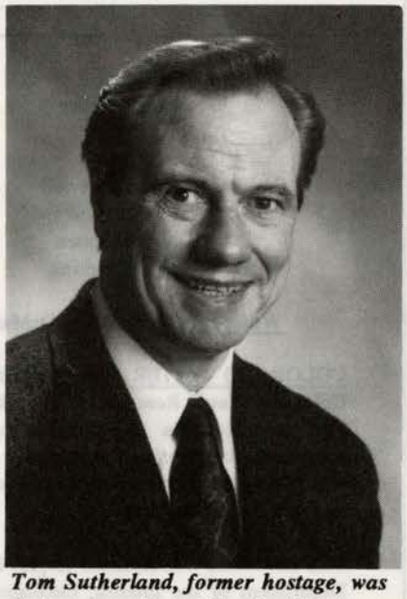
COLORADO WATER

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

WATER ITEMS AND ISSUES . . . *April 1992*



Tom Sutherland, former hostage, was featured speaker at the Conference

Joint Meeting

COLORADO WATER ENGINEERING AND MANAGEMENT CONFERENCE & AWRA COLORADO SECTION

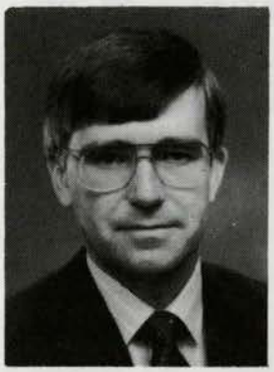
March 2-3, 1992

See page 21

UPCOMING MEETINGS

May 19, 1992 - Children's Water Festival See p. 20
July 13-17, 1992 - Water Resources and Environment: Education, Training and Research See p. 29
July 22-24, 1992 - Showdown on the Colorado River See p. 29
September 15-18, 1992 - A Workshop on Environmental Assessment of Mountain Streams See p. 31
October 27-28, 1992 - Defining Ecological and Sociological Integrity for the South Platte River Basin See p. 30
June 15-17, 1992 - Uncovering the Hidden Resource: Groundwater Law, Hydrology and Policy in the '90s
(see p. 4, Natural Resources Law Center)

Colorado State University



MAKING "VITAL CONNECTIONS"

by Robert C. Ward

One of CWRRI's major reasons for existing is to connect the water expertise of higher education to the needs of water users, water managers and water professionals in Colorado. Colorado State University President, Albert Yates, has referred to this purpose as "Vital Connections." Making such connections requires knowledge of what is available to connect! During my first few months as CWRRI director, I have initiated an "inventory" of water expertise in Colorado's higher education system, primarily for the purpose of making such expertise readily available to people off campus. I am inventorying faculty, courses, Extension personnel and seminars (these latter two were published in the February 1992 issue of *Colorado Water*). In this issue you will find a list of faculty at Colorado State University who apply their discipline to some aspect of water. I've chosen to list the faculty by water interest area rather than academic department or discipline. Also, each faculty member is listed only once, under the area that most closely describes his or her major specialization. As you will clearly see, the list had to be shortened in some manner to publish it in the newsletter.

This list of Colorado State University water faculty will be followed by lists of other higher education faculty and courses (e.g., the University of Colorado-Boulder and Colorado School of Mines) as they are developed. I hope *Colorado Water* readers will use these lists to establish "vital connections" with higher education's water expertise. Faculty often need to be made aware of the places and forums within which their expertise can be most welcomed and beneficial. As Fort Collins Mayor, Susan Kirkpatrick, notes in her comments on page 6, there is a need to integrate water expertise, wherever it may exist, into the discussions on water matters. Hopefully, the CWRRI inventories will greatly assist in connecting higher education's water expertise with the needs of Colorado's water management system.

RESEARCH OPPORTUNITIES

Environmental Protection Agency--The Office of Pollution Prevention and Toxics announces the availability of approximately $3 million in FY92 grant/cooperative agreement funds under the Pollution Prevention Incentives for States Grant Program (Fourth Funding Cycle). This program supports state and regional-based programs that address the reduction or elimination of pollution across all environmental media: air, land and water. Deadline: April 20, 1992. Contact your contracts and grants office for more information.

Federal Register, 3/17/92

National Science Foundation--The President's Budget Request for FY1993 includes a request for $2.5 million to begin a new program in hydrologic sciences at NSF. It will provide funding for basic research relating to water in the form of precipitation, lakes, streams, and groundwater, and their interactions with landforms, climate, weather, the biosphere, and the Earth's crust. Subject to appropriation of funds by Congress, the new program will receive proposals from university and college investigators beginning in May 1992 for funding during FY1993. Proposal deadline dates are expected to be June 1, 1992 and December 1, 1992. The new NSF program is intended to complement more applied research programs in federal "mission" agencies including the U.S. Geological Survey, the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Weather Service and the Agricultural Research Service.

For information contact James Hays, Division Director, Division of Earth Sciences, NSF, Washington, D.C. 20550 (Phone 202/357-7958; FAX 202/357-0364).

COLORADO WATER

Vol. 9, No. 2 Date: Apr. 1992

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COLORADO WATER is a publication of the Colorado Water Resources Research Institute. The scope of the newsletter is devoted to enhancing communication between Colorado water users and managers and faculty at the research universities in the state.

This newsletter was financed in part by the U.S. Department of the Interior, Geological Survey, through the Colorado Water Resources Research Institute. The contents of this publication do not necessarily reflect the views and policies of the U.S. Department of the Interior, nor does mention of trade names or commercial products constitute their endorsement by the United States Government.

Published by the Colorado Water Resources Research Institute, Colorado State University, Fort Collins, CO 80523. Phone: (303) 491-6308

Robert C. Ward, Director

WATER RESEARCH

CITY OF COLORADO SPRINGS JOINS LYSIMETER STUDY

In the Spring of 1991 the State Engineer's Office and CWRRI designed a research program to study and develop a methodology to estimate return flows resulting from urban lawn watering. Researchers Ramchand Oad and Terry Podmore, professors of agricultural engineering at CSU, hope that results will contribute to an improvement in water conservation and a better understanding of water use along the Front Range. In January the City of Colorado Springs signed a Memorandum of Understanding with CWRRI to cooperate in the study.

At the Agricultural Engineering Research Center, site of the research, the project's first phase will determine the accuracy of small lysimeters (12-inch and 16-inch) for estimating consumptive use and for deriving deep percolation. A lysimeter is a device for measuring the percolation of water through soils and determining the soluble constituents removed in the drainage. The CSU facility has a standard lysimeter (1 sq. m) that will be used for comparison with the small lysimeters. It also has a weather station where climatic data can be obtained and used to estimate grass consumptive use, irrigation and soil moisture. The deep percolation can either be measured directly as drainage or as a residual in the volume balance equation.

The study is considering two types of small lysimeters. The first is a drainage type used extensively by the City of Colorado Springs in their return flow study. It is permanently installed flush with the ground surface and sod is allowed to grow over the lip. The measurements taken for this type of lysimeter are application and drainage. Consumptive use is calculated as the difference between application and drainage. This approach assumes no change in soil moisture storage. The second type of lysimeter is a weighing lysimeter. Here the installation differs, in that this lysimeter is designed to be lifted out of the soil for weighing and drainage. Consumptive use is derived from a balance of application, drainage, and soil moisture storage change. As collection of data continues in the summer of 1992, investigators will assess the accuracy of small lysimeters as a function of lysimeter type and soil type. After the accuracy of the small lysimeters is established, the study will move on to the more difficult question of quantifying return flows. The small lysimeters will be placed in representative urban lawn environments and the deep percolation will be estimated and then related to return flows.

CSU REVEGETATION STUDY IS PART OF SUPERFUND CLEANUP EFFORT

The Department of Range Science at Colorado State University is involved in a four-year study begun in 1991 to identify potential reclamation techniques for revegetation and reclamation of hillsides at Bunker Hill, Idaho. The study is being conducted by the Range Science Department, and is funded by the Pintlar Corporation of Coeur d'Alene, Idaho. Bunker Hill is a site which has historically been severely impacted by lead and zinc mining activity and resulting sulphur dioxide emissions during the twentieth century. It is one of the oldest EPA Superfund sites in the United States. Colorado State University's role through the Range Science Department is part of this Superfund cleanup effort.

The Department of Range Science is well-known in the field of reclamation research and revegetation work. According to Dr. Edward Redente, professor of Range Science, this expertise developed in the early 1970's with research in revegetation of potential oil shale development sites on Colorado's western slope. Dr. Redente was a graduate student in Range Science at Colorado State University at that time. With the demise of the oil shale industry in Colorado, reclamation research shifted and expanded into other areas.

Reclamation of the hillsides at the Bunker Hill site began in 1972 for research purposes, and larger scale reclamation work began at the site in 1976. Some portions of the hillsides have proven much more difficult to reclaim. These sites typically have steep slopes, low pH soils, and have been devoid of vegetation for the past thirty to forty years. This is due to both fire and sulphur dioxide emissions. Test plots for the first year of this current study are located on these slopes. For the study these sites have been planted with Idaho white pine seedlings alone and in combination with different shrub species, and a mixture of grasses on some plots to serve as an understory component. According to Dr. Redente, results from the first year's test plots are encouraging, but no firm conclusions can be drawn. The first year data of this four-year study is preliminary, and will undoubtedly change with time.

SOUTH PLATTE RIVER ECOLOGICAL HISTORY

Greg Silkensen, a graduate student of history at Colorado State, is currently studying the ecological history of the South Platte River Basin as a student intern for CWRRI. More specifically, he hopes to describe the ecosystem of the South Platte before 1859 (when irrigated agriculture was initiated) and describe how the river's ecosystem evolved with the increased irrigation since then. There were many conflicting observations written during the 1800s, and Greg hopes to further clarify the ecological conditions and changes that took place in the South Platte during the 1800s.

Greg is particularly interested in reading journals or personal accounts of pioneers, gold seekers, and others who traveled up the South Platte River Valley and may have recorded ecological and physical descriptions of the South Platte. If you have any information that will help Greg in his research, please contact him at the Institute (491-6308).

NRLC COMPLETES STUDY ON USBR TRANSFERS

Bureau of Reclamation facilities constructed over the past 90 years in the 17 Western states deliver an average of 30 million acre-feet of water annually. About 85 percent of the water goes for irrigation; 11 percent is provided to municipal and industrial use. The nearly 190 units included in this system represent a key component of the West's water supply. Because of the importance of this water supply, the Natural Resources Law Center (NRLC) initiated a study of water transfer opportunities from the USBR facilities to new uses in September 1989. The study focused on case studies of USBR projects in nine Western states where transfers either had been proposed or had occurred.

In particular, the project examined the effect of federal law, policy and procedure on transfer of water supplied from these federal facilities. In the absence of Congressional guidance, the Department of the Interior has now established a general water transfer policy. Project case studies reveal a number of areas where additions and clarifications to this policy are needed. Of primary importance is the need for clarification of the nature of the water delivery rights enjoyed by users of water supplied from Bureau facilities. Also, clarification is needed regarding the federal role in these transfers.

The report, Facilitating Voluntary Transfers of Bureau of Reclamation-Supplied Water, is in two volumes. The first contains the general findings from the study and includes recommendations. The second volume presents the detailed results from the case studies. The complete two-volume report can be purchased for $22 or the volumes can be purchased separately: $20 for Vol. I and $15 for Vol. II. Contact: NRLC, Univ. of Colorado, Campus Box 401, Boulder, CO 80309-0401.

Mission of The Natural Resources Law Center

The Natural Resources Law Center (NRLC) was created at the University of Colorado School of Law in 1981 to provide a forum for sustained academic inquiry and a source of broad public education on current issues of natural resources law and policy. Its activities revolve around three program areas with a strong focus on water resources: public education, research and publications, and a visitors program. NRLC has sponsored over 20 educational programs dealing with water issues, including its well-known annual June water conference which draws participants from all across the country. The title of this year's water conference (June 15-17) is "Uncovering the Hidden Resource: Groundwater Law, Hydrology, and Policy in the 1990's." It will be held concurrently with the Rocky Mountain Groundwater Conference, organized by the Colorado Groundwater Association.

Over its ten years of existence, NRLC has published numerous books, research papers, and articles, including: Controlling Water Use: The Unfinished Business of Water Quality Protection (1991); Instream Flow Protection in the West (1989); Water and the American West: Essays in Honor of Raphael J. Moses (1988); Tradition, Innovation and Conflict: Perspectives on Colorado Water Law (1987); and Special Water Districts: Challenge for the Future (1984). Among the Center's many other publications on water resources are a series of ten discussion papers by leading authorities on western water policy and six occasional papers on a variety of water issues. The Center's newsletter, Resource Law Notes, often contains articles related to water resources.

The NRLC research program has produced an extensive collection of detailed reports dealing with law and policy issues related to water resources. A few of the most recently-completed research projects include an examination of wetlands protection and water rights, an in-depth analysis of the water transfer process as a management option for meeting changing water demands in the western states, and a detailed inquiry into options for facilitating voluntary transfers of water supplied by the federal Bureau of Reclamation. All of these research reports are available to the general public.

The Natural Resources Law Center's visitors program has two parts: visiting research fellows and distinguished visitors. The Fellows program allows individuals employed in private practice, industry, government, or public interest to spend a semester in residence at the law school, conducting research and writing on a natural resource topic of mutual interest to them and the Center. The Center's Distinguished Visitor program brings prominent scholars, practitioners, and government officials involved in natural resources to the law school for two-day visits. While in residence, the distinguished visitors participate in seminars, present lectures to students and local attorneys, and enjoy informal discussions with students and faculty. Many of the Center's distinguished visitors have presented unique and informative perspectives on water resource issues.

The Natural Resources Law Center is located in the University of Colorado School of Law in Boulder. Its professional staff includes Lawrence MacDonnell (Director), Sarah Bates (Assistant Director), and Teresa Rice (Senior Staff Attorney). Inquiries may be directed to Campus Box 401, University of Colorado School of Law, Boulder, Colorado 80309-0401, telephone (303) 492-1286.

ELECTRODES HELP CLEAN GROUNDWATER

Experiments using low-voltage electrodes to clean up groundwater are being conducted by Don Runnells, Chairman of the Geology Department at the University of Colorado, and three graduate students. When low-voltage electrodes were placed in wells extending below a simulated water table, a variety of contaminants migrated toward them and became concentrated in the wells. The water could then be pumped out, treated using existing technology and returned to the ground. The technique is especially efficient in attracting sulfate and should be effective to a lesser degree for removing low-level uranium, copper, zinc, arsenic, chromium and selenium, and select man-made compounds including some solvents.

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

CSU Evaluation of Engineering in Society--A Broader Professional Curriculum, Charles O. Neidt, Human Factors Research Lab
Sediment Entrapment in Vegetated Channels, Steven R. Abt, Civil Engineering
***Evaluation of NEXRAD Doppler Weather Radar Algorithms and Mesoscale Analysis...**, Thomas H. Vonderhaar, CIRA Admin. Unit
Aquatic Resource Analysis, Stephen A. Flickinger, Fishery & Wildlife Biology
Very High Resolution Gridded Meteorological Forecast Development, Gerald L. Browning, CIRA Admin. Unit
Assessment of Research & Applications on Natural Hazards, Dennis S. Mileti, Graduate School
Joint CSU-USSR Cloud-Radiation Climate Studies, Stephen K. Cox, Atmospheric Science
***Biosphere-Atmosphere Interactions--A Study of the Energy, Water and Carbon Cycles**, David A. Randall, Atmospheric Science
Bureau of Reclamation--Saline Water Research, Milan Rewerts, Cooperative Extension
Colorado Transportation Information Center, Darrell G. Fontane, Civil Engineering
Reducing Formation of Municipal Solid Waste, Harry W. Edwards, Mechanical Engineering
***Evaluating Log-Drop Structures as Habitat Improvement for Trout**, Kurt D. Fausch, Fishery & Wildlife Biology
***Training and Education for Agricultural Chemicals and Groundwater**, Lee E. Sommers, Agronomy
***Research in Support of a Microwave Precipitation Retrieval Algorithm for TRMM**, Graeme L. Stephens, Atmospheric Science
Integrating Remote Sensing and Ecological Modeling for Assessing Terrestrial Ecosystems, Roger M. Hoffer, Forest Sciences
Economic Evaluation of Dryland Cropping Systems, Sanford L. Gray, Agricultural & Resource Economics
***Climate Change Effects on Soil Carbon Balance**, Edward T. Elliott, Natural Resource Ecology Lab
***Agroecosystem Carbon Pools and Dynamics**, Edward T. Elliott, Natural Resource Ecology Lab
***Investigation of the Influence of Surface Heat and Moisture Fluxes on Mesoscale Climate...**, Roger A. Pielke, Atmospheric Science
***Effects of Gradation and Cohesion on Scour**, Albert Molinas, Civil Engineering
Cirrus Cloud Studies Using the NCAR Sabreliner as Part of Phase II FIRE, Graeme L. Stephens, Atmospheric Science
***Observational and Modeling Studies in Support of the Atlantic Stratocumulus Transition...**, Stephen K. Cox, Atmospheric Science
Modeling of CO2 Impact on a Grassland System, William J. Parton, Natural Resource Ecology Lab
Preferences of Users of Arapaho and Roosevelt National Forests, Michael J. Manfredo, Recreation Resources
***An Evaluation of the Leachability of Heavy Metals from Fly Ash Liner Materials**, Charles Shackelford, Civil Engineering
***Hillside Revegetation for Bunker Hill**, Edward F. Redente, Range Science
***Coordination, Chemical Analysis and Support Services for NADP/NTN Deposition Mointoring...**, James H. Gibson, Natural Resource Ecology Lab
***Clouds--Their Prediction and Simulation**, William R. Cotton, Atmospheric Science
Incremental Assessment of Habitat, Discharge & Modification for Low Flow, Steve Abt, Civil Engineering

University of Colorado, Boulder, CO 80309

***Innovative Approaches for Valuing Perceived Environmental Quality**, William Schulze, Center for Economic Analysis
Mammoth Lakes Michelson Tiltmeters Maintenance, Roger Bilham, Cooperative Inst. for Research in Environmental Sciences (CIRES)
***Development and Implementation of ADSS (Advanced Decision Support Systems) for River Operations in the West**, Kenneth Strzepek, Civil Engineering
Estimating Ecosystem Biogeochemistry Through Hyperspectral Analysis, Carol Wessman, CIRES
The Significance of Geology, Climate and Local Relief on the Load of Rivers, William Hay, CIRES
Stable Isotope Measurements in Waters at the Rocky Flats, James White, Institute of Arctic and Alpine Research (IAAR)
Development of an Optimal Predictive Supervisory Control Scheme for a Canal System with Multiple Local Automatic Controllers, David Clough, Civil Engineering
Investigations of Natural Groundwater Hazards at the Proposed Yucca Mountain High-Level Nuclear Waste Repository, Charles Archambeau, CIRES
Interaction of Terrestrial and Atmospheric Hydrological Cycles in the Context of the North American Southwest Summer Monsoon, William Emery, Aero-Colorado Center for Astrodynamic Research-Aerospace Engineering
Comparative Lithological Mapping Using Multipolarization, Multifrequency Imaging Radar and Multispectral Official Remote Sensing, Fred Kruse, Cooperative Institute for Research in Environmental Sciences (CIRES)
Summer Climate Interactions in the Arctic Basin, Mark Serreze, CIRES
Modeled and Observed Sea Ice Variability in the Arctic: Sensitivity to Atmospheric Conditions and the Surface Energy Budget, James Maslanik, CIRES
Channeling in Soft Clays, Dobroslav Znidarcic, Civil Engineering

Colorado School of Mines, Golden, CO 80401

The Application of Inverse Methods to the Ocean Environment, Norm Bleistein, Center for Wave Phenomena
Solubility of Minerals in Supercritical Water, Robert Baldwin, CPR
Extraction of Inorganics with Supercritical Water, Robert Baldwin, CH
Hydrate Formation from Ice, E. Dendy Sloan, CPR
Emulsion Liquid Membrane Extraction of Phenolics from Industrial Waste Waters, Annette Bunge, CPR
Abatement of Manganese in Coal Mine Drainage Through Use of Constructed Wetlands, Tom Wildeman, CH
Development of a Computer Code to Model Constructed Wetlands for Aid in Engineering Design, Ron Klusman, CH
Distribution of Hydrophobic Halogenated Organic Compounds and Hydrophilic Herbicides on the Suspended Sediment Phase of the Mississippi River from Minneapolis MN to Belle Chasse, LA, Steve Daniel, CH
Adsorption of Copper, Cadmium and Zinc on Suspended Sediments in a Stream Contaminated by Acid Mine Drainage: The Effect of Seasonal Changes in Dissolved Organic Carbon, Don Macalady, CH
Develop a 3-Dimensional Visual Representation of the Hydrodynamic Model of the Chesapeake Bay, Joan Gosink, EG
Design Parameters for a Constructed Wetland for Treatment of Mine Drainage in the Arkansas River Basin, Ron Cohen, ESEE
Monitoring the Success of Wetlands Created at the Chatfield Arboretum, David Cooper, ESEE
Wetland Treatment Project, John Emerick, ESEE
Assess the Feasibility of Wetland Treatment of Mine Drainage at the Pecos Mine, Torerro, NM, John Emerick, ESEE
Constructed Wetland Treatment Systems for the Eagle Mine: The Optimization Ecology Conditions of a Constructed Wetland Treatment System, Ron Cohen, ESEE
Application of 3-Dimensional GIS to Regional Groundwater Modeling at Yucca Mountain, NV, Keith Turner, GE
Assessment of Uncertainty in the Migration of Groundwater Contamination, Eileen Poeter, GE
Geology and Geochemistry of the Myrick Springs and Fort Irwin Hot-Springs System, R. Hutchinson, GE
Field Assessment of Stream-Aquifer Interaction in the Denver Basin and Comparison with Computer Representation, E. Poeter
The Nature of Interactions that May Occur Between Organic and Inorganic Compounds in the Pore Waters of Sedimentary Rocks, Wendy Harrison, GE
Simulation of Petroleum Derivatives in Groundwater Phase I: Assessment of Available Codes, Required Data and Preliminary Code Demonstration, Eileen Poeter, GE
Development of Optimum Geophysical Field Techniques to Map the Detailed Hydrogeologic Character of the Contaminated Alluvial Aquifer North of Rocky Mountain Arsenal, Abdelwahid Ibrahim, GP
Assessment of Uncertainty in the Migration of Groundwater Contamination, Eileen Poeter, GE
Valuing Wetlands Characteristics and Analysis of Alternative Methodologies for Valuing Non-Market Environmental Goods Applicable to OTS, Wade Martin, ME
Optimizing Substrate for Anaerobic Removal of Heavy Metals in Constructed Wetlands, Tom Wildeman, PH

Departmental Abbreviations: CPR-Chemical Engineering and Petroleum Refining; CH-Chemistry and Geochemistry; EG-Engineering; ESEE-Environmental Science and Engineering Ecology; GE-Geology and Geological Engineering; GP-Geophysics; MA-Mathematics and Computer Science; ME-Mineral Economics; MT-Metallurgical and Materials Engineering; PH-Physics

*Project received supplemental funding

FEATURES

KNOW YOUR NEIGHBORS: THE NEED TO COMMUNICATE WHAT YOU KNOW ABOUT WATER RESOURCES IN THE WEST

by Susan Kirkpatrick, Mayor, City of Fort Collins

Ten short years ago the population of Fort Collins, Colorado was 68,890. The estimated 1991 population of the city is 89,439, an increase of roughly 21,000 people, some of whom relocated to the community from very different parts of the United States in terms of water policy. The experience in Fort Collins is not unique in the state; my guess is that many communities in Colorado have welcomed new residents over the past ten years who bring with them varied experiences and expectations with respect to water policy. For example, it is common to hear newcomers to Fort Collins express near disgust when they find out that single-family residences built before July, 1991 generally were built without water meters in a semi-arid climate!! It is hard to explain to newcomers that some very smart, logical people opposed the installation of water meters in single family residences in our community and that it took a state law to finally change our local policy. The citizens and taxpayers in the state represent a spectrum of experience and background with respect to knowledge of water resources in the West.

Recognizing the importance of knowledge about water policy in Colorado is critical for policy makers in the state. In the City of Fort Collins, the net city operating budget is more than $115 million. The water, wastewater and stormwater utilities represent roughly $30 million of the net operating expenses. Efficient, businesslike operation of that part of the city's responsibility is critical to the future of our community. The City Council determines the water policies that drive the expenditures and revenues in water, wastewater and stormwater utilities. Therefore, it is imperative that city council members and the citizens they represent have at least a rudimentary knowledge of water resources in the West. With the new residents and the changing nature of political participation in communities today, citizens who are knowledgeable about water planning and water policy need to recognize their obligation to communicate their policy understanding to their non-expert neighbors.

In January, 1992, I declared the **Year of the River** in Fort Collins. My intent was to focus attention on the Cache la Poudre River to help the community move toward important environmental, resource and cultural goals. The proposed National Heritage Area along the Poudre will provide an ongoing focus on the River and institutionalize communication about water resources in the West beyond this year. Technical experts in the area of water resources are needed to explain water policy to lay people who are participants in the development of policy for the future. Use the **Year of the River** in 1992 or the National Heritage Area in subsequent years to help your neighbors comprehend some of the features of Colorado water policy that you understand. Reach for that link between technical knowledge and public policy. Your community will benefit from your efforts.

COLORADO'S ENVIRONMENT

by Peter H. Evans, Legal Counsel
Colorado Department of Natural Resources

Let me start out by giving you a little bit of perspective on where the Department of Natural Resources is right now. A little over a year ago, Ken Salazar came in as the executive director when Chips Barry left to become the manager of the Denver Water Department. When Governor Romer appointed Ken as executive director, they agreed on five priorities for Ken's stewardship of the Department of Natural Resources:

(1) administrative efficiency;

(2) the Great Outdoors Colorado program, which is an effort to try and put some emphasis on our acquisition of public lands that are important for a variety of recreational, ecological and natural resource reasons;

(3) water issues, the whole gamut;

(4) education initiatives, the idea being that we need to help make sure that future generations of Coloradoans understand how difficult it is to balance development with protection; and

(5) ethnic diversity.

The Department of Natural Resources has not had a good reputation over the years of recruiting a diversity of people, especially in upper management levels. The Governor and Ken agreed at the outset that we really wanted to put some emphasis there.

When Ken came on board, he discovered that we really had no strategic plan for resource management. We had ten very strong divisions, some stronger than others; some that worked together and others that didn't. He also found that by statute the Colorado Department of Natural Resources and the executive director are directed to develop a resource management plan, so he began right from the start to develop such a plan.

That was about a year ago,and we now have a draft strategic plan that covers the period 1991-1995. Working with the division directors, the state engineer and others in the department, Ken developed this plan and with the division directors presented it to the Governor last November. We made some minor revisions as a result of the Governor's feedback and it is now out for public review. It has been circulated through all the boards and commissions in the Department's ten divisions.

The plan is not something that will be set in stone, but simply a list of objectives. Ken Salazar and the ten division directors have articulated a series of roles, the kinds of things that we think the Department ought to be taking care of. You will read very clearly in this document that we feel Colorado is entering an environment of increasing complexity.

Since my topic is supposed to be Colorado's environment, I'd like to talk about it in two different ways. First is the socio-economic, political environment that we need to operate in as we address environmental and natural resource development issues. Second will be the environment itself. We are discovering that we have a very limited budget. We, over the last couple of years that I have been with the Department of Natural Resources, have been asked repeatedly to take percentage budget cuts across the board - throughout the Department - every program and every division; it's not just DNR, we're not being singled out. But the consequence is an erosion of our ability to do what the statutes direct us to do. At the same time we are seeing a tremendous increase in public participation in natural resource decision making. I saw it first hand in the Two-Forks process. There never could have been enough studies to answer all the questions definitively.

We are seeing a decrease in the amount of federal money that is available for Colorado to develop and manage its natural resources, at the same time that there is an increase in the number of regulatory programs coming into play on any given

number of regulatory programs coming into play on any given resource issue - it's not just water. As a result of the regulatory programs, we are trying to deal with a number of environmental concerns in the context of natural resource management initiatives.

As an example, we really have not focused our integration of water quality concerns as they relate to our management of water rights. The development of Colorado's water is assumed under the Constitution; yet now we have water quality, endangered species and a lot of other questions popping up that will make it increasingly difficult to carry out the provision that the founders of the state recognized. We are also under increasing pressure from downstream states. As they look at the rate of Colorado's development compared to theirs, they have a lot of concerns about how much water was set aside under the compacts for Colorado's future development. We need to be very careful as we negotiate water issues with other states, as there are questions on every side of us.

We are seeing a much greater interest in recreational use of water. As a result there is a variety of new pressures on our system, pressures that were not anticipated 100 to 150 years ago, and at this point we don't have a well established process for dealing with those pressures. A lot of us think that it is just a matter of time until some kind of change will become necessary in the way we address the management of our water resources.

At the same time, we are seeing that many of the water resource facilities that we've developed are not fully utilized. Look around the West Slope - there are a lot of reservoirs that have been built and have unused storage capacity. We have over 150,000 acre-ft. of active storage spread across the state that's not being used because of dam safety concerns.

Finally, if you look at the Metro-Front Range area, there doesn't seem to be any question that it will be the center for most of most water demand in the near future. The strongest demand for new water resources is in the metro area, and by necessity that water will have to come from someplace else. Where will it come from? That's the $64 million dollar question. Will it be the San Luis Valley, the Arkansas, the Gunnison, the Upper Colorado? It can come from a lot of different places. The bottom line is that it is becoming more important than ever that we Coloradoans coordinate ourselves so that we can work together in a more sophisticated manner to address each of these new concerns. We can no longer afford to have different parts of state government or local government running off and trying to take care of only their own concerns. It is not going to work that way.

I have been trying to coordinate Colorado's presence in the Upper Colorado River Endangered Fish Recovery Program for the last couple of years. Active participants in that program are the Division of Wildlife, the Water Conservation Board and the State Engineer's Office. Very disparate interests, and yet it is our view that unless we find a way to integrate those concerns to the maximum extent that we can, we just shoot ourselves in the foot.

Over the last year in the water arena, Ken has organized an in-house water team comprised of the state engineer and the director of the Water Conservation Board, most of the members of the Water Conservation Board, a number of staff members at both the Conservation board and the Division of Water Resources, and members of the Division of Wildlife and Division of Parks, all of whom have major water interests. The development of the 4-year strategic plan was one of our first efforts at team work - to lay out a common agenda and coordinate ourselves as to how we were going to pursue those goals together as a team. We've had a mixture of successes and failures.

The Colorado River negotiations is another good example of the need to work together. The Governor appointed both the State Engineer and the Water Conservation Board Director to the negotiating team for the Colorado River Basin, along with Ken Salazar and Jim Lockhead, the Upper Colorado River Compact Commissioner, to work with the other six basin states. As you know, we made a proposal and we were criticized for doing so. But most of you know the reason for doing that. California had twice asked the Bureau of Reclamation to declare a surplus of water in the Upper Basin and a shortage of water in the Lower Basin. I don't know how many compact scholars there are here, but the consequences would have been dramatic for Colorado. We have more undeveloped water than any of the other Upper Basin states, and to set that kind of precedent we viewed as very detrimental.

The concept of what constitutes a surplus has never been defined. So, when we got word that President Bush and his Chief of Staff, John Sununu, had asked to meet with Secretary Luhan, the idea of perhaps the Bush Administration getting involved in this question made us nervous. We decided that the best thing to do was initiate discussions governor-to-governor, state-to-state, rather than see the Federal Government get involved. We would try to initiate a discussion ourselves, first protecting our allocation under the compact but also trying to be of some help to California in its sixth year of drought.

In that process, we discovered the need for better information. We really don't, as a state, have the internal ability to analyze the decisions that are proposed and later made with respect to the Colorado River. We really don't have the tools in-house to analyze those questions. We put together an advisory committee that drew both from resources inside the department and from the major water constituencies around the state. We see this as the direction of the future - at least, for the next couple of years - that we will be calling increasingly on the expertise that lies outside the Department to complement the expertise that lies within.

The Arkansas River is another good example. Not only the lawsuit with Kansas, which I think we are handling very well, but also a number of internal questions. Boaters wanted better flows on the Upper Arkansas for rafting purposes, but fishermen and Trout Unlimited and the Division of Wildlife were concerned that increased flows would be detrimental to the trout fishery. We were able to resolve that concern internally. It

didn't make everybody happy, but the Division of Wildlife and the Division of Parks were able to work together on a very professional level, express their concerns, meet with Ken and come up with a decision that they could all live with. We had a set of flows and a research program that allows to us to improve conditions for boaters and figure out the impact to the trout fishery, so that next year we can make a better decision about how to balance those competing views.

In the lower Arkansas Valley, people have talked for a long time about wanting a state park centered around a body of water, perhaps John Martin Reservoir. We have yet to do, let's say, a perfect job of maintaining a minimum recreation pool with John Martin. When the water gets drawn down too far the water gets too warm, water quality becomes unacceptable for the fish, and we lose the fishery. We've had a tremendous amount of support from the State Engineer's Office, the Water Conservation Board, the Division of Wildlife and the Division of Parks analyzing the different opportunities, both land-based and water-based, to make something happen in Southeastern Colorado.

The difficulties that we've had you're all very familiar with. It has been a very difficult month. Beginning about February 5th, the level of frustration over the difficulties we were having working together as a team came to a head. Faced with the challenges that I have just reviewed with you - from water quality and wetlands to endangered species and wilderness - we need a team that works well together. Ken went through the laborious process required by the personnel rules and decided that we had to make some changes. Ken has not tried to introduce his own elements of policy or those of the Governor other than that we have to work together in a coordinated and professional manner.

Let me touch back, one more time on the endangered species issue because it so nicely typifies the trouble that we are running into in the water quality area, the wetlands area and the wilderness area. We have proposed flows right now for the Piedra Wilderness Area. The Water Conservation Board is taking a hard look at protecting flows necessary to preserve the wilderness values in a downstream wilderness area pursuant to Colorado's instream flow law.

What we are finding, over and over again, is that the science is really hard to come by. We have to protect flows for those fish, and yet we don't have the foggiest idea what kind of flows they need. The scientists are doing everything, I think that, they reasonably can. There is a lot that they know about fish; unfortunately, there is a lot more that they don't know, or can't quantify. They have this very strong sense that because the fish evolved and survived over millions of years in an unregulated river that the key to their recovery is to return the flows in the direction of a natural hydrograph. To a lot of people that starts to sound like you take all the reservoirs out of the system. We can't do that. We have too many people here, too many businesses, too many families, too many friends that are dependent on our ability to regulate those flows. Maybe we can regulate them back in the direction of a more natural hydrograph, but we can't put all the water back in the stream; not without everyone going home to wherever you and I all came from.

Those fish live in muddy water. We know a lot about trout because they live in clean water, they are sports fish and so we've researched the hell out of them for years. We put scuba divers in the stream to watch them, but you can't do that in muddy water. These fish are rare, they're endangered, and that means their aren't a lot of them left. So you've got to really go out of your way even to find what parts of the river they live in. They migrate and they do different things at different times of the year in different places. The research requirement is awesome.

So, as in most of the other areas where water resources management is at issue, we find ourselves making a well educated decision with a lack of information. It doesn't matter whether it's endangered fish, wilderness values or water quality - we have a lack of hard data. We really don't know how often a riparian wetland along a riverbank needs to be inundated before it's not only stressed but begins to undergo significant changes - we don't know that.

We have a big challenge ahead of us. We are going to do everything we can to become more coordinated and efficient with the dollars that taxpayers are willing to give us. We have to. We have to count more on you to share expertise with us. I think we will move more in the direction of educational programs, partnerships, outreach, advisory committees and providing basic information. We have our work cut out for us and we know that you do too. We look forward to all the help that you can give us and all the help we can give you.

WHAT CAN COLORADO LEARN FROM CALIFORNIA'S DROUGHT?

by Maureen Maxwell

How much do Coloradoans have to pay for water relative to how much has been invested in water projects and treatment facilities, and how much are we willing to pay in our monthly water bill for more water? California residents have come face to face with the "conservation contradiction"--they are using less water but paying higher rates. The March/April 1992 issue of *Western Water* took an in-depth look at urban water costs in California, what determines them, how they have developed over the years, and what the future may bring. The following is a summary of the *Western Water* report.

Under California state law water is free and customers are billed for the capital and operating costs to transport water from a well, river or reservoir to a treatment plant and from there to their faucets. Water storage, diversion, conveyance, treatment, distribution, construction repayment and drought related costs are included in monthly rates, as well as operating and maintenance expenses and, in the case of a private utility, taxes

and any profit. On average, urban residents now pay about the same for their water as residents in cities throughout the United States. Utilities sold less water during the drought but faced the same or higher expenses to meet fixed delivery system costs and to finance special conservation programs.

AVERAGE MONTHLY WATER CHARGES BY REGION

Northern	$19.22	San Joaquin Valley	$11.50
Coastal	$28.17	Southern	$17.89

Source: Black & Veatch

The long drought has increased interest in more reliable water supplies. In a 1990 Field Institute Poll, 81 percent of those polled said it was necessary to build new water supply facilities. The public may not realize, however, the effect such facilities will have on their monthly water bills. Water will not be as inexpensive as customers have come to expect, but it could still be their least expensive utility: Lester Snow, general manager of the San Diego County Water Authority (SDCWA), estimates that even with a proposed rate increase to finance capital projects, the average SDCWA customer's water bill would be close to one-third of the average monthly gas and electric bill and comparable to the lowest monthly cable bill.

HISTORY--Hydraulic mining, irrigation, and urban growth were the first uses of rivers and underground aquifers as pioneers moved into California. Los Angeles and San Francisco quickly outgrew their local water supplies and built reservoirs and aqueduct systems to use water from the Owens Valley and the Hetch Hetchy Valley. Only recently have the full capacities of these systems been reached. Because these systems were built years ago with extra capacity, consumer rates have remained very low. Newer projects involve higher construction and engineering costs, environmental mitigation, interest, and transportation costs, usually making state water much more expensive than federal water. Per acre-foot wholesale costs south of the Sacramento-San Joaquin Delta range from $44 in the San Joaquin Valley to $237 in southern California, 440 miles south of the Delta.

URBAN WATER RATES--State law prohibits utilities managed by a city or a separately elected board of directors from earning a profit on water sales. Rates are set to meet delivery costs, including repayment on local storage and distribution systems, local share of repayment on a state or federal project, water treatment costs, maintenance and administrative costs. Pass-through fees imposed by a wholesale entity and the projected capital costs of future water treatment and supply facilities, such as reservoirs and wastewater reclamation systems, are also included. The Public Utilities Commission permits utilities owned by private investors to charge rates that include a "reasonable" return on their investment.

It used to be common for customers to be charged a monthly service fee and then charged on a declining block rate for each unit of water used (the per unit rate of water drops as usage increases). Only two percent of California's 218 retail water purveyors still use declining block rates, 58 percent have uniform block rates and 29 percent use inclining block rates. Suppliers in some areas adopted steeply inclining block rates to encourage customer conservation during the drought. Even when the drought ends, more suppliers are expected to use inclining rates because of the "conservation ethic." A Memorandum of Understanding regarding water conservation in California was signed in December 1991 by 130 urban agencies, environmentalists and public interest groups. It encourages suppliers to adopt either a uniform or an inclining block rate structure.

In addition to the cost of providing water service, urban utilities now take other issues into consideration when setting water rates: should growth pay for itself through new connection fees, should low- and fixed-income consumers be subsidized by other users, and should water supplier policies influence urban growth.

DROUGHT COSTS--The drought has raised consumer water bills in a number of ways. It has forced some urban utilities to buy supplemental and more expensive water supplies. Some drilled additional wells and installed more pipeline to augment usual sources. Conservation programs such as policing water-wasting rules, providing ultra-low-flow toilet rebates and launching extensive public relations campaigns have increased utility costs and therefore customer water bills. In addition, reduced consumption has reduced utilities' revenues, but fixed operation and maintenance costs and debt service on state and federal projects still have to be paid. Many utilities raised water rates or proposed rate increases, to the objections of some customers.

For example, the Santa Clara Valley Water District (SCVWD) bought water from the emergency Drought Water Bank and Placer and Yuba counties to offset reductions in its usual supplies. At the same time, the district had to maintain payments on the State Water Project and the Central Valley Project. Officials had to raise wholesale untreated water rates from $100 per acre-foot in 1987-88 to $262 per acre-foot in 1991-92. The San Jose Water Co., supplied by the SCVWD, raised customer water rates more than 75 percent since 1988.

AVERAGE MONTHLY WATER CHARGES

Top Five Counties		Bottom Five Counties	
Marin	$40.86	Shasta	$ 9.70
Santa Barbara	$30.51	Sacramento	$ 9.85
Monterey	$29.49	Stanislaus	$10.04
Nevada	$27.68	Madera	$10.25
Amador	$27.30	Tulare	$10.35

Source: Black and Veatch

Revenues of the Los Angeles Department of Water and Power (LADWP) dropped 25 to 30 percent as consumers cut their water use by 30 percent. At the same time LADWP spent more than $26 million on its ultra-low-flow toilet rebate program. The result was a proposed 11 percent rate increase. LA City Council approved a 3.6 percent increase by a one-vote margin.

A 1991 survey of 335 California cities and water purveyors conducted by consulting engineers Black & Veatch shows the Although rate structures and average use of water differ between cities, Black & Veatch compared water charges in the cost of purchased water and conservation-designed water rates. communities based on a uniform monthly usage of 1,500 cubic feet or 11,000 gallons. The average single-family residence pays $18.31 a month for water, from a range of $60.20 per month in drought-stricken Santa Barbara to $5.80 in Los Banos, a Central Valley farming town that uses groundwater.

Another factor urban utilities must consider is the cost to industry of unreliable or inadequate water supplies. California manufacturing uses only two percent of the state's water, but a study released in November 1991 by the California Urban Water Agencies concluded that California's economy and business climate were being adversely affected by unreliable water supplies. The study found that the largest production losses from a hypothetical water supply shortage would hit the refining, computer and electronics, beverages and food industry groups. The study also found that plants were spending several times the unit cost of purchased water on water conservation projects to protect themselves from drought rationing and uncertain utility water supplies.

FUTURE RATES, RELIABILITY, AND QUALITY--In the short run, urban water rates may drop after the drought if water sales go up. In the long run, however, water costs will continue to rise as water officials work to increase supplies and improve reliability. Capital costs to build new off-stream reservoirs, wastewater reclamation systems and desalination plants will play the largest factor in increasing the price of water. Water marketing may also increase rates.

Proponents of water marketing say it would provide the least expensive source of new supplies for municipal areas. Current prices are not driven by supply and demand, and water marketing could result in cheaper water in urban areas. On the other hand, the electricity and capital costs of transporting the water must be considered.

Water marketing would provide only a portion of the supply needed to meet predicted future demand. The state Department of Water Resources is working on the proposed off-stream Los Banos Grandes Reservoir and other projects. The Metropolitan Water District of Southern California (MWD) is considering a rate increase to fund the proposed 800,000 off-stream reservoir in Riverside County, which would double the agency's storage capacity. This is just part of a planned $6 billion in capital projects that is expected to raise MWD's rate for untreated municipal and industrial water to $490 an acre-foot by 2000.

The San Diego County Water Authority is considering a general rate increase to finance a major capital improvement program of $660 million. The program would include one or more new reservoirs and an improved and expanded pipeline system. Revenue will also be needed for reclamation, desalination, conservation and water treatment.

Statewide, developers now are charged $1,000 to $15,000 per single-family house to connect to a municipal system. These charges could increase as urban utilities work to increase their water supply. This "growth should pay for itself" policy could help reduce monthly bills for all customers.

However, another factor affecting rates is compliance costs for treatment standards under the 1986 Safe Drinking Water Act. The act directed the Environmental Protection Agency (EPA) to set maximum contaminant levels for 83 substances and to date, the agency has set standards for 48. In addition, California urban water utilities will have to comply with the EPA's 1989 surface water treatment rule requiring suppliers to filter all surface water. These will raise treatment costs, especially affecting the consumer rates for smaller utilities that have fewer customers to absorb the cost of a new or renovated treatment system. For example, Citizens Utilities in Felton, a private utility with 1,300 customers, has asked the PUC to approve a 71 percent rate increase for this year, an 18.7 percent increase for 1993, and a 5.8 percent increase for 1994 to help finance a new treatment plant or an extensive upgrade of its existing plant to comply with new federal rules.

Environmental planning and mitigation does increase the costs of new projects. In addition, there is interest in rehabilitating wilderness areas by transferring developed water from urban and/or agricultural users and dedicating it to fish and wildlife. The cost will depend on what system is used to supply these instream sources. If it comes from federal CVP contractors, the cost to the irrigation district will be the cost of replacing the water and any loss of profits from land no longer used for agriculture. If it is unappropriated flow not now available for water permits, the cost is zero, unless one looks at what the loss of allocating such water to someone else's use might be.

WHAT DOES IT MEAN FOR COLORADO?

If the California situation is what Colorado can expect in the future, we can learn from watching how they handle the drought water supply crisis. Also, some Coloradoans are already working on the subject.

Charles Howe and researchers at the Institute of Behavioral Science at the University of Colorado at Boulder (UCB), through the Research Program on Environment and Behavior, have designed mail survey methods to gather information on water user attitudes toward urban water supply reliability and on users' willingness-to-pay for increased reliability. Their study presents a framework for including this willingness-to-pay in the design of water supply systems. Publication of the report is pending--it will be available through the National Technical Information Service.

In addition, Max McGowan, a CWRRI graduate assistant funded by the Denver Water Department, is assisting in a study comparing water conservation and rate structures in California's Bay Area and in the Denver Metropolitan Area. Dr. William H. Bruvold, University of California, Berkeley, is the principal investigator. Colorado has not had the water restrictions many Californians face. Does our water future look like California? At least, by learning from California's experience, we may be better prepared.

ADMINISTRATION OF WATER QUALITY AND WATER QUANTITY IN COLORADO: CAN THEY WORK TOGETHER?

Following is a transcript of the AWRA-Colorado Section/Colorado Ground Water Association Program on January 15, 1992. The topic was discussed by a panel including: Jeris Danielson, former State Engineer; Paul Frohardt, Administrator of the Colorado Water Quality Control Commission, Greg Hobbs, Attorney for the Northern Colorado Water Conservancy District; and Melinda Kassen, Professor of Law at the University of Denver and Attorney for the Environmental Defense Fund. The discussion was moderated by Sara Bates, Asst. Director of the Natural Resources Law Center, University of Colorado-Boulder. (Transcribed and edited by CWRRI staff. Question/Answer session not included due to lack of space but transcript is available from CWRRI upon request (491-6308).

Remarks by Jeris Danielson

To understand implementation of water quality in the State of Colorado and concerns about it, you have to go back and look at our history. There has not been a *revolutionary* approach to the problem; it has been *evolutionary.* Water development began back in the mid-1800's, and it was a time when (1) there were no water quality problems, or very few, and 2) there was not that demand, need or competition for the resource, in a broad sense. And so water quality was not a problem.

As we moved into the 20th century, you find that long before, as is usually the case, the federal government discovered water quality and passed the Clean Water Act, our legislature put into the statutes of the state engineer's office directions and concerns about water quality where, in the administration of water, quality would be a concern. And this was at the turn of the century. So Coloradoans have been dealing with the issue of quality and quantity. perhaps not in a perfect fashion, but at least it has been in the law; there has been concern.

In the seventies, we began to see the question of the integration of quality and quantity come into the water courts. There was a case up on Clear Creek with the Church ditch where the discharger wanted to substitute water down the Crow canal that was not very good quality. The City of Westminster brought the case to the water judge, and the polluter was told he couldn't make that kind of a substitution. Why? Because for 80 years, we've had a law on the books that says a substitute supply has to be of a quality to meet the needs of the senior appropriator. So we began to see these kinds of efforts come more and more into the courts.

I have to give credit where it is due, though. In the '70s also we began to see the awakening of a real public awareness in the general populace because the efforts of people like Melinda, and EDF, and the environmental community who perceive that, you know, things are not all screwed up, at least, out here in the West yet. Most of them migrated out of the screwed up mess in the East. But there was an awareness that began in the '70s, I think a very healthy one, and I think water users began to understand this too, that a water run has imbedded in it a quality; it isn't just the volume - it is the quality of that volume. So, I think we are way out in front as usual of the federal government dealing with the issue.

People have criticized Senate Bill 181 for not really going very far, and it doesn't go very far. But it at least makes that first small step of combining decision making with administration of quality and quantity and at least getting a kind of coordinated approach. The Water Quality Control Commission sets Standards and Classifications, and my office and other agencies then implement those standards through the administration of water rights.

Now it is certainly not an ideal marriage, but I think it is a first step. And I think what we will see as we move ahead in the implementation is a reorganization. I think we'll begin to see the legislature understand that water decisions need to be made in a holistic fashion. I think in the next two to four years you will see that integration at least under some kind of an umbrella of that decision making process.

What are some tough issues about 181? If I had listened to certain parties in the hearing, I would have taken points of compliance. For example, how do you define the point of compliance for the granting of a well permit for irrigation? A tough issue. Do I as an administrator say, "Well, you are going to irrigate with this well. The Water Quality Control Commission has said that this aquifer, from which you are withdrawing the water, is a source for domestic drinking water, so if you want to irrigate you can't use herbicides, fertilizers, or pesticides. And by the way, if you are doing that now, on the High Plains of Colorado for example, you are going to have to stop because that is also the only source of drinking water." How do you find the point of compliance for that issue? Well we took the obvious and chicken way out. Fortunately, the general assembly passed Senate Bill 126, which said that the Department of Agriculture has to deal with nonpoint source pollution. And so we defined our point of compliance at the casing of the well, and we don't have a problem.

A recharge pit. Where is the point of compliance? Is it at the interface of the pit with the aquifer? Is it at the point where the

recharge water reaches the groundwater itself? Or is it at the point where that effluent is the return flow, as it comes back to the stream, enters the streambed? Tough issues.

What kinds of sources of water, substitute supplies, should be automatically accepted? Not a tough issue, but certainly a definitional problem because there are all kinds of sources. If Health has permitted a point-source discharge under NPDES, and I as the State Engineer determine that it violates this pristine water standard that they have set as a standard for that stream, do I go shut off the NPDES discharge? No, but do I accept it as a substitute supply plan? Or if you have an instream flow set up by the Water Conservation Board for cold water fishery, and I have a substitute supply that introduces water through modification and that water is going down to an irrigator, and it is of a quality sufficient to meet that irrigators needs, but it violates that instream flow standard, do I let that source go ahead and be dumped into the stream? We have taken the position, "Of course. We will call Paul and tell him that we are going to permit a substitute supply that is going to violate his standard and classification and he may want to do something about it.

Remarks by Paul Frohardt

First I want to flesh out a little bit more where we are in Colorado today in terms of integration of quality and quantity management, and then to give you some of my personal thoughts on what needs to happen from here and what some of our options are. Right now we have basically three different agencies within state government that deal, in some manner, with issues that relate to the water quality-quantity relationship.

One is the State Engineer's Office, and I'm not going to try to second guess or recharacterize anything that's going on in that office as it moves forward with implementing senate bill 181.

The second location is the Water Conservation Board and its instream flow program. Certainly, most of the people in this room recognize that in fact there are some varying perceptions of that program and what it has accomplished to date. It is certainly a program with a broad statutory mandate, talking about instream flow rights to protect the natural environment to a reasonable degree. I think that most people feel that the implementation of that concept has been pretty modest, to date.

The third location is the water quality agencies--the Water Quality Control Commission and Division. A few things have been going on there that relate to this interface. First of all, Senate Bill 181, in addition to saying that the State Engineer was an implementing agency to implement water quality classifications and standards adopted by the Commission, included some new consultation requirements that say whenever the Water Quality Control Commission or Division are considering some action which may adversely impact water rights, they are required to consult with the State Engineer and the Water Conservation Board.

Understand that there has previously been, in the State Water Quality Act, a series of prohibitions in Section 104 where the legislature has said, in three to eight different ways, "Thou shalt not mess around with water rights" to the water quality agencies. The legislature tried to make it very clear that no actions taken by the water quality agencies are supposed to have any impact on water rights.

In Senate Bill 181, since they couldn't figure out another way to say that, they decided that maybe they would suggest some other people that we ought to talk to who can help explain what that means. So they put in the consultation provisions, and I think in fact those consultation provisions have worked reasonably well in practice. I think they have resulted in some increased dialogue between water quality agencies and the Water Conservation Board and State Engineer's Office, and I think that has been constructive.

There is a Section 104 prohibition against adversely impacting water rights. What has the experience been to date? Certainly, that is a concern that has been raised in many Commission hearings by representatives of the water user community. My sense is that the Water Quality Control Commission has been very sensitive to that concern and has tried very hard to make sure that its actions do not adversely impact water use.

For example, I've heard reference to the antidegradation provisions. What is antidegradation all about? Basically, it is an added element of the water quality programs that says where we have water that is currently cleaner than standards, before we allow someone to degrade that water, we make them look to see whether there are any available alternatives that wouldn't degrade the water. And if there are economically, technologically and environmentally reasonable alternatives they are not allowed to degrade the water. If there aren't such alternatives they are allowed to degrade the water.

In adopting these provisions, the Commission put in an explicit provision that says any alternative that would be inconsistent with Section 104 of our statute ("Thou shalt not mess around with water rights") will not be considered an available alternative. So, they have tried very hard to make sure that the antidegradation program will not be one that restricts the ability to exercise water rights.

The Commission over the last couple of years has looked at the issue of hydrologic modifications as a non-point source of pollution. The state has generally taken a voluntary approach to non-point source control. I think that Colorado, in general, has a constructive program addressing non-point sources, within the limitations of the available funding.

With respect to hydrologic modifications there is a great concern about whether the program could really be kept voluntary. And I think that this is a legitimate concern, the way the world

works. They were concerned that if certain technological alternatives were labeled "best management practices," even though they were supposed to be voluntary, there was the risk that some federal agency would say "This is a best management practice, must be a good thing to do, and we will require that as a part of our federal permit," even though the state had intended for it to be voluntary. The Commission listened to that concern and has adopted a non-point source management program for hydrologic modifications that doesn't use that best management practice label, in that manner. Instead, it defines a process as the best management practice, to try to get the interested groups together when there is a hydrologic modification impact issue, to see if they can come up with a reasonable solution.

There was some mention of bio-criteria or biological criteria that EPA is trying to move toward having states adopt. The Water Quality Control Commission is scheduled to hold a hearing on biological criteria this coming August. Currently, the staff recommendation is that the Commission move slowly in this area. We think that biological criteria are, when looked at in a monitoring sense, a very useful tool that can develop important additional information about our water resources. But I think there are legitimate concerns about how, if this were simply adopted, currently, as a water quality standard, EPA would implement that under the federal act.

So where do we go from here? Well again, in my purely personal view, I start with a few premises. My first premise is that people, in fact, care about ecological integrity - that the majority of people in this country don't think ecological integrity is a dirty word and a bad thing. It is, in fact, a value that people more and more think is important and that ought to be taken into consideration.

Secondly, I don't think that acknowledging the legitimacy of the ecological integrity concern necessarily means that we need to return to pristine conditions or that we always have to protect the most sensitive uses in every stream segment throughout the country. I think in many ways it is not that radical a concept. What does "protect the natural environment to a reasonable degree" mean? That's the Water Conservation Board's statutory charge in instream flows. Sounds like it has something to do with ecological integrity, to me.

The third premise is that I think we need, as we move forward in this area, to recognize that we have an intensively managed water resource in the West and that is not going to change. We are not going to move back again to natural conditions. Our society, our economy is dependent upon substantial use of that resource and substantial management of that resource.

The fourth premise, as we move forward to explore how these two areas and sets of concerns interrelate, is that I think we need to make sure that we pursue alternatives that recognize existing property rights. I don't think that an approach that attempts, perhaps through federal law, to essentially undermine existing state water rights is going to be productive or constructive.

So, with those premises, where do we go from here? One, I think that we do need to better integrate and reconcile these recently recognized values like ecological integrity with the values that are recognized by the historical prior appropriation system. And here I certainly have some different perceptions about where we are and where we have been than Greg does. Greg seems to think there has already been a marriage in this area. I guess I still have a more romantic notion of the institution, one that involves a little more passion and intimacy than I have seen in this area, to date. In fact, I don't know if Greg is aware of this, but one of these supposed marriage partners has been living in Denver and the other in Washington D.C., for the past 20 years. I don't think we are there yet. I think that there is a lot to be done if we are going to genuinely integrate ecological integrity, instream use considerations and values in a meaningful way into our Western water rights system.

Next issue: Where do we do it? How do we do it? Again, my personal viewpoint is that the best place is within the state water allocation system: not at the federal level and not in state water quality agencies. I think that if this is going to happen in a meaningful, constructive way it has to be integrated within the water quantity management system.

How do we get there? I am very encouraged to hear Greg indicate that in fact the system is a very innovative one. I think that it is going to have to be a lot more innovative. I would suggest that this will happen in a way that society will consider meaningful only if we find a way to factor ecological integrity values into our decision making as one of the priorities that needs to be taken into account. I think that is going to happen within the state water system only if the leaders of the water development community step forward and decide to make that a priority and to reach out and include all perspectives, including the environmental community, in how that can be accomplished. I don't think we are anywhere close to that having happened, to date. I think that to date, we have an inclination to want to suggest that there is not a problem, that the prior appropriation system already addresses these things.

Yes, the statutes say something about water quality; yet I don't think that water quality is integrated in a very thorough way into the considerations taken into account, in how Jeris' office does business on a day to day basis. That is not meant as a criticism of anybody -it is just a statement of fact as to where we are and what people have been told to do, to date. I think there is a lot to be done if things are going to be genuinely integrated, and I think it is only going to happen if that leadership comes from the state water development community.

As a last point, I would suggest that if that doesn't happen, the likely result is that the environmental groups will prevail with an essentially preemptive strike at the federal level at some point in the future. I can't tell you when, but at some point it will happen and we will get these values integrated from the federal level and in a manner that I personally don't think will be as constructive or positive for the state of Colorado.

Remarks by Greg Hobbs

It's impossible to participate in a panel like this without listening very carefully. What is the problem? What is the great problem we have in the state of Colorado? We are recognized as having some of the best water quality in the entire United States. We are managing our water resources and we are serving a multitude of uses. We have a Water Conservation Bill, passed last year by the State Legislature, that starts on the residential area and I would say that it will come to the agricultural community through non-point source control. We have a law passed in 1986; Senator Martha Ezzard carried it. It allows the market system to be utilized to donate or purchase for the Water Conservation Board prior rights and the Water Conservation Board has included conditional rights with that -- return it to the stream.

Where is this great cesspool and this great devastation in the West that's occurred? I'm having some trouble. Paul, I heard you very well and carefully and I agree we have to integrate some of these things. But there are some agendas out there that have to be looked straight in the eye. The public, sure, wants ecological integrity but there is no definition in this bill, right now, about ecological integrity. You know, as a lawyer, that the EPA is going to have authority to interpret what that is and what that means. I think Paul set out an action-plan roadmap for many state water interests to look at this bill and do some major modifications on it. I think it is called for. I certainly agree that it needs to be done at the state level and it can't be done by EPA.

Amen for the Water Quality Commission. The Commission, in my opinion, has stood up where it needs to - to the EPA, to water users in some of these hearings, and to industrial dischargers. We need to have clean water in this state and means of point and non-point sources of pollution have got to be controlled, because if they aren't "dilution is the solution to pollution in evolution," and we will see a national water law. There is no doubt in my mind that the environmentalists' agenda is in fact to have a national water law. That's not been a secret. They don't want to leave this up to the states. Their idea of leaving it up to the states is that water quality standards and water quality uses promulgated on the federal level will drive it. I think there is a lot of progress that's been made in the state that the legislature is not given credit for. We have a nine-member citizen Water Quality Commission that has given both charges - to look at water quality and water rights through the provisions that Paul has said. That's a good process. Representative Irwin has a bill to transfer the Water Quality Commission and Division to the Department of Natural Resources. There is a mistake in that bill. It would transfer the Commission as a type 2 transfer to DNR, that should not happen. It ought to be type 1. The difference is that on a type 2 the rule-making authority is vested in the executive director of the agency. I think that would be a great mistake. Representative Irwin needs to correct that. The Commission should come over intact as a citizen body to hear all the evidence, all the dialogues, some of which you heard, and then make reasoned judgements and stand up to people where they need to.

We are moving on. You can see that happening every year. The plethora of basin of origin protection bills that has been introduced is absolutely amazing, including a proposed constitutional amendment. There is a public interest and activism working out there that traditional water users do have to adjust to.

Remarks by Melinda Kassen

If Colorado, or any other western state, wants the feds to stay out of its water rights system, then it is going to have to do a little more adjusting and a little more quickly than it's doing now. And that means things like the instream flow statute, which says protect the natural environment to a reasonable degree - it does not just mean protect trout, which is all that it has been used for now. If there is this great marriage that Greg Hobbs and Jerry Danielson talked about, that means that the waste in the water rights statute doesn't just mean quantity it means quality - it means that if you're returning polluted water to the stream that that constitutes waste as well.

There are all kinds of opportunities in the existing Water Rights Determination Act. To transform that act into something that protects water quality, but it ain't there now and its not being interpreted that way now, the interpretation could change. If the interpretation changes, then there probably doesn't need to be a heavy federal hand. But on the one hand you have water rights champions getting up and saying "See we can do it under our water rights statutes as they exist," and on the other hand it is not happening. And until the rhetoric that's thrown out to the feds matches what actually happens in the state, until the two match, there will continue to be efforts at the federal level to protect water quality.

I agree with Greg: Colorado from a national standpoint has water quality that is substantially better than the water quality in New Jersey or the water quality on the Cuyahoga River where I grew up; Although, the Cuyahoga River is now a lot cleaner than it used to be. But there are also problems in Colorado. It may be that the best place to deal with agricultural non-point pollution is not in the Clean Water Act. The Environmental Defense Fund has suggested that perhaps the best place to deal with agricultural polluted runoff is in the Farm Bill, as opposed to in the Clean Water Act. But there need to be some changes here, and I would welcome any further efforts to integrate quality and quantity in this state through the Water Rights Act, as it stands, provided that water quality does not remain the poor step-sister.

UNIVERSITY WATER NEWS

COLORADO STATE UNIVERSITY FACULTY EXPERTISE IN WATER RESOURCES - 1991/92

The following faculty have been categorized by water or water-related expertise. Faculty are listed only once, under the topic most relevant to their teaching, research and/or service. Except as noted, all addresses must be completed by adding "Colorado State University, Fort Collins, CO 80523". Also, all phone extensions can be completed by adding (303) 491-xxxx.

Name	Phone Extension	Address
Climatological Processes		
William R. Cotton	8593	Atmospheric Science Department, 212 Atmospheric Science Building
Lewis O. Grant	8675	Atmospheric Science Department, 101 Atmospheric Science Building
Thomas B. McKee	8545	Atmospheric Science Department. Annex A, Atmospheric Science Dept.
Roger A. Pielke	8293	Atmospheric Science Department, 220 Atmospheric Science Building
David A. Randall	8474	Atmospheric Science Department, 201C Atmospheric Science Department
Graeme L. Stephens	8541	Atmospheric Science Department, 208 Atmospheric Science Building
Economics		
Lee Gray	6955	Agric. and Resource Economics Dept., C310 Clark Building
Paul Huszar	6948/6132	Agric. and Resource Economics Dept., B325 Clark Building
John McKean	5251/6132	Agric. and Resource Economics Dept., B324 Clark Building
R.K. Sampath	5301/6132	Agric. and Resource Economics Dept., B329 Clark Building
Warren Trock	6133/7307	Agric. and Resource Economics Dept., B326 Clark Building
Robert Young	7346/6132	Agric. and Resource Economics Dept., B330 Clark Building
Groundwater		
Deanna Durnford	1625/8361	Agric. and Chemical Engr. Dept., 207 Engr. South (Glover) Bldg.
David McWhorter	8452/1116	Agric. and Chemical Engr. Dept., B03 Engr. Research Center Bldg.
Daniel Sunada	8655/5861	Civil Engineering Department, A201 Engr. Research Center Bldg.
James Warner	8381/5861	Civil Engineering Department, B105 Engineering Building
James Waltz	5072/5661	Earth Resources Department, 335 Natural Resources Building
Hydraulics		
Steven Abt	6707/8203	Civil Engineering Department, A223 Engineering Research Center
Johannes Gessler	1058	Civil Engineering Department, AR104 Engineering Building
Pierre Julien	8450/6016	Civil Engineering Department, A221 Engineering Research Center
Albert Molinas	8640/6016	Civil Engineering Department, A217 Engineering Research Center
Everett Richardson	8655/6262	Civil Engineering Department, B207 Engineering Research Center
James Ruff	8404/6095	Civil Engineering Department, B203 Engineering Research Center
Morris Skinner	5291	Civil Engineering Department, 18 Engineering Building
Hydrology		
Hubert Morel-Seytoux	6762/8549	Civil Engineering Department, B111 Engineering Building
Jorge Ramirez	8650	Civil Engineering Department, A317 Engineering Research Center
J.D. Salas	8460/6047	Civil Engineering Department, A311 Engineering Research Center
Freeman Smith	5678	Earth Resources Department, 334 Natural Resources Building
Irrigation and Drainage		
Israel Broner	6172	Agric. and Chemical Engr. Dept., 204 Engr. South (Glover) Building
Wayne Clyma	5252	Agric. and Chemical Engr. Dept., 100 Glover Building
Alan Early	7920/2868	Agric. and Chemical Engr. Dept., AR 24 Engineering Building
Marvin Jensen	2868	Colorado Inst. for Irrigation Mgt., 422 North Univ. Service Center
Ramchand Oad	7682	Agric. and Chemical Engr. Dept., 202 Engr. South (Glover) Building
Terry Podmore	1624	Agric. and Chemical Engr. Dept., 206 Engr. South (Glover) Building
Tim Gates	8461/6095	Civil Engineering Department, A219 Engineering Research Center

Name	Phone Extension	Address
Irrigation and Drainage (cont'd)		
Hunter Follett	6201	Agronomy Department, C2 Plant Science Building
Parviz Soltanpour	6975	Agronomy Department, C126 Plant Science Building
Greg Butters	6314	Agronomy Department, C107 Plant Science Building
James Ells	7079	Horticulture Department, 103 Shepardson Building
Richard Renquist	(303)434-3264	Horticulture Department, Orchard Mesa Research Center, 3168 B .5 Road, Grand Junction, CO 81503
Law, Institutions, Policy, History		
Robert Hiller	5253	Agric. and Chemical Engr. Dept., 100 Engr. South (Glover) Building
George Radosevich	6949/6132	Agric. and Resource Economics Dept., B334 Clark Building
Dan Tyler	6461	History Department, B354 Clark Building
Holmes Rolston	5328	Philosophy Department, 50 Eddy Building
Stephen Mumme	7428	Political Science Department, C329 Clark Building
James Lester	6225	Political Science Department, C340 Clark Building
Sandra Davis	5281	Political Science Department, C335 Clark Building
Charles Davis	6803	Political Science Department, B351 Clark Building
Bimitris Stevis	6082	Political Science Department, C352 Clark Building
David Freeman	6045	Sociology Department, C244 Clark
Evan Vlachos	6089	Sociology Department, B240 Clark Building
Library Materials		
Michael Culbertson	1874	Morgan Library, 213 Morgan Library
Management and Planning		
Darrell Fontane	5247	Civil Engineering Department, 212 Weber Building
Neil Grigg	5049	Civil Engineering Department, AR 204 Engineering Building
John Labadie	8596/6898	Civil Engineering Department, A331 Engineering Research Center
Bill Shaner	1365	Mechanical Engineering Department, A 213 Engineering Building
Models/Computer Data Management and Presentation		
Luis Garcia	5144	Agric. and Chem. Engr. Dept., Fourth Floor N., Univ. Ser. Center
Roger Hoffer	0602	Forest Science Dept., 113 Forest Science Building
David Zachmann	6514	Mathematics Department, 110E Engineering Building
Non-point Source Pollution Control		
Paul Ayers	6172	Agric. and Chem. Engr. Dept., 204 Engr. South (Glover) Bldg.
Jim Loftis	7923/6172	Agricultural and Chem. Engr. Dept., 205 Engr. South (Glover) Building
Anthony Koski	7070	Horticulture Department, 101A Shepardson Building
Kenneth Doxtader	5283	Agronomy Department, C-110 Plant Sciences Building
Recreation Resources		
Robert Aukerman	5511	Recreation Resources and Landscape Architecture Department, 246 Forestry
Richard Walsh	6959/7307	Agricultural and Resource Economics, B316 Clark Building
Sediment Transport		
Ellen Wohl	5298	Earth Resources Department, 330 Natural Resources Building
Gene Kelly	6881	Agronomy Department, C22 Plant Science Building
Statistics		
Duane Boes	5269	Statistics Department, 101 Statistics Building
Peter Brockwell	5330	Statistics Department, 100 Statistics Building
Hariharan Iyer	6769	Statistics Department, 212 Statistics Building
Stream and Riparian Zone Biology/Wetlands		
Ralph Dix	6702	Biology Department, ZE 411 Anat/Zoology Building

Name	Phone Extension	Address
Stream and Riparian Zone Biology/Wetlands cont'd		
James Ward	5024	Biology Department, ZE 328 Anat/Zoology Building
Kurt Fausch	6457	Fishery and Wildlife Biology Dept., 234 Wagar Building
Dale Hein	6510	Fishery and Wildlife Biology Dept., 210 Wagar Building
Ken Wilson	5020	Fishery and Wildlife Biology Dept., 135 Wagar Building
Boris Kondratieff	7314	Entomology Department, C-134 Plant Sciences Building
Louis Bjostad	7860	Entomology Department, C-134 Plant Sciences Building
Don Smith	6371	Agronomy Department, C106 Plant Science Department
Wayne Leininger	7852	Range Science Department, 239 Natural Resources Building
Toxicology		
Will Clements	0690	Fishery and Wildlife Biology Dept., 236 Wagar Building
John Tessari	5128/7037	Environmental Health Department, 109 Physiology Building
Howard Ramsdell	5698	Environmental Health Department, B 104 Microbiology Building
Raymond Yang	5652	Environmental Health Department, B 120 Microbiology Building
Richard Johnson	5984	Entomology Department, C-134 Plant Sciences Building
Waste Minimization		
Harry Edwards	5317	Mechanical Engineering Dept., A113 Engineering Building
Water Quality Management/Monitoring		
Robert Ward	6308	Colorado Water Resources Res. Inst., 410 N. Univ. Services Center
Lee MacDonald	6109	Earth Resources Dept., 339C Natural Resources Building
John Stednick	7248	Earth Resources Dept., 327 Natural Resources Building
Water and Wastewater Treatment/Environmental Engineering		
David Hendricks	8237	Civil Engineering Dept., B329 Engineering Research Center
Thomas Sanders	5448	Civil Engineering Dept., B113 Engineering Building
Richard Walters	8248	Civil Engineering Dept., B309 Engineering Research Center
Vincent Murphy	1791/5252	Agric. and Chemical Engr. Dept., 108 Engr. South (Glover) Bldg.
Ken Reardon	6505	Agric. and Chemical Engr. Dept., 107 Engr. South (Glover) Bldg.
Donald Klein	6947	Microbiology Dept., B209A Microbiology Building
Michael Richard	7909	Environmental Health Dept., B215 Microbiology

TWO CSU GRAD STUDENTS NOMINATED FOR UCOWR DISSERTATION AWARD

The Universities Council on Water Resources (UCOWR) annually conducts a thesis/dissertation competition and presents an award recognizing a graduate student in the field of water resources. This year two Ph.D dissertations by Colorado State graduate students (current and former) were entered in the competition.

Robert A. Young, Professor of Agricultural and Resource Economics at CSU, nominated a dissertation by James F. Booker, "Economic Allocation of Colorado River Water: Integrating Quantity, Quality, and Instream Use Values." In his letter of nomination Young says: "Booker's approach adds an important degree of hydrologic realism to the economic evaluation of interregional and interstate water allocation. He has done an excellent job of interdisciplinary basin-wide policy analysis on the Colorado River, and has helped extend our understanding of the complex economic and hydrologic interrelationships in the basin."

James Ruff, Professor of Civil Engineering, nominated a dissertation by Dr. Ghassan AlQaser, "Progressive Failure of an Overtopped Embankment," for the award. Ruff says of the dissertation, "Dr. Alqaser's research is at the forefront of a new challenge in predicting and evaluating future dam safety. This work gives insight and should provide the inpetus for future research into the breaching of cohesive embankments by overtopping flows."

Award winners will be announced in June.

EDITOR'S IN-BASKET

COLORADO INVESTIGATORS SUBMIT 15 SECTION 105 PROPOSALS FOR FY1992

A total of 265 proposals nationwide were submitted in response to the Geological Survey's Request for Applications under the Water Resources Research Grant Program for FY1992 (Sec. 105 of the Water Resources Research Act). Colorado submitted 15 proposals and participated in a regional proposal submitted by the University of Nebraska (see below).

Colorado State University 8 Proposals
University of Colorado 6 Proposals
Colorado School of Mines 1 Proposal

Regional Proposal Submitted--The University of Nebraska is lead university for a cooperative proposal by the water institutes of Colorado, Nebraska and Wyoming. The proposal, "Quantifying Water Resources for a Multistate River Basin," was an outgrowth of a CWRRI project to develop a water database management system for the South Platte River Basin. Tim Gates, Professor of Civil Engineering at CSU, is principal investigator for the CWRRI project that will continue in 1992-93. The project is currently developing a prototype of a connectivity system for linking different water organizations around the basin into a single 'federated' database system. Data security, management, and storage will remain with the original data owners while access will be across the system. This system would allow different groups to manage their water programs using basinwide data. Applications for both water quality and water quantity management will be tested for the database system.

With Nebraska and Wyoming expressing an interest in developing the database for the entire Platte Basin, the three state institutes are working together to seek funding for the extended system. One of the most important aspects of the research, if funded, would be how to incorporate ecological factors. Rollin H. Hotchkiss, the principal investigator, is a hydrologist from the University of Nebraska-Lincoln.

The proposed research would be conducted through the water institutes at the Universities of Nebraska-Lincoln and Wyoming and Colorado State University. Each institute is represented by three members: one representing hydrology, one representing ecology, and one representing socioeconomics. Both co-principal investigators are socioeconomists: Jeff Booker from the University of Wyoming and Paul Huszar from CSU. Water institute/center directors Bob Volk of Nebraska, Steve Gloss of Wyoming and Robert Ward of Colorado participated in developing the proposal and will participate in the research if the project is funded by the Geological Survey.

Lower Colorado River Authority--A proposal on the "Effects of Greenhouse Warming Temperature Increases on Reservoir Water Budgets" was submitted by Q. Martin of the Authority.

NAWID MEETING REPORT

The National Association of Water Institute Directors (NAWID) held its annual meeting March 10-13, 1992 at Hilton Head, South Carolina. This organization serves as the major network linking water resource expertise in all 50 states, the District of Columbia, the Virgin Islands, Puerto Rico and Guam. NAWID also promotes the Water Institute Program within the USGS (federal administrator of the Water Resources Research Act which established the state institutes) and with the U.S. Congress, which appropriates federal funds for the institutes. Steve Gloss, Director of the Wyoming Institute, currently serves as chair-elect of NAWID.

Robert Ward attended the NAWID meeting for the first time this March. He was particularly impressed by the high regard many directors have for two of their former colleagues who now head the Civil Engineering Departments of the University of Colorado (Jim Heaney, former director at the University of Florida) and Colorado State University (Neil Grigg, former director of the North Carolina and Colorado Institutes). Colorado is truly fortunate to have such strong connections in this national water resources networking and promoting organization. Robert also noted that Vernon Norman, USGS coordinator for the Central Region water institutes, is located at the Denver Federal Center in Lakewood.

Robert attended a special orientation session at the meeting for new Institute directors that covered the water institute program history, the NAWID organization and purpose, the USGS administrative structure and procedures, and the federal budget cycle, including outlooks for the future. This overview of the national Water Institute scene was very helpful in placing CWRRI activities in a national context.

The heart of the NAWID meeting dealt with a national collective overview of institute publications, NAWID collaboration to enhance communication and research, water education, new plans to evaluate the water institutes, future activities of NAWID (e.g., national newsletter), regional water research problems/collaboration, and an annual business meeting. At the business meeting the organization changed its name to National Institutes for Water Resources, to reflect the broader nature of its activities.

WATER TRANSFERS IN THE WEST

The Committee on Western Water Management of the National Research Council has released a prepublication copy of its report entitled "Water Transfers in the West: Efficiency, Equity, and the Environment." The report concludes that the interests of rural communities, American Indians, many diverse groups of water users, and other "third parties" deserve more careful consideration whenever western water is transferred. The Committee urges state, tribal, and federal governments to

develop clear-cut mechanisms for protecting the interests of all potentially affected parties, while also promoting desirable, voluntary water transfers.

The report notes an increase in water transfers as supplies are stretched further, and predicts this trend is likely to continue. To identify the characteristics of water transfers, the Committee analyzed seven specific cases, including: (1) the Truckee/Carson Basins in Nevada; (2) the Arkansas Valley and Front Range in Colorado; (3) Northern New Mexico; (4) the Yakima Valley in Washington; (5) Central Arizona; (6) the Central Valley in California; and (7) the Imperial Valley in California. Based on a review of these cases, the Committee made eleven recommendations.

The recommendations, in addition to calling on states to develop efficient and equitable ways to consider third party interests, ask that the Secretary of Interior adopt a formal process for assessing transfers of water. The Committee recommends that the cost of mitigating third party effects should be incorporated in the cost of each water transfer, to be funded by beneficiaries or proponents of the transaction. The Committee took an optimistic view of the role that voluntary water transfers can play in "a new era of more efficient water use," but cautioned that judicious intervention will be needed to protect environmental rights and the whole spectrum of affected parties.

Dan Tarlock, Professor of Law at the Chicago-Kent College of Law, and Chairman of the Committee, urged the promotion of the "twin goals of equity and efficiency in water transfers, and that governments must develop procedures and laws that bring a broader group of participants into the loop." The Committee represented a wide range of interests, and included Marvin Jensen, Director of the Colorado Institute for Irrigation Management, Keith Higginson, Director of the Idaho Department of Water Resources and Chair of the WSWC Legal Committee, as well as WSWC Executive Director Craig Bell. The report will be published in June and released through a series of workshops to bring together selected Committee members, other representatives from the sponsoring agencies, and parties interested in water transfers at the federal, state and tribal levels to discuss the report's findings. A workshop on the report is tentatively scheduled in Denver on July 14.

Western States Water, 3/13/92. Editor: Tony Willardson

WATER CONSERVATION GRANTS GET GO-AHEAD

The state's Office of Water Conservation has been given a green light to begin 14 new water conservation projects throughout the state. At its March 5-6 meeting, the Colorado Water Conservation Board (CWCB) approved funding for grants throughout the state, including Carbondale, Loveland, Silt, Castle Rock, Gilcrest, San Miguel County, Bayfield, Lake Pueblo State Park, Arvada, Steamboat Springs, Fort Collins, LaSalle, NW Council of Governments, and Cherry Creek Valley Water District. The Water Conservation Act of 1991 established the Office of Water Conservation and included a one-time allocation of $500,000 from the CWCB construction fund to be distributed as grants to public agencies. They will be awarded annually until the funds are exhausted. For information contact Kim Hout at (303)866-3441.

'COOL' DESCRIBES 1992 CCWCD CHILDREN'S WATER FESTIVAL

by Mary DeMartini

"COOL!" was beyond a doubt the most common word used by the fourth and fifth graders at the Children's Water Festival; their animated faces and evident curiosity demonstrated their excitement. The second annual Children's Water Festival, sponsored by the Central Colorado Water Conservancy District, was held on Tuesday, March 24 at Aims Community College in Greeley. District Manager Tom Cech, the sponsors, and presenters should be commended for working together to increase the awareness of today's youth on water issues.

About 1500 fourth and fifth grade students from the surrounding schools participated in the festival. They attended several pre-scheduled classes for twenty minutes each. The classroom activities covered a wide spectrum of water concerns: irrigation, hydrology, water court, water quality, water treatment, water supply, the properties of water, and water conservation. Also, in an exhibition hall the students had the opportunity to learn about gold panning, snowpack, irrigation, water delivery systems and more in a hands on environment with interactive displays.

This year I had the opportunity to be an exhibitor and prepared a simple display to demonstrate and explain the function of a water filter. The kids were drawn to my table by their curiosity and pointed at my homemade water filter asking "What is that?" They appeared fascinated and were eager for me to fill their minds with more information. "COOL!" they would say. Through this rewarding experience, I learned that it only took something relatively simple to capture their attention, impress them, and stimulate their interest in water.

I encourage others to share their area of expertise with today's youth. There will be plenty of opportunities here since many Colorado cities will be organizing water festivals for children of this age group, modeled after Central's success.

CITY OF FORT COLLINS AND NCWCD PLAN WATER FESTIVAL

On Tuesday, May 19th, there will be a water festival in Fort Collins on the CSU campus (Lory Student Center) sponsored by the City of Fort Collins Water & Wastewater Utility, Colorado State University, Poudre R-1 Science, and Northern Colorado Water Conservancy District. Among the 32 classroom activities, some of the titles are: "Do You Know Your Dirt?;" Order in the Court;" and "Let's Make a Water Shake." Among the 16 exhibits are found titles such as "How Thirsty Do Trees Get?;" "What's a Snow Pillow;" and "There's Gold in That Water."

A corollary theme at the festival will be recognizing 1992 as the "Year of the River" in Fort Collins. See you there!

Neil Grigg, Jeff Herbert and Gale Norton after Gale's presentation to the 1992 Water Engineering and Management Conference

JOINT MEETING DRAWS WATER INTERESTS TO DENVER ON MARCH 2-3

Colorado Water Engineering and Management Conference and Annual Meeting of the American Water Resources Association, Colorado Section

Water experts from around the state met at the Colorado Water Engineering and Management Conference March 2-3 in Denver. Speakers and attendees discussed surface water issues and water rights; climate change, droughts and watersheds; computing innovations in water resources; water quality issues; and decision support systems. The Annual Meeting of the American Water Resources Association, Colorado, Section, followed.

Featured speakers were Dr. Tom Sutherland and Dr. Vujica Yevjevich. Dr. Sutherland is Professor Emeritus of the Animal Sciences Department at Colorado State University (CSU) and a recently returned hostage in the Middle East.

In his comments on the importance of water in the Middle East, Sutherland stated that although many consider oil to be the number one commodity in the Middle East, ultimately more battles will be fought over water than oil. "You know, water is like freedom--nobody ever thinks about it until you lose it and then it becomes pretty important to you," he commented.

Sutherland was introduced by Dr. Robert Ward, Director of CWRRI, who highlighted Sutherland's abilities as a teacher and community activist.

Dr. Vujica Yevjevich, 1992 Program of Excellence Distinguished Lecturer, spoke on "Water and Civilization." Yevjevich is Professor Emeritus, Department of Civil Engineering at CSU. The Water Resources Programs at CSU were designated as a "Program of Excellence" in 1990 by the Colorado Commission on Higher Education.

David Holm, WQCD, and Julie Kraus, SEO, spoke during the AWRA Colorado Section session. They discussed water quality issues from the perspectives of their agencies.

The symposium was organized and sponsored by CSU, Office of the State Engineer, and American Water Resources Association, Colorado Section. Co-sponsoring organizations were the Adolph Coors Company, Bureau of Reclamation, ERO Resources Corporation, League of Women Voters of Colorado, Natural Resources Law Center, USGS WRD-Colorado District, and the Wyoming Water Research Center.

WATER SUPPLY CONDITIONS UPDATE

From the Office of the State Engineer, March 1992--A wintertime shift in the major SWSI component from streamflow (summer component) to snowpack (winter component) and heavy snowstorms statewide during the month of November caused large increases in the SWSI values computed during early winter. A dry December and January have lowered the SWSI components significantly. Statewide reservoir storage was 107 percent of average on March 1. The San Juan-Dolores-Animas basin has the highest storage rate at 132 percent of average while the Rio Grande basin has the lowest storage rate at 92 percent of average.

Statewide snowpack was 84 percent of average on March 1. Snowpack is below average nearly statewide. The highest average is the Sangre de Cristo Mountains of Southern Colorado. Readings of 136 percent average were measured in the Cucharas and Huerfano watersheds. For the remainder of the state, below average snowpack is the rule. The Yampa and South Platte basins have snowpack totals of 75-80 percent of average. Although the state has received below average snowfall this year, the snowpack statistics remain above last year's March 1 readings. Snowpack readings range from 103 percent of last year in the Yampa and White river basins to 131 percent of last year in the Arkansas River basin.

The National Weather Service 30-day forecast (March 1) for Colorado is for near normal precipitation and normal temperatures in most of the state with above normal temperatures and precipitation in the southwestern quarter of the state. The 90-day forecast (March 1) is for the same weather pattern to continue through the 90-day period.

The Surface Water Supply Index (SWSI) developed by the State Engineer's Office and the USDA Soil Conservation Service is used as an indicator of water supply conditions in the major river basins of the state. It is based on snowpack, reservoir storage, and precipitation for the winter period (Nov.-April). During the winter period snowpack is the primary component in all basins except the South Platte basin where reservoir storage is given the most weight. Inclusion of snowpack in winter computations results in an emphasis on the present snow storage for next spring's runoff. The following SWSI values were computed for each of the seven basins on March 1, 1992.

Basin	March 1, 1992 SWSI Value	Change From Previous Mo.	Change From Previous Yr.
South Platte	-0.3	-0.2	+1.0
Arkansas	-1.2	-1.1	+0.9
Rio Grande	+0.6	-0.4	+1.0
Gunnison	-1.5	-0.2	-0.3
Colorado	-2.0	-0.2	+0.1
Yampa/White	-2.9	-0.5	-0.6
San Juan/ Dolores	-0.4	-0.1	-0.7

SCALE

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

POSITIONS AVAILABLE

Assistant/Associate Cooperative Extension Specialist in Hydrology/Hydrogeology--Kearney Agricultural Center, University of California, Parlier (near Fresno). This is an academic career-track position in the Department of Land, Air, and Water Resources, Hydrological Sciences Section, University of California, Davis. The major responsibility is to develop and implement strategies for addressing hydrology problems with emphasis on mitigating and preventing groundwater contamination. Responsibilities are state wide with emphasis on the San Joaquin Valley and Central Coast Valleys.

QUALIFICATIONS: A Ph.D in geology, engineering, hydrology, hydrogeology, or a closely related field. A broad hydrology background and interest in water quality, contaminant transport, and field applications are desirable. SALARY: Commensurate with experience and within the Assistant/Associate Cooperative Extension Specialist rank in the University of California.

APPLICATION: Direct to Larry Schwankl, Search Committee Chair, Cooperative Extension Specialist position in Hydrology-Hydrogeology, Dept. of Land, Air, and Water Resources, Univ. of California, Davis, California 95616, Phone (916)752-1130. Include a resume, official undergraduate and graduate academic transcripts; statements of research and teaching interests and experience; copies of publications and reports; a summary or abstracts of the Ph.D. dissertation; and names, addresses, and telephone numbers of at least three references.

DEADLINE: Applications will be accepted until May 31, 1992.

STUDENTS --SUMMER EMPLOYMENT

The Bureau of Land Management seeks a seasonal hydrologic technician for the summer, 1992. The position is 14 weeks in duration and is located in Lewistown, Montana.

The successful applicant may work any 14-week period between June 1 and October 2, 1992. The 14 weeks must be consecutive. The position is grade GS-05 and pays approximately $8.45 per hour. The employee will also receive food allowance for the time spent overnight in the field.

The position covers a wide spectrum of hydrologic duties including, but not limited to, gaging streams, dam safety inspections, water quality sample collection, sample analysis, riparian vegetation inventory, water rights analysis, and volume calculations of reservoirs and pits.

The Lewistown District is located in central Montana and covers an area roughly the size of the state of Indiana. Travel throughout the district is strictly mandatory. Overnight trips will require that the employee stay in tents, trailers, or motels depending on the location of the duty assignment. Most duties will be out-of-doors, often in remote locations. Some laboratory time will also be required. Expect a variety of weather conditions as the district ranges from 8000+ feet mountains to semi-arid plains. Black bear, mountain lion, and rattlesnakes may be encountered while performing work duties.

The job description calls for a rugged, outdoors-oriented person. The employee will have to forgo television, curling irons, and Big Macs with the majority of the time spent in the field. However, the employee will experience the Upper Missouri National Wild and Scenic River with stretches virtually unchanged since the days of Lewis and Clark. For the person willing to sacrifice a few luxuries, it will be an unforgettable summer.

To receive application packet, call or write the Montana Job Service, Lewistown Office, 300 1st Ave. North, Lewistown, MT 59457. Phone: 406/538-8701. Deadline: May 15, 1992.

SEMINAR SERIES

COLORADO SCHOOL OF MINES
Department of Chemical Engineering and Petroleum Refining

Date	Topic and Lecturer
Apr. 16	**Hazardous Waste Treatment Using Molten Metal Technology** - Kevin Sparks, Molten Metal Technology, Cambridge, MA
Apr. 23	**Supercritical Water Solubility of Minerals** - Laurel Watts, CEPR Department
Apr. 30	**Enhancement of Coal Reactivity by Mild Chemical Pretreatment** - Kay Shams, CEPR Department

Meeting Time: Thursday, 2:00 p.m. Location: Alderson Hall, Room 304, Colorado School of Mines, Golden

SHORT COURSES

COLORADO SCHOOL OF MINES
International Groundwater Monitoring Center
Groundwater Modeling Short Courses - Tentative Schedule 1992

Apr. 20-24	**Applied Ground-Water Modeling**
May 18-22	**Geographic Information Systems in Ground-Water Modeling**
June 1-5	**Multiphase Organic Transport Modeling with Emphasis on Pollution by Hydrocarbons**
July 16-17	**Introduction to the Application of Geostatistics and Kriging to Spatial Estimation Problems in Ground-Water**
Aug. 10-14	**Applied Modeling of Ground-Water Chemistry**
Sept. 13-18	**Introduction in Ground-Water Modeling**
Oct. 19-23	**Statistical Methods in Ground-Water Pollution**
Nov. 16-20	**Incremental Flow Modeling**

For additional information contact International Groundwater Monitoring Center, Colorado School of Mines, Golden, CO 80401.

COLORADO STATE UNIVERSITY

May 25-June 2	**Operation, Maintenance and Rehabilitation of Dams**
June 1-5	**Water Treatment Plant Design**
June 8-12	**Design of Water Quality Monitoring Networks**
June 15-16	**Computer Simulation and Design of Water Distribution Systems**

June 15-19	**Platte River System Tour Number 1**
June 15	**Environmental Law**
June 16-18	**Hazardous Materials/Waste Manager Training**
June 22-26	**Activated Sludge Process Control**
July 6-17	**Application of GIS in Water Resources Engineering**
July 6-31	**Microcomputer Applications in Irrigation Data and Project Management**
July 13-17	**Platte River System Tour No. 2**
July 13-17	**Water Resources and Environment: Education, Training and Research**
July 27-31	**Water Resources Development and Environmental Protection: Problems, Issues and Solutions**
July 27-31	**Building Safety Evaluation and Damage Assessment Methodologies**
July 27-31	**Managing Complex Water Systems**
August 3-14	**Microcomputers in Water Resources Systems Management**
August 10-14	**Platte River System Tour No. 3**
August 17-21	**Wind Effects on Buildings and Structures**
August 24-26	**Paleohydrology**

For additional information contact Janet Lee Montera (IICE), Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone: 303/491-7425; FAX 303/491-7727.

WATER NEWS DIGEST

WATER PROJECTS

Suit Filed to Stop Animas-La Plata

The Sierra Club Legal Defense Fund filed a federal lawsuit February 25 to stop the construction of the Animas-La Plata project. The suite would require the U.S. Bureau of Reclamation to prepare a new environmental-impact statement on the grounds that the 1980 EIS is outdated. In addition, the suite claims the Bureau has not obtained permits under the federal Clean Water Act and that the project violates the National Environmental Policy Act.

Southern Ute Tribal Chairman Leonard Burch accused the Sierra Club, another plaintiff in the suit, of expressing concern for the rights of Indian tribes and then filing a lawsuit designed to delay the project meant to settle 129-year-old water rights claims held by the Southern Utes and Ute Mountain Utes in south-western Colorado. U.S. Representative Ben Nighthorse Campbell, whose district includes southwestern Colorado, said the project has met all requirements for federal environmental laws and that the project only needs updated permits and paper work to proceed legally and in an environmentally sound manner.

Other plaintiffs in the lawsuit are Four Corners Action Coalition, Colorado Wildlife Federation, Taxpayers for the Animas River, and Southern Utah Wilderness Alliance.

Grand Junction *Daily Sentinel* 2/26/92, 2/25/92; *Rocky Mountain News* 2/26/92

Judge Rejects Castlewood Canyon Dam

District Judge Thomas Curry rejected an effort by Parker to build a reservoir and inundate part of Castlewood Canyon State Park. The judge ruled that the town and the Parker Water and Sanitation District lack the authority to condemn property owned by the Colorado Division of Parks and Outdoor Recreation and convert it to another public use. Parker's attorneys argued that the Colorado constitution gives power to home-rule cities to condemn property for an urgent public need such as water. The state parks division opposed the plan, arguing that it would destroy Castlewood's inner canyon and would set a dangerous legal precedent for parklands throughout the state, making them vulnerable to similar projects by towns and special districts.

Denver Post 2/6/92

Central Arizona Project District Sues for Pipe Repairs

The Central Arizona Water Conservation District has sued the U.S. government and three companies that supplied pipe for the Central Arizona Project to recover nearly $150 million in repairs to six section of the pipe. The six sections have been determined defective and could shut down the CAP if ruptured. The district estimates that it will cost $146.7 million to replace the six siphons.

U.S. Water News March 1992

California Governor Proposes Major Reservoir Near Los Banos

California Governor Wilson sketched his vision of new water policy for California, including construction of a major reservoir near Los Banos. The Governor endorsed a variety of means to increase the water supply, including desalinating ocean water, reclaiming sewage, and transferring water from farms to cities. Los Banos Grandes would not involve damming a river, but would be filled with water pumped from the Sacramento-San Joaquin River Delta.

Knight-Ridder Newspapers

Corps Supports Reversal of Straightening of Florida River

The U.S. Army Corps of Engineers has issued a final report supporting the restoration to its original meandering path of part of the Kissimmee River in south-central Florida north of the Everglades. The Corps straightened this section of the river to a 29-mile canal in the 1960s as part of a flood-control project, but its report states that channeling the river destroyed most of the fish and wildlife habitat once provided by the river and its wetlands, degraded water quality, sped soil erosion, and endangered the Everglades. Florida has promised to contribute one-half of the construction costs, including the purchase of 68,000 acres that will be subject to flooding. Although the federal government has promised to pay the other half, Nancy Dorn, Assistant Secretary of the Army for Civil Works said land acquisition will not be covered, leaving a significant shortfall in necessary funds. The final decision may have to be determined by Congress.

U.S. Water News March 1992

WATER ALLOCATION

February Storms Improve Water Allocation Outlook

A new estimate indicates there will be enough federal irrigation water to give everyone a little, contrary to earlier warnings to California farmers that none would be available. February storms increased the snowpack in the Sierra Nevada, the source of most of California's water. This allowed the U.S. Bureau of Reclamation to ease its projection of no water allocations to 7,000 farmers in the Sacramento and western San Joaquin valleys. The new estimate states that one million acre feet of water will be released for Central Valley agriculture.

The Montrose Daily Press 3/6/92

WATER TRANSFER

Arkansas Valley Water Transfer Canceled

Colorado Water Supply Co. withdrew its offer to purchase Fort Lyon Canal water rights after failing to obtain enough options to purchase 51 percent of the canal water rights. CWS has no plans to revive the effort, although company officials pointed out that there are farmers interested in selling and their reasons for selling still exist. CWS offered farmers $2,200 per share in an attempt to purchase 51 percent of the 93,900 Fort Lyon shares. This would have given the company 50,000 acre-feet of water per year, which CWS planned to pipe to Front Range cities. Some who wanted to sell their water were disappointed, while members of Task Force One, a group organized to find alternatives to the CWS purchase, will continue working on plans to keep the water in the valley.

The Pueblo Chieftain 3/14/92

AWDI Appeals Ruling

American Water Development Inc. is appealing the ruling against its claims to 200,000 acre-feet per year of underground water in the San Luis Valley. Alamosa Judge Robert Ogburn ruled against AWDI last November, finding that its claims to non-tributary water rights actually involved tributary water affecting other rights in the valley. The Colorado Supreme Court could take up to another two years to rule on the appeal.

Pueblo Chieftain 3/27/92

Revegetation of Farms Gives Mixed Results

Revegetation of farms from which Aurora purchased irrigation water is taking more time than anticipated and is working better in some areas than others. When the water court agreed to a change of use for the Rocky Ford Ditch water that Aurora purchased from the Resource Investment Group, it stipulated that the ground be revegetated to keep it from returning to the Dust Bowl-like conditions of the 1930s. Water Judge John Tracey will tour farms in the revegetation program after April 15. It was originally estimated that wild grasses would take root within two years, but the time frame is closer to three or four years, according to Gerald Knapp, a Rocky Ford resident hired by Aurora to oversee the revegetation project. Aurora hopes to move the water for its use in 1993.

Rocky Mountain News 2/17/92, Pueblo *The Chieftain* 2/22/92

WATER QUALITY

Westerners Wary of Pending Water Legislation

Proposed federal water legislation could lead to a difficult decade, officials representing western water interests said at the Four States Irrigation Council meeting in Ft. Collins in January. The likely vehicle for the reauthorization of the 20-year-old Clean Water Act, a bill introduced by U.S. Senator Max Baucus, D-Mont., would require the Environmental Protection Agency to develop standards to assure "ecological integrity" in waters throughout the United States and to judge the quality of streams and lakes in comparison with streams and lakes in pristine condition. Speakers raised concerns that this language would interfere with state control of water rights and would prevent any new water projects that might alter natural ecological conditions.

Fort Collins *The Coloradoan* 1/10/92

Clean Water Act Price Tag Lower Than Previous Estimate

The new estimate for federal, state, and local government costs of building new and improving existing publicly-owned sewage treatment facilities is $80.4 billion over the next 20 years, according to the U.S. Environmental Protection Agency's 1990 Needs Survey. The Supplemental State estimates for additional wastewater treatment needs in 40 states and territories would bring the total to $110.6 billion. This figure is $6.4 billion

below the last survey made two years ago. It also is lower than the $137.9 billion estimate released by the Association of State and Interstate Water Pollution Control Administrators last October.

U.S. Water News March 1992

Pump-and-Treat Groundwater Technology Under Review

The technique of recycling water by routing it back into natural, underground reservoirs or aquifers is the subject of a two-year National Research Council study. The study will consider if the method should remain the technology of choice in cleaning tainted groundwater. The technique has been the accepted process in arid, coastal, or densely populated regions where water supplies are scarce. Recent studies have outlined apparent failures, but because the reasons are not fully known, the council has established a Committee on Ground Water Recharge to investigate cleanup alternatives.

U.S. Water News March 1992

Scientists and Colorado Farmers Fight Salinity

The Colorado River has become the nations's saltiest river, carrying about 9 million tons of salt per year past the Hoover Dam. Scientists and farmers are both involved in the Colorado River Salinity Control Program, a 20-year-effort by state and federal agencies to reduce the salt load caused by both natural and manmade sources. Irrigation contributes more than one-third of the salt load to the river system. Farmers near Delta, Colorado, are in their third year of participating in the program's Lower Gunnison Basin Project Unit 1 and have already surpassed SCS goals of reducing salt by 82,000 tons annually. Two variations of surge irrigation, the ported ditch system, and the in-line surge system, are helping to reduce the deep percolation that typically passes through ancient sea beds below the fields and carries salt from those beds back to the river.

Salinity is also a problem for farmers along the South Platte, where soluble salts, rather than high pH, are the main problem. There is no permanent cure for the problem, but some production techniques are available to decrease the problem. Testing for salinity helps the farmer to set realistic crop yield goals and to fertilize accordingly. Irrigation techniques can help, such as flushing the salts away from the roots with the first irrigation, followed by light, frequent irrigation.

Colorado Rancher & Farmer 2/25/92

Federal Agencies Work With Coloradoans to Solve Water Quality Problems

Several demonstration projects are underway in Colorado to help farmer and ranchers address water quality concerns. Federal agencies are funding and participating in many of these projects, including the U.S. Department of Agriculture, Soil Conservation Service, Cooperative Extension, and the U.S. Environmental Protection Agency. Projects include:

* the Patterson Hollow Hydrologic Unit in the Lower Arkansas River basin, attempting to reduce the amount of salts reaching the river in return flows and improve the irrigation water management being practiced in the area;

* the San Luis Valley Demonstration Project, seeking to reduce pollution of ground water by agricultural chemicals through adoption of recommended best management practices by Valley farmers;

* the North Fork of the Republican River Watershed Project will identify disturbed riparian and upland regions in the project area and demonstrate BMPs that will reduce sediment loadings to the system and improve the aquatic habitat in the North Fork and its main tributary, Chief Creek;

* the Badger Creek Non-Point Source and Range Treatment Program to protect and improve fisheries, wildlife habitat, range resources, recreation and water quality of the Badger Creek watershed. The treatment also will reduce sediment discharge in the upper reaches of the Arkansas River;

* the Boulder county Small Lot Grazing Statewide Education Project to increase awareness and use by the public of grazing management on small acreage and to identify feasible technology for composting horse manure.

Colorado Rancher & Farmer 2/25/92

Brighton Tests Reverse Osmosis

Brighton has chosen reverse osmosis over other methods to resolve its water quality problem. Brighton's water historically has exceeded standard levels of nitrate concentration. Also, the water is hard, corrosive and 74 percent of Brighton's residents use bottled water or have installed a water softener. Reverse osmosis was developed years ago as a way for submarines to remove salt from ocean water for drinking purposes. Recently filters have improved and are produced by several companies, making them a more affordable option for cities such as Brighton. Osmosis is the movement of a fluid through a porous membrane. With reverse osmosis, the fluid is physically forced through the filtering membrane to remove impurities. Brighton is testing several filters to see which works best. Brighton plans to have a reverse osmosis plant operating by the end of 1993.

Rocky Mountain News 3/8/92

Rocky Flats Water to be Diverted Away From City Water

The Department of Energy is building a $73 million project to prevent water flowing through Rocky Flats from reaching drinking water supplies for north-side Denver suburbs of Broomfield, Northglenn, Westminster, Federal Heights and Thornton. The plan is for Broomfield to discontinue using Great Western Reservoir and get replacement water from the northern Colorado mountains. Both Great Western Reservoir and Standley Lake, source of water for the other cities, receive

water that flows through Rocky Flats. The water contains minute amounts of radionuclides, toxic solvents and heavy metals such as chromium. The water has been certified as safe by every city, bureaucracy or agency that has measured it. When the DOE project is completed by Jan. 1, 1995, however, it will provide further protection by diverting water around Standley Lake with canals, interceptor ditches and pipelines, and back into the creeks downstream.

Montrose Daily Press 2/17/92

Arsenal Water Treatment Plant Built

A $7.25 million water treatment plant and a $90 million toxic incinerator have been built on the Rocky Mountain Arsenal to be used in the Superfund cleanup of the arsenal, expected to cost more than $1 billion and continue at least another decade. The water treatment plant will cleanse contaminated water generated during the Superfund cleanup.

Denver Post 12/5/91

Nitrate Levels Too High in Some Colorado Water

The water supplies of 14 Colorado communities and an unknown number of private wells have levels of nitrates that exceed health standards. According to the Colorado Department of Health's Water Quality Control Division, most of the communities are in rural agricultural areas northeast of Denver. Private wells with unacceptable levels are harder to identify, since they are not regulated. Public wells are checked every three years. State health officials are working with the communities to alleviate the problem.

The Pueblo Chieftain 3/4/92

The Good Side of Ozone: Water Treatment

Because of the increasing concern over the effects of chlorine as a water disinfectant, water ozonation is gaining attention as a possible alternative. Ozonation is being used for high-purity industrial applications and to treat water in public aquariums and marine exhibits. Ozone gas, an oxidizing chemical disinfectant produced by a high-voltage electrical charge, kills bacteria and viruses while leaving water brilliantly clear. Purification of potable water and industrial wastewater treatment are other uses being explored.

U.S. Water News March 1992

National Organization for Citizen Monitors to be Discussed

Teams of citizen water quality monitors from across the country will discuss formation of a national organization at the Third National Citizens' Volunteer Water Monitoring Conference in April. The conference is organized by the Izaak Walton League in cooperation with America's Clean Water Foundation and the Alliance for the Chesapeake Bay, and will focus on how volunteers can work together to monitor the quality of rivers, lakes, wetlands, and estuaries. Monitoring of surface water quality by individual citizens involves using biological and/or chemical testing to determine overall health of the water body. Chemical testing often involves technical expertise beyond the capabilities of citizen volunteers, living organisms such as aquatic insects and shellfish are often used.

U.S. Water News Feb. 1992

WILDERNESS

Piedra River Controversy Unresolved

The Colorado Water Conservation Board has delayed a decision on instream flow rights for the Piedra River through a 15-mile long portion of the river's canyon in southwestern Colorado. This portion of the river has been proposed as a federal wilderness area and is part of a compromise wilderness plan to protect over 640,000 acres of undeveloped land in Colorado.

At its March meeting, the board formed a subcommittee to further investigate the controversy, but set no deadline for completion of the investigation. The compromise wilderness plan between U.S. Senators Tim Wirth (D-Colo.) and Hank Brown (R-Colo.) specifically prohibits federal water rights for wilderness areas, but allows the Colorado Water Conservation Board to file for wilderness water rights through state courts. U.S. Rep. Ben Nighthorse Campbell (D-Colo.) has proposed a similar wilderness bill which may have a greater chance of passing the full House because it omits the controversial Piedra River section.

Grand Junction *Daily Sentinel* 3/6/92; *The Montrose Daily Press* 3/6/92.

ENVIRONMENT

California Agricultural Runoff to Resume

The U.S. Bureau of Reclamation has approved a final Finding of No Significant Impact (FONSI), clearing the way for the reopening of the federally owned San Luis Drain in California. The 85-mile agricultural drainage ditch in the San Joaquin Valley drains farm runoff into the Kesterson Wildlife Refuge. It was closed in 1986 when birds, fish, and other wildlife in the refuge were found to be dying from runoff tainted with selenium, which occurs naturally in certain soils. The ditch will no longer empty into the wildlife reserve, but instead will be rerouted into Mud Slough before emptying into the San Joaquin River. Although agricultural return flows are exempted from discharge permits and regulation under the Clean Water Act, the reopening of the ditch is dependent on meeting certain water quality standards in the slough during the first two years of operation. The Bureau of Reclamation has formed an oversight committee which includes environmental representation, and has agreed to cease operation if damages occur.

U.S. Water News December 1991

Rio Grande Cleanup Proposal

Texas Congressman Kika de la Garza has proposed forgiving a portion of Mexico's debt to the U.S. if Mexico will agree to spend an equal amount for cleanup of the Rio Grande. The U.S. Environmental Protection Agency and Mexico are attempting to develop a program to clean up what Texas Lt. Gov. Bob Bullock calls "one of the most polluted rivers in the United States." The EPA has called Kika de la Garza's proposal interesting and worth further study.

U.W. Water News December 1991

Reducing Acid Rain May Quicken Global Warming

Researchers report in a new study that sulfur dioxide and other sulfate pollutants which cause acid rain also shield the earth from increasing temperatures associated with the so-called greenhouse effect. The study suggests that a reduction in these acid rain agents in the atmosphere may lead to an increase in global temperatures. Lead author Robert Charlson, professor of atmospheric science at the University of Washington, said that the researchers do not suggest cutting back on efforts to decrease acid rain, but that the totality of greenhouse emissions must be reduced. This report supports earlier findings on the global-warming issue. The report was published in the January, 1992, issue of *Science* magazine.

Ft. Collins *Coloradoan* 1/24/92

Gunnison River Streamflow Protection

The Bureau of Reclamation, National Park Service, Bureau of Land Management, and the Colorado Water Conservation Board will enter studies and negotiations for a water service contract to provide long-term protection of streamflows on the Gunnison River through the Black Canyon of the Gunnison National Monument and the Gunnison Gorge. A preliminary working draft of the contract has been developed, and is available from the Bureau's Grand Junction Projects Office. The purpose of the contract and negotiations will be to ensure that there are sufficient flows in the Gunnison River to meet the purposes of the Monument and to protect natural resources and recreation in the Gunnison Gorge. The first contract negotiation meeting is expected to occur this summer. Meeting dates will be announced. The public is invited to attend. To be included on the mailing list contact Jone Wright, Bureau of Reclamation, Grand Junction Projects Office, 2764 Compass Dr., P.O. Box 60340, Grand Junction, Colo. 81506, telephone (303) 248-0636.

Montrose Daily Press 1/23/92

Proposed Gravel Mine on Uncompahgre River Draws Fire

A plan to mine gravel from the Uncompahgre River near Ouray has reopened a two-year controversy. ZMK Mine Construction of Ouray plans to mine gravel near the Idlewild subdivision on the West side of the river. In 1990 another proposal to mine gravel near the current site obtained a required county permit, but has been so far denied a permit from the state. Opponents of the gravel operations say the impact will be disastrous, while proponents allege minimal environmental impact.

Grand Junction *Daily Sentinel* 1/23/92

Greenhouse Effect on Major River Basins

The University of Colorado is participating in an EPA funded three-year study of climate change in developing nations around the world. Research teams have focused on four areas: sea level (based at the University of Maryland), vegetation (University of Virginia), agriculture (Columbia University), and major river basins (CU-Boulder). The CU project is directed by geographer William Riebsame, and has studied how global warming could affect five of the world's major rivers: the Nile in northern Africa, the Zambezi in south-central Africa, the Mekong in Southeast Asia, the Indus in Pakistan, and the Uruguay in South America. Goals included assessing consequences to developing countries around these rivers if the greenhouse effect doubled by 2050, and working with local experts in each river basin for future planning. The study demonstrates both the need for and benefits of this type of collaborative research. The research teams from CU, Maryland, Virginia, and Columbia will present their results to the EPA in June.

ENDANGERED SPECIES

River's Role in Recovery Plan Could Affect Fishery

The San Juan River, a prime fishery in New Mexico, is part of the U.S. Fish & Wildlife Service's recovery plan for threatened and endangered fish species, especially the Colorado squawfish. At least one squawfish has been found downstream of Farmington, N.M., below where the San Juan and the Animas rivers join. The Animas is threatened with depletion once work begins on the Animas-La Plata Project. According to the Recovery Implementation Plan for the squawfish, Navajo Dam, via the San Juan River, will account for water lost from the Animas. The plan projects the river mimicking the flows prior to the completion of Navajo Dam. This means a high spring runoff followed by low water levels through late summer and fall. Users of the fishery worry that although a brief period of low flow may not hurt the fishery, an extended low flow period will strand fish in the shallows and kill much of the invertebrate life which supports the river's fish.

Grand Junction *The Daily Sentinel* 3/12/92

MISCELLANEOUS

Denver Faces First Water Rate Hike in Five Years

A 7 percent water rate hike to go into effect this year will increase by $7.20 a year the cost for a typical Denver residential customer. The first rate increase in five years, it does not apply to suburban water board customers.

Denver Post 3/4/92

CALLS FOR PAPERS AND PROGRAM ANNOUNCEMENTS

INTERNATIONAL ASSOCIATION FOR WATER POLLUTION RESEARCH AND CONTROL

International Conference on Diffuse (Nonpoint) Pollution: Sources, Prevention, Impact and Abatement, Sept. 20-24, 1993, Chicago, IL. Format includes platform and poster presentations. Maximum length for abstracts is 500 words. Deadline: June 15, 1992. Contact: Dr. Vladimir Novotny, Dept. of Civil and Environ. Engr., Marquette Univ., 1515 West Wisconsin Ave., Milwaukee, WI 53233. FAX: (414)288-7082.

STOCHASTIC AND STATISTICAL METHODS IN HYDROLOGY AND ENVIRONMENTAL ENGINEERING

An International Conference in Honor of Professor T.E. Unny, June 21-23, 1993, Univ. of Waterloo, Waterloo, Ontario, Canada. Extended abstract due Oct. 15, 1992. Contact: Prof. Keith W. Hipel, Department of Systems Design Engineering, University of Waterloo, Waterloo, Ontario, CANADA N2L 3G1. Phone (519)885-1211 ext. 2830 or 3113; FAX (519)746-4791.

COLORADO STATE UNIVERSITY
UPCOMING JULY CONFERENCE/WORKSHOPS ON

WATER RESOURCES AND ENVIRONMENT:
Education, Training and Research

Water Resources Education - Status and Needs
Environmental Education - Status and Needs
Educating Minority Citizens - Key to the Future
International Water/Education Issues
Research Trends in Water and Environment
Outreach - Connecting Education and Action

CONFERENCE/WORKSHOPS THEME:
USING EDUCATIONAL PROGRAMS TO SOLVE WATER AND ENVIRONMENTAL MANAGEMENT PROBLEMS

JULY 13-17, 1992
COLORADO STATE UNIVERSITY, FORT COLLINS, COLORADO

ORGANIZED AND SPONSORED BY THE DEPARTMENT OF CIVIL ENGINEERING AND COLORADO WATER RESOURCES RESEARCH INSTITUTE

CONTACT: JANET LEE MONTERA, CIVIL ENGINEERING DEPARTMENT, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523. PHONE: 303/491-7425; FAX 303/491-7727. REGISTRATION FEE: $325.00.

SHOWDOWN AT THE COLORADO WATER WORKSHOP

Showdown on the Colorado River is the theme for the 17th annual Colorado Water Workshop, scheduled for July 22-24 at Western State College in Gunnison. Speakers will discuss the history of agreements and laws that govern the management of the Colorado River system. Panelists will explore whether existing agreements and management techniques can satisfy the demands of a growing urban population, environmental requirements, and Native American rights. Will water transfers from agriculture provide the solution? Where does water for recreation fit? The inviolability of interstate compacts will also be debated. New management solutions will be discussed. Speakers include negotiators from the Colorado basin states, a variety of water users, economists, philosophers, demographers and water suppliers.

Western State College will offer one undergraduate or graduate credit for the three-day conference. Eighteen CLE credits will also be available. The registration fee, which includes meals, is $200. A limited number of scholarships will be available. The conference schedule and registration information will be mailed in late May. For more information, please contact Lucy High at 303/641-2238 or -2239.

Announcement & Call for Papers

Defining Ecological and Sociological Integrity for the South Platte River Basin

October 27-28, 1992
University Park Holiday Inn Fort Collins, Colorado

Current direction by the U.S. Congress on reauthorization of the Clean Water Act has brought a new term to water management - ecological integrity. What does this term mean? What will be its implications for resource management in the Western United States? How will the South Platte Basin be changing under this new federal mandate? Must the ecology of the region return to what it was before European influence - high plains desert and mountain meadow? How can we as resource managers and citizens of the Basin define direction for our way of life under these policies? How can we maintain sociological integrity of the basin while seeking ecological integrity?

To provide a forum for these important questions, the 1992 South Platte Research Conference is to be held October 27-28, 1992 at the University Park Holiday Inn, Fort Collins, Colorado. As the third annual conference, this meeting desires to follow the pattern of multi-disciplinary discussion and formulation of direction through better understanding of the South Platte River system. Target participants include water management organizations, citizen groups, agricultural interests, outdoor recreationists, resource consultants, local and regional government, university members, conservation organizations, and federal resource agency personnel.

The format of the 1992 South Platte conference will include invited presentations that seek to define the past and present ecology of the South Platte Basin. Short presentations on specific aspects of the South Platte Basin are planned as well as discussions, posters, and audio visuals.

You are invited to submit a one-page abstract of a planned short presentation to the organizing committee by July 15, 1992. The abstracts will be reviewed and authors whose papers are selected for presentation will be notified by August 15, 1992. The abstracts should be one page or shorter in length, and be submitted in both hard copy and Wordperfect or ASCII format on disk. The actual presentation should be approximately 15 minutes in length and allow for an additional five minutes of discussion. Submitted abstracts will be published in the proceedings.

Submit materials to:

Colorado Water Resources Research Institute
410 University Services Bldg., CSU
Fort Collins, Colorado
Phone: (303) 491-6308
FAX:(303) 491-2293

Sponsored by: Colorado Division of Wildlife, US Fish and Wildlife Service, Colorado Water Resources Research Institute, Denver Water Department, and Northern Colorado Water Conservancy District

A Workshop on
ENVIRONMENTAL ASSESSMENT OF MOUNTAIN STREAMS
September 15-18, 1992
Wild Basin Lodge, Allenspark, Colorado

Objectives--To understand the role and interaction of climate and hydrology on the chemical, biological and physical characteristics of mountain streams. To develop an appreciation and to respect the logistical limitations and difficulties associated with making field measurements and collecting samples for sediment, chemical and biological analyses. The workshop focuses on the need for a holistic view and interdisciplinary approach to environmental assessments.

Format and Topics--The Workshop will provide a lecture/field format with approximately **half of the time in the field** on the North St. Vrain Creek. General technical topics will include: the use of available information related to mountain streams; basin characteristics; hydraulic patterns; stream-reach characterization; identification and measurement of stream attributes; stream aesthetics; modern techniques of physical, chemical and biological stream measurements; evaluation of field-collected information. Particular emphasis is placed on working with identified problems of data collection and analyses in mountain rivers.

Location and Registration Fee--Wild Basin Lodge is near Allenspark, Colorado adjacent to the North St. Vrain Creek and upstream from the Rocky Mountain Hydrologic Research Center (State Highway 7, about 8 miles south of Estes Park). The registration fee is $350 per person.

Workshop Organizers and Contact--Sponsored by the Rocky Mountain Hydrologic Research Center and organized by the Civil Engineering Department and Colorado Water Resources Research Institute at CSU with participation by the National Park Service (Water Resources Division) and the U.S. Geological Survey. For information and brochure contact: Janet Lee Montera, Civil Engr. Dept., Colorado State University, Fort Collins, CO 80523. Phone (303)491-7425; FAX (303)491-7727.

April 9-10 **ENVIRONMENTAL FIELD MONITORING WORKSHOP**, Denver, CO. Center for Continuing Engr. Education, Univ. of Wisconsin; For registration or information use the numbers listed above.

April 13-14 **ADVANCED OXIDATION PROCESSES WORKSHOP**, Coral Gables, FL. Presented by the American Water Works Assoc. and the International Water Supply Assoc. Contact: Phil Carter or Elaine Youngren at AWWA, 6666 West Quincy Ave., Denver, CO 80235 or call (303)794-7711.

April 29-30 **CORROSION CONTROL STUDIES AND STRATEGIES SEMINAR**, Denver, CO. Call Jim Ginley at AWWA (303)794-7711, ext. 2806.

May 11-13 **SIXTH NATIONAL OUTDOOR ACTION CONFERENCE ON AQUIFER RESTORATION, GROUNDWATER MONITORING, AND GEOPHYSICAL METHODS**, Las Vegas, NV. Contact: National Groundwater Association, Education Foundation, 6375 Riverside Dr., Dublin, OH 43017. Phone (614)761-1711; FAX (614)761-3446.

June 1-2 **CONFERENCE ON HAZARDOUS WASTE RESEARCH**, Boulder, CO. Contact: Great Plains/Rocky Mountains Hazardous Substance Research Center, 113 Ward Hall, Kansas State Univ., Manhattan KS 66506-2502.

June 9-11 **ANNUAL MEETING, GREAT PLAINS AGRICULTURAL COUNCIL**, Lincoln, NE. Contact: Melvin Skold, Department of Agricultural and Resource Economics, Colorado State Univ., Fort Collins, CO 80523. (303)491-7370.

June 18-22 **AMERICAN WATER WORKS ASSOCIATION ANNUAL CONFERENCE**, Vancouver, B.C., Canada. Contact: AWWA, Meetings Dept., 6666 West Quincy Ave., Denver, CO 80235 or call (303)794-7711.

Aug. 3-5 **WATER FORUM '92**, Baltimore, MD. Four individual (divisional) national conferences held simultaneously under one roof. Technical sessions arranged, to the extent possible, to allow participants to move from one conference to another. For information contact: American Society of Civil Engineers, Conference Department, 345 East 47 Street, New York, NY 10017. Phone 1-800-548-ASCE; FAX (212)980-4681.

AMERICAN WATER RESOURCES ASSOCIATION
COLORADO SECTION SCHOLARSHIP PROGRAM

Annual Stipend: $1,000

The American Water Resources Association (AWRA)-Colorado Section announces a scholarship competition that is open to any person enrolled as a student in a degree program in any accredited Colorado public or private college or university and also involved in research or independent study pertaining to hydrology, geology, engineering, hydrogeology, law, economics, planning, computer science, environmental science, or other topics concerning water resources in Colorado. Applicants should send an abstract of their proposed research, a resume and a letter of reference from their faculty advisor no later than June 1 prior to the beginning of the academic year to:

Chairman, AWRA-Colorado Section Scholarship Committee
P.O. Box 9881
Denver, Colorado 80209-0881.

Abstracts will be reviewed by a standing committee of the AWRA-Colorado Section and the top three candidates' applications sent to the AWRA-Colorado Section Board of Directors for final selection. Announcement of the selected candidate will be made by August 1.

The goal of the AWRA-Colorado Section scholarship is to further interest and research in water resources of Colorado. Funding for the scholarship is from various contributors, which to date have been local and national members of AWRA. For more information contact either Ed Rovey, Water & Environmental Systems Technology, Inc., 2914 West 29th Ave., Denver, CO 80211 (Phone 433-9125), or Jim Kunkel, Advanced Sciences, Inc., 405 Urban St., Suite 401, Lakewood, CO 80228 (Phone 980-0036).

This newsletter was financed in part by the Department of the Interior, U.S. Geological Survey. The contents of this publication do not necessarily reflect the views and policies of the Department of the Interior, nor does mention of trade names or commercial products constitute their endorsement by the United States Government.

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