evaluation and Management
- Sedimentation
- Landscape Erosion, Scour

MODEL DEMONSTRATION: Two half-day sessions for up to 30 demonstrations each will be offered. Individuals wishing to take part in these demonstrations will be required to furnish their own computers and software. In lieu of a formal paper, individuals wishing to participate in these demonstrations will be required to prepare an extended abstract for publication in the proceedings.



WORKSHOPS: Several major topics will be chosen from the subjects listed above for the development of mini-workshops. Papers will be given on these subjects. A discussion and recommendation period will follow. All presentations will be 20 minutes long.

SUBMISSION OF ABSTRACTS: Papers and computer demonstrations which address the theme of the conference and directly support the responsibilities and missions of the federal agencies will be given preference. Federal agency authors wishing to present papers or participate in the computer demonstrations are requested to submit an abstract of not more than 500 words to their Hydrology Subcommittee representatives. All other authors should submit their abstracts to Don Frevert or Don Woodward at the addresses or e-mail given below.

Abstracts are required by April 15, 1997.

Indicate which topic area the paper is to be considered for and whether it is to be an oral presentation or computer demonstration. Authors will be notified of paper acceptance and provided with format instructions by June 15, 1997. Camera-ready papers are due by October 15, 1997. Senior authors are responsible for obtaining approval of their papers by their organizations prior to final submission.

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CHANGING WATER REGIMES IN DRYLANDS

Lake Tahoe, California – June 9-13, 1997

Sponsored by Desert Research Institute, University and Community College System of Nevada

The objective of the meeting will be to identify research needs and priorities for the first decades of the 21st century. Through a series of invited speakers, poster sessions and discussion groups, the symposium will explore the characteristics of natural and human-altered systems that affect water availability in drylands and will assess the responses of these systems to the highly variable nature of drylands climates and environments.

POSTER SESSIONS – DEADLINE March 1, 1997. ABSTRACTS, REGISTRATION AND FIELD TRIP PAYMENTS MUST BE RECEIVED NO LATER THAN MARCH 1, 1997. All participants are invited to contribute posters on any of the symposium themes. Submit a two-page abstract of your poster presentation to: Jack Gillies, Desert Research Institute, P.O. Box 60220, Reno, NV 89506. E-Mail: jackg@sage.dri.edu.



MEETINGS

The Colorado Section of the American Water Resources Association
Announces a Second Symposium on

WATERSHED PLANNING AND MANAGEMENT
March 14, 1997

Planning and management of water resources systems through multi-disciplinary approaches and interagency cooperative efforts is becoming more essential in light of ever-increasing pressure to preserve the environment. Water quality, water quantity, earth resources and biological habitat must be kept in balance. The movement to watershed management approaches is occurring rapidly, because better decisions are resulting from coordinated efforts. A full-day symposium in 1996 drew the attendance of 86 people including 26 presenters. A second full-day symposium in 1997 will further examine and discuss these approaches to water resources planning and management. Subject areas will include the following:

- Institutional Approaches to Integrated Management
- Integrated Operating Rules for Multi-jurisdictional Systems
- System Optimization Techniques
- River and Reservoir Operations
- Computerized Decision Support Systems
- Federal, State and Local Government Approaches
- Conjunctive Use of Surface Water and Ground water
- Total Maximum Daily Load (TMDL) and Waste Load Allocation (WLA) Studies
- Sanitary Surveys
- Market-based Approaches to Pollution Control
- Endangered Species Preservation Efforts
- Wetland Management and Preservation
- Urban and Agricultural Runoff Management Practices

For further information contact Steve Forvilly at 303/286-3325.



CALENDAR

- Mar. 6-7 WESTERN WATER LAW—FOURTH ANNUAL CONFERENCE ON WATER RIGHTS, WATER USE & WATER QUALITY ISSUES, Denver, CO. Contact: CLE International, 1541 Race St., Suite 100, Denver, CO 80206, Phone 303/377-6600, FAX 303/321-6320, e-mail cleintl@nilenet.com.
- Mar. 10-12 THE OGALLALA AQUIFER – MANAGING FOR DROUGHT AND CLIMATE CHANGE, The Great Plains Symposium 1997, Lincoln, NE. Contact: Robert Kuzelka, Phone 401/472-7525, FAX 402/472-3574, e-mail to rkuzelka@unlinfo.unl.edu.
- Mar. 14 Second Symposium on WATERSHED PLANNING AND MANAGEMENT, Denver, CO. Contact: Colorado Section, American Water Resources Association, P.O. Box 9881, Denver, CO 80209-0881, Steve Forvilly at 303/286-3325.



- Apr. 8 PLANNING FOR A SAFER TOMORROW, Golden, CO. Contact: Fred Sibley with Colorado Natural Hazards Mitigation Foundation at 303/273-1775 or Shannon Kelly with Western Insurance Information Service at 303/790-0216.
- Apr. 21-23 WHAT'S NEW IN THE TOOLBOX? APPLIED RESEARCH FOR MANAGEMENT OF WYOMING'S WATER RESOURCES, Casper, WY. Contact Chris Goertler, Wyoming Water Resources Center, P. Box 3067, University Station, Laramie, WY 82071; Phone 307/766-6653, FAX 307/766-3785, e-mail goertler@uwyo.edu.
- May 7-9 COMMUNITIES WORKING FOR WETLANDS, Alexandria, VA. Contact: Terrene Institute, 4 Herbert Street, Alexandria, VA 22305, Phone 800/726-4853 or 703/548-5473, FAX 703/548-6299, E-mail terrene@gnn.com.
- May 28-31 IAIA '97 - REFLECTIONS ON WATER: LEARNING FROM HISTORY AND ASSESSING THE FUTURE, New Orleans, LA. Contact: International Association for Impact Assessment, NDSU-IBID, Hastings Hall, PO Box 5256, Fargo, ND 58015-5256, FAX 701/231-1007.
- June 29-
July 3 AWRA/UCOWR ANNUAL SYMPOSIUM, WATER RESOURCES EDUCATION, TRAINING AND PRACTICE: OPPORTUNITIES FOR THE NEXT CENTURY, Keystone, CO. Contact: John Stednick, General Chairperson, AWRA, Phone 970/491-7248, E-mail jds@cnr.colostate.edu; or Robert Ward, General Chairperson, UCOWR, Phone 970/491-6308, E-mail rward@vines.colostate.edu.
- July 14-15 1997 ROCKY MOUNTAIN SYMPOSIUM ON ENVIRONMENTAL ISSUES IN OIL AND GAS OPERATION, Golden, CO. Contact: Continuing Education, Colorado School of Mines, Phone 303/273-3321; FAX 303/273-3314; E-mail space@mines.edu.
- Aug. 5-8 HYDROPOWER: NEW CHALLENGES, OPPORTUNITIES AND PARTNERSHIPS, Atlanta, GA. For information contact: American Society of Civil Engineers at Direct Line 703/295-6000, Exhibits 703/295-6009, FAX 703/295-6144, Website: www.asce.org.