

Colorado Water

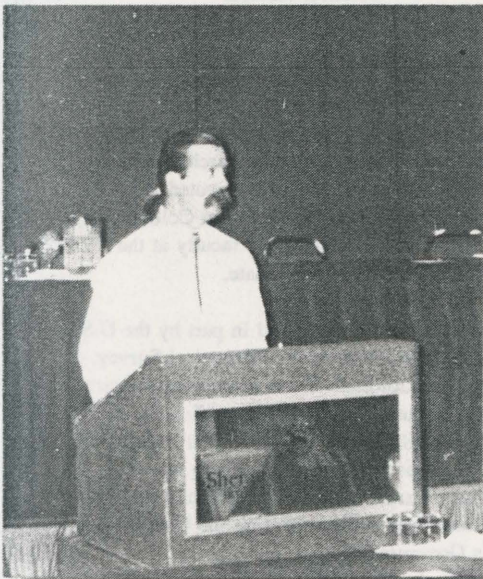
Newsletter of the Colorado Water Resources Research Institute. Fort Collins, Colorado 80523

WATER ITEMS AND ISSUES ...

April 1994

ANOTHER "ENDANGERED SPECIES"! -- Editorial by Robert C. Ward	2
Water Research	4
Features	9
Water Supply	17
Water Publications, Databases	19
Editor's In-Basket	20
Water News Digest	24
1994 AWRA-Colorado Section Meeting	29
Meetings, Calls for Papers, Short Courses	30
Calendar	36

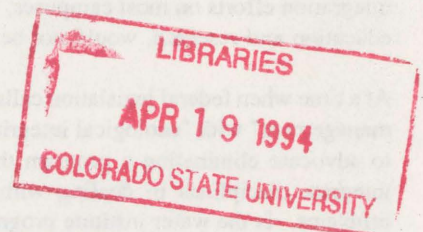
QUENCHING THE URBAN GIANT --see page 34



AWRA-Colorado Section Meeting
March 18, 1994 -- Denver, Colorado

*Biodiversity and Ecological Integrity --
Meeting Tomorrow's Challenges Today*

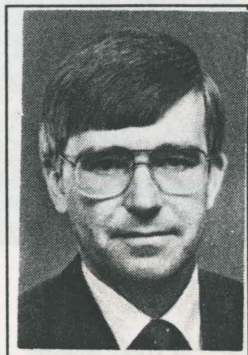
John Stednick briefs conference participants
on CWRRI Ecological Integrity Task Force's
progress. See page 29 for a meeting summary



Colorado
State
University

ANOTHER "ENDANGERED SPECIES"!

by Robert C. Ward



Has the national environment for water resources research institutes changed to the point where they will become extinct? The administration's budget, submitted to Congress in February, eliminates federal funding for the national water institute program of which CWRRI is a part. Loss of federal funding would force CWRRI to end its research program and reorganize its outreach programs, if it could continue them at all.

There certainly is a strong push for changing (reinventing) government's organization and operation. The national water institute program is being targeted as one of the 115 programs proposed for elimination. Some may say that loss of the water institutes is a small price to pay for a more streamlined federal government. Let's look further into the situation, though, before completely writing off the water institutes. In particular, let's look at the role of CWRRI, its functions in Colorado and pose the question: What would replace CWRRI if it were eliminated?

CWRRI was established by joint federal and state legislation and has, during its 30 years of existence, supported faculty efforts to bridge their disciplines across water concerns via innovative and integrated water education, research and outreach. There is no "water" department or discipline on most campuses of higher education. As has been understood for many years, water education and research is best conducted at the interface of disciplines - the major role of CWRRI. Without such discipline-integration efforts on most campuses, water issues, as a focus of education and research, would not be addressed.

At a time when federal legislation calls for "integrated watershed management" with "ecological integrity" goals, it seems strange to advocate eliminating a program that has always worked to integrate disciplines in dealing with water and water-related problems. Is the water institute program simply the baby being thrown out with the "reinvention" bath wash?

Currently, CWRRI receives one-third of its \$300,000 annual budget from the Federal government (through the U.S. Geological Survey). This money comes with a required 2 to 1 match (which is currently supplied by Colorado State University). The federal funding is the fundamental basis around which CWRRI is currently structured. Its termination removes CWRRI's funding and networking foundation. Unlike many water institutes, CWRRI does not have direct state funding with which to continue operations, even in a reduced fashion, if federal funding is eliminated.

What does CWRRI contribute to Colorado's efforts to improve its water management system? Over the years, CWRRI has

published the results of over 300 research projects, published a newsletter six times a year to disseminate the research findings (as well as water happenings on Colorado's campuses of higher education), cosponsored approximately 4 water conferences each year, provided water-oriented educational opportunities for approximately 25 students per year, and coordinated an active interface between Colorado's higher education faculty and water users and managers around the state.

CWRRI has changed its research focus in recent years in response to the evolving education and research needs of Colorado's water management system. This year, 40 percent of CWRRI's research budget is being reallocated to teams of faculty and Colorado water managers for the purpose of synthesizing existing knowledge about a current water problem.

COLORADO WATER

Vol.11, No. 2

Date: April 1994

Editor

Shirley Miller

Writers

David Barnes

Jennifer Roberts

Greg Silkensen

Heather Ward

David Williams

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

Eighteen faculty will work directly with 17 water managers/users to synthesize water knowledge related to important Colorado water issues such as developing a Colorado definition of "Ecological Integrity"; defining the concept of "Agricultural Water Conservation" within Colorado's water law system; understanding the role of sediment in Colorado's streams and reservoirs; and examining the evolving nature of public water information in light of the death of the Two Forks project and the expanding use of ballot initiatives.

The entire 1994/95 CWRRI research program is described beginning on page 4 of this issue of *COLORADO WATER*. As you can see, other critical water issues are being addressed. Included are projects examining: (1) cost effective management of urban water runoff; (2) use of GIS systems for assessing non-point source BMPs; (3) available water models for use in "decision support systems" for the South Platte watershed; (4) use of lysimeters to accurately measure return flows from lawn watering; and (5) processes involved in using wetlands to remove iron from acid mine drainage.

CWCB ISSUES CALL FOR GRANT APPLICATIONS IN WATER CONSERVATION/WATER USE EFFICIENCY

The Colorado Water Conservation Board will award grants of up to \$100,000 to Colorado water providers, water resource managers and water users to implement water conservation and water use efficiency demonstration projects directed at agricultural and multipurpose water systems in Colorado. Grant recipients will be required to provide matching funds that may include in-kind services.

The Colorado Legislature authorized the use of \$500,000 by the CWCB, on a 50 percent cost-sharing basis, for agricultural and multipurpose water systems water conservation and water use efficiency pilot demonstration projects.

Applicants are encouraged to develop cooperative relationships with a broad base of water users and water managers. In that the long-term success of water conservation and water use efficiency in agriculture depends on the level of acceptance by the agricultural community, it is recommended that demonstration projects include the participation of individual irrigators and local agricultural extension agents.

Project Eligibility

In general, water conservation and water use efficiency projects eligible for grant awards should be designed to either add to the knowledge of existing practices or management procedures relative to their effectiveness in achieving water savings or operations costs savings or address new innovation and technology. Any proposed project that appears to meet the goals of the demonstration grant program will be considered by the CWCB for grant funding. The duration of demonstration projects under this grant series must not exceed 30 months from the date of contract to submittal of a final report.

As Colorado attempts to become more efficient, inclusive, and integrated in its approach to water management, the role of education, research and outreach, on the part of higher education, is more critical than ever. Unfortunately, it is at this crucial juncture in western water management that funding for higher education's only attempt to integrate disciplines, and its connection with water users and managers, is being challenged by the administration's proposal to eliminate the national water institute program. The extinction of the national water institute "species" will result in Colorado universities and water users having to forge, and fund, a new means of connecting their needs and expertise.

What are the alternative means and costs by which Colorado water users and managers can make better use of higher education's water expertise? The question begs the attention of all Colorado citizens. You may wish to express your opinion on this subject directly to your Congressperson.

Matching Funds Requirements

Applications for grants must provide for and identify matching funds to satisfy a 50 percent cost sharing basis, as stipulated in SB 87. Matching funds can include direct expenditure of applicant funds and/or in-kind staff support and services necessary to project tasks.

Application Period

The application period for this grant series will remain open until July 1, 1994.

Application Review and Award Cycles

Grants selections will be determined and awards will be made approximately 75 days after application deadline.

For additional information contact:

Chris Bridges, Program Director
Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman Street
Denver, Colorado 80203
Phone 303/866-3441
FAX 303/866-4474

Grant application instructions are available from Colorado State University's Office of Sponsored Programs:

Phone 303/491-6355; FAX 303/491-6147

WATER RESEARCH

PROJECTS SELECTED FOR 1994-95 WATER RESEARCH PROGRAM

CWRRI received 33 proposals from faculty of Colorado State University, the University of Colorado, and the Colorado School of Mines in response to its Request for Preproposals (RFP) for the 1994-95 water research program. CWRRI's Research Planning Advisory Committee (water professionals) reviewed and rated the proposals for relevance to Colorado water problems, and the Technical Advisory Committee (faculty members from CSU, CU, and CSM) ranked them on technical merit. Based upon evaluations by the two advisory committees, CWRRI's 1994-95 program will be comprised of three knowledge synthesis task forces on the subjects of agricultural water conservation, providing the public with information about water, and sediment in Colorado rivers and streams.

KNOWLEDGE SYNTHESIS TASK FORCES

Agricultural Water Conservation: Myth or Reality?

"If agriculture only would save 10 percent of the water it uses, Colorado would solve its water problems." This statement often is repeated by many Coloradans who live along the Front Range. Is this true? Those involved in agriculture say that really there is no such thing as agricultural water conservation in Colorado -- water that is not consumed by plants is returned to rivers and streams, in a delayed fashion, to become someone else's water right. This use of Colorado's rivers and surface and subsurface return flows, in fact, results in high water use efficiency from a total watershed perspective. Which view is correct? What is the true situation? As with most water issues, the truth probably lies somewhere in between the above perspectives.

"Agricultural Water Conservation -- Myth or Reality?" was identified as one of the top ten water research priorities by CWRRI's Research Planning Advisory Committee (RPAC) prior to CWRRI's Call for Preproposals. Three preproposals were received that addressed this topic in one form or another, but none directly addressed the "lack of definition or understanding" that surrounds this issue. Consequently, CWRRI has invited the investigators of the three preproposals to serve on a Task Force that will attempt to spell out exactly what the concept "Agricultural Water Conservation" means to the state of Colorado and its citizens.

The faculty who have been invited to serve on the Task Force are:

Dan Smith (Agronomy, CSU), Chair
Grant Cardon (Agronomy, CSU)
Israel Broner (Agricultural and Chemical Engineering, CSU)
Marshall Frasier (Agricultural and Resource Economics, CSU)

Dan Champion (Cooperative Extension - Grand Junction)
Dick Bartholmay (Cooperative Extension - Grand Junction)

Since several of the proposal investigators are Extension employees, Cooperative Extension has been requested to join CWRRI as a cosponsor.

Dan Smith has agreed to serve as Chair of the Task Force. Kathleen Klein, an MS candidate in Earth Resources, has agreed to serve as support staff for the Task Force for the fiscal year 1994-95 even though she will complete her MS degree in December 1994. Seven members of CWRRI's Research Planning Advisory Committee (RPAC) will also serve on the Task Force:

David Merritt (Colorado River Water Conservation District)
Hal Simpson (State Engineer)
Rod Kuharich, (City of Colorado Springs)
Ralph Curtis (Rio Grande Water Conservancy District)
Dan Parker (Soil Conservation Board)
Eric Wilkinson (Northern Colorado Water Conservancy District)
Chuck Lile (Colorado Water Conservation Board)

This blend of university staff and water managers should result in an explanation of "Agricultural Water Conservation" that will help all Colorado citizens better understand the role of agricultural water conservation in Colorado's future.

Specific Tasks

The Task Force will meet regularly (once every two weeks, initially, to get acquainted) as it attempts to develop agreed-upon definitions of the following key terms related to agricultural water conservation:

Consumptive use
 Salvaged water
 Conjunctive use
 Irrigation efficiency
 Beneficial use
 Production function
 Crop water use efficiency
 "Use it or lose it" water rights principle

In addition to defining exactly what the term "Agricultural Water Conservation" means, the Task Force will also examine the potential impacts (intended and unintended) such conservation could have on:

Administration of water rights
 Economic viability of agricultural operations
 Alternative water supplies for urban areas
 Ecology (wetlands, minimum stream flows, and habitat)

With some agreement on definitions, the Task Force will also evaluate alternative structural and non-structural means to achieve more efficiency in water use in Colorado, including a discussion of where, when and how "agricultural water

conservation" fits in. The Task Force will also attempt to identify those areas of the state where agricultural water conservation tends to be feasible at either the farm level or at the basin level. While the Task Force will probably not be able to get specific on this task, it could point out directions for more specific future studies. In fact, it is hoped that the Task Force will also develop specific proposals for future water conservation research/studies for Colorado.

The Task Force will draw heavily upon the knowledge and experience of its members. It is their expertise that will be brought to the table and integrated in the search for understanding of "Agricultural Water Conservation." The Task Force also will review existing literature (especially previous CWRRI reports) on the topic and develop a bibliography that can serve as an information resource for all Colorado citizens. In addition, the Task Force will interview water users, water managers and citizens around the state to integrate existing written definitions with the operating definitions that are used in the day-to-day administration of Colorado's water rights.

The final product will be a "white paper" that clearly explains the concept of agricultural water conservation to Colorado citizens and their elected representatives.

People and Water: An Information Puzzle

"The public does not see the need for Two Forks. Why?" "If agriculture only would save 10 percent of its water use, Colorado would solve its water problems!" "Why does the public become interested in water management only when we have a drought or flood?" "Why can't water users leave enough water in the streams to protect our stream ecology?" Questions like these stream out of public conversations about water. Where does the public get information to answer such questions? In an era when water management is becoming more inclusive, there is a need to make sure that all parties involved in water decisions are informed about the many dimensions and roles of water in Colorado. How do water users and managers ensure that the public is informed?

Providing public information about water was voted a top priority by the Institute's Research Planning Advisory Committee (RPAC). The response to the Call for Preproposals resulted in two proposals addressing this issue. Neither, however, seemed to address the issue as viewed by the water management organizations involved. Both preproposals were directed toward specific tasks rather than a general definition of public water information and its role in the evolving nature of water management in Colorado.

Consequently, CWRRI has opted to join the principal investigators from the two preproposals, with water managers, to examine the issue. CWRRI will create a Public Water Information Task Force to examine how the more inclusive public can become better informed about water issues, and in the process, rightly assume their role as informed decision makers regarding water management in Colorado. In an era

when ballot initiatives are defining a variety of dimensions of state government, it is more important than ever that the public be well informed about water issues. The faculty invited to serve on the Public Information on Water Task Force are:

Marilee Long (Technical Journalism, CSU), Chair
 Greg Luft (Technical Journalism, CSU)
 Mark Kumler (Geography, CU)
 James Wescoat, Jr. (Geography, CU)

The water users/managers that will be invited to serve on the Public Information on Water Task Force are:

Carmine Iadarola (AquaSan Network, Inc.)
 Tom Cech (Central Colorado Water Conservancy District)
 Trina McGuire (Denver Water Department)
 Tommy Thomson (Southeastern Colorado Water Conservation District)
 Chris Bridges (Colorado Water Conservation Board staff)
 Kevin Dennehy and Nancy Driver (USGS National Water Quality Assessment Program)

Informing the public about water issues is not easy. Water management in Colorado involves a complicated legal system, an extremely intricate ecological system, a connected social and economic system, and uncertain hydrologic (amounts of water) inputs. Overlay this with the need to correct past social

injustices, restore damaged ecosystems and an ever-growing population, and one begins to realize that the water management picture in Colorado is too complicated for the public to understand. This is a fatal mistake!

These various dimensions of water information need to be evaluated by communication professionals who specialize in converting complex legal and scientific information to a form easily understood by the public. There is a need to present water management to the public in clear and precise language that captures the essence of the situation without all the complicating details.

Specific Tasks

The fundamental elements of water management in Colorado need to be extracted from the maze of legal, engineering, economic, ecological and biological jargon that currently surrounds it. These elements then need to be expressed in terms that the average Colorado citizen understands. The Task Force will first define the current citizen understanding of water management in Colorado and relate this to the reality of actual water management practice. The differences will be extracted and examined. Alternative public information vehicles, which could be used to bridge the gap, will then be identified and related to the current understanding of Colorado water management.

Considerable water data and information is collected by local, regional, state and national organizations. For example, the U.S. Geological Survey is currently collecting considerable water quality-related data/information on the South Platte and mainstem of the Platte in Nebraska as part of the agency's National

Water Quality Assessment Program. This information, when blended with information for other agencies, has the potential to explain the current status of water quality and ecological relationships in the Platte River system. Such an understanding would be very useful to the public as federal and state agencies disagree over water use and endangered species.

Carrying the example further, what does the public know about the ecological, hydrological, water conservation, and water quality issues in the Platte River? What information is the U.S. Geological Survey producing that could enhance public understanding? How should this information be presented to the public to enhance an understanding of these issues in the Platte River basin? These are communication issues that confront both the professional water manager and the general public.

Gaps in understanding among the public, the professional water manager and water user will be quantified. This gap, especially as it relates to public votes for water management funding, will be examined with respect to the need of water management agencies to better inform their rate payers.

Again, using the U.S. Geological Survey's NAWQA program on the Platte River as an example, such a data/information collection effort could be examined in a case study mode to determine NAWQA's ability to inform the public of its findings in the Platte River basin.

The Task Force will prepare a summary of its communication definitions, findings, conclusions and recommendations. This summary will be presented in a "white paper" designed to be easily read and understood by Colorado citizens.

Colorado Sediment: The Good, The Bad and The Ugly!

Sediment in Colorado rivers and streams is an evolving concern associated with the physical, chemical and ecological status of the health of Colorado waters. Some rivers are sediment balanced; some are sediment rich; some are sediment poor; and some, at certain times, are grossly damaged by sediment. Why is sediment viewed as good, bad and ugly?

This White Paper will serve as a defining statement on sediment in Colorado rivers and streams. Terms will be defined as the role of sediment in the health of Colorado rivers and streams is discussed and explained. The White Paper will also note the situations where sediment is a problem, where it is needed, and where it becomes excessively damaging.

The paper will also discuss what opportunities are available in the administration of Colorado's water to address the role of sediment in improving the health of Colorado's rivers and streams. In particular, the operation and maintenance of reservoirs and diversion structures, control of urban runoff, and control of agricultural and mining runoff will be examined and discussed. Task Force members, representing a number of

different dimensions of Colorado's water management community, are:

Steve Abt (Civil Engineering, CSU), Chair
Chester Watson (Civil Engineering, CSU)
Ellen Wohl (Earth Resources, CSU)
Steve Puttmann and Jay Skinner (Division
of Wildlife)
Representative from the State Engineer's Office

The Task Force will meet regularly as it develops a consensus on the role of sediment in Colorado rivers and streams and how the management of dams and diversion structures, and control of urban, agricultural and mining runoff, can be enhanced to improve the good dimensions of Colorado sediment.

In addition to preparing a "white paper," the Task Force will prepare a follow-up proposal that will address those aspects of sediment that warrant further study.

WATER RESEARCH PROJECTS

Linking a GIS to Non-Point Source Pollution Models for Assessing the Implementation of Best Management Practices

This project will be a pilot study on the development of a GIS-based model that can evaluate nonpoint source pollution from agricultural practices at a watershed level. The model will be designed to pinpoint problems such as the generation and destination of sediment and runoff-borne nutrients and pesticides. The display and analytical capabilities of such a system can greatly aid in: visualization of the problem; the assessment of alternative scenarios and solutions; and in the evaluation and recommendation of best management practices for Colorado farmers. Principal Investigators: *Jay Nuckols, Microbiology, CSU; Luis Garcia, Agricultural and Chemical Engineering, CSU.*

The Colorado State Engineer's Office is currently working with the Colorado Water Conservation Board and South Platte water users on the South Platte Water Rights Management System. The following two projects were designed to complement that effort.

Initiating a Water Management Decision Support System for the South Platte Basin

The second year of this project builds on the first year's coordination of effort among the water institutes of Nebraska, Wyoming and Colorado. The research has produced a summary of water resource modeling in the South Platte River Basin and a summary of discussions with representatives from a variety of water resource institutions involved in the basin. During the second year, the research team will document the issues faced by users of a decision support system on the South Platte River; identify conflicting issues by which the system could be constrained; develop a vision of and requirements for the DSS; and develop networking and possible collaboration of water managers in the basin. Principal Investigators: *Darrell Fontane, Tim Gates and John Labadie, Civil Engineering, CSU.*

Decision Support for Water Rights Administration

Various "river basin" simulation models have been developed; however, they are generally theme-specific and do not easily lend themselves to integration with other types of models. To utilize the effort invested in existing models requires an integrated approach. The primary purpose of this project is to coordinate the use of multiple models with a data management system that results in a multi-model subsystem for integrated watershed management in the South Platte River Basin. The project will utilize existing models to integrate the latest information technology, including relational databases, local and wide-area networks, geographic information systems and artificial intelligence techniques. The State Engineer's Office will provide supplemental support for the project. Principal Investigator: *John Eckhardt, CWRRI, CSU.*

Design and Operation of Small Lysimeters

This is the third and final year of research to estimate the amount of water lost as deep percolation in lawn water use, how much of the loss is preventable, and what management practices will help. This year the research involves estimating the amount of deep percolation as affected by soil types and the amount of water applied. The study is partially funded by the State Engineer's Office and the City of Colorado Springs. Principal Investigators: *Ramchand Oad and Terry Podmore, Agricultural and Chemical Engr., CSU.*

Characterization of Iron Transport Through a Natural Wetland Impacted by Acid Mine Drainage

Acid mine drainage affects soil, surface water and groundwater systems in Colorado. At the St. Kevin Gulch site near Leadville, Colorado, acidic surface water runoff from an abandoned mine recharges the natural wetland of Tennessee Park. For the past six years, the Upper Arkansas River Toxic Substances Hydrology Program of the U.S. Geological Survey (USGS), in cooperation with the Colorado District of the USGS Water Resources Division, has conducted a variety of hydrogeologic and geochemical studies at the site. This research, an extension of previous work, will quantitatively characterize iron transport through the Tennessee Park wetland and test the hypothesis that reduced iron is transported out the wetland and flushed into the underlying aquifer during the late summer and fall. Investigators will also evaluate the applicability of reaction transport modeling to acid mine drainage impacts and remediation. USGS support to the project will include access to existing site data and to field and laboratory equipment. Principal Investigators: *Wendy Harrison and S. Paschke, Geological Engineering, Don Macalady, Geochemistry, CSM.*

Cost-Effective Management of Urban Runoff Quality

A key feature in the Clean Water Act amendments is non-point source pollution control; however, no clear guidelines exist. Municipalities face the potential of costly monitoring and control programs that may do little to improve the quality of receiving waters. This project will develop an assessment methodology to evaluate the relative importance of urban stormwater runoff quality impacts on receiving waters in Colorado. In previous research, the principal investigator conducted nationwide assessments of the economic impact of urban stormwater management and the expected receiving water responses (under sponsorship of the Environmental Protection Agency). The Denver Urban Drainage and Flood Control District, the City of Boulder and the U.S. Environmental Protection Agency have offered their support to the study. The Region VIII EPA office has provided \$12,000 in financial support for a stormwater workshop and conference which will be held at CU during the summer of 1994. Principal Investigator: *James Heaney, Civil Engr., CU.*

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

- *WILDLIFE ECONOMIC ANALYSIS AND RESEARCH UNDER THE ENDANGERED SPECIES ACT...John R. McKean,
Cooperative Fish and Wildlife Research
- *STATISTICAL METHODOLOGY FOR NATIONAL WETLANDS INVENTORY STATUS AND TRENDS DATA,
Kenneth P. Burnham, Cooperative Fish and Wildlife Research
- CHARACTERIZE CHANNEL STABILITY OF THE GUNNISON RIVER, Ellen E. Wohl, Earth Resources
- *BIOSPHERE-ATMOSPHERE INTERACTIONS -- A STUDY OF THE ENERGY, WATER AND CARBON CYCLES,
David A. Randall, Atmospheric Science
- *NATIONAL FOREST USER PERCEPTIONS AND THE ROLE OF INTERPRETATION ON GRAZING ALLOTMENTS,
George N. Wallace, Natural Resource Recreation and Tourism
- *SPATIAL TRENDS IN SURFACE WATER QUALITY, NOATAK NATIONAL PRESERVE, Daniel Binkley, Forest
Sciences
- *DEVELOPMENT OF THE NATURAL RESOURCES WORKSTATION, Luis Garcia, Agricultural and Chemical
Engineering
- *IRRIGATED AGRICULTURE MANAGEMENT IMPROVEMENT PROCESS, Wayne Clyma, Agricultural and Chemical
Engineering
- MESOSCALE CONVECTIVE SYSTEMS AND THE ATMOSPHERIC BOUNDARY, Richard H. Johnson, Atmospheric
Science
- REGIONAL PROJECTIONS OF C DYNAMICS WITH GLOBAL CHANGE IN THE CENTRAL US, Edward T. Elliott,
Natural Resources Ecology Lab
- *ASSESSMENT OF DRIFTING LARVAL FISHES IN THE YAMPA AND GREEN RIVERS, Robert T. Muth, Fishery and
Wildlife Biology
- *THE DIURNAL AND SEASONAL RESPONSE OF BOUNDARY LAYER CLOUDS TO SOLAR WARMING, David
Randall, Atmospheric Science
- *STATISTICAL METHODOLOGY FOR NATIONAL WETLANDS INVENTORY STATUS AND TRENDS DATA,
Kenneth P. Burnham, Cooperative Fish and Wildlife Research
- DEC HYDROLOGIC INVESTIGATIONS, Chester C. Watson, Civil Engineering
- DEMONSTRATION AND MONITORING OF BANK STABILIZATION USING BIOENGINEERING TECHNIQUES,
Chester C. Watson, Civil Engineering
- *DEVELOPMENT OF AN OCEAN MODEL BASED UPON THE REDUCED SYSTEM OF EQUATIONS, Tom
Vonderhaar, CIRA
- *FLAMING GORGE STUDIES: ANNUAL ASSESSMENT OF MAINSTEM RAZORBACK SUCKER PRODUCTION,
Robert T. Muth, Fishery and Wildlife Biology
- *PROCESSING OF PLANKTON-NET AND BENTHOS CORE SAMPLES COLLECTED IN WETLANDS, Robert T.
Muth, Fishery and Wildlife Biology

University of Colorado, Boulder, CO 80309

- *DEVELOPMENT AND EXPERIMENTAL VERIFICATION OF THEORIES FOR UP-SCALING OF WATER FLOW
AND SOLUTE TRANSPORT IN SATURATED POROUS MEDIA, Tissa Illangasekare, Civil Engr.
- *DESIGN RELIABILITY FOR ESTIMATING COST OF PILE FOUNDATIONS PHASE 3: COMPUTER CODE
IMPLEMENTATION AND GENERALIZATION, Dan Frangopol, Civil, Environmental and Architectural Engineering
- AN INTERDISCIPLINARY MATHEMATICAL APPROACH TO THE ANALYSIS AND DEVELOPMENT OF
INTERMEDIATE MODELS OF ATMOSPHERE AND OCEANIC DYNAMICS, James Curry, Applied Math
- THE RECORD OF ENSO IN THE WARM POOL OF THE WESTERN PACIFIC: MULTI-CENTURY
RECONSTRUCTIONS FROM THE GEOCHEMISTRY OF LONG-LIVED CORALS, J.E. Cole, Institute of
Arctic and Alpine Research
- EFFECTS OF CLIMATE CHANGE IN THE COLORADO ALPINE: ECOSYSTEM RESPONSE TO ALTERED
SNOWPACK AND RAINFALL REGIMES, Timothy Seastedt, Institute of Arctic and Alpine Research
- SOUTH PLATTE MANAGEMENT SUPPORT SYSTEM, Jacquelyn Sullivan, CE&A - Advanced Decision Support for
Water and Environmental Systems (CADSWES)
- WIND-ELECTRIC ICE-MAKING, Michael Brandemuehl, CE&A - Joint Center for Energy Management
- SOUTH PLATTE WATER RIGHTS MANAGEMENT SYSTEM, Terri Betancourt, CADSWES
- INCORPORATING TRACERS IN THE HYDROLOGIC CYCLE OF THE GENESIS EARTH SYSTEM MODEL, Julie
Cobb, Institute of Arctic and Alpine Research

*Indicates additional funds and/or extension of date

FEATURES

WATER RESOURCES PLANNING AND MANAGEMENT: CHANGE IS ON THE HORIZON

by Jennifer Roberts

Recently, I picked up a copy of the *State of the World Report*. In a single paragraph I read about the scarcity of new crop land and fresh water; the negative effects of soil erosion, air and water pollution; continuing rapid population growth; deforestation; overgrazing; and the inadequacies of regulations and current policies to address these problems. The problems appear at the very least overwhelming and at the most insurmountable. Lately, there has been a great deal of focus, especially following the March 1993 Watershed conference held in Washington D.C. on *integrated or holistic* watershed planning and management. So, how, with the many varied and complicated threats to our ecosystem, can an approach that confronts everything all at once help?

What is it?

Let's begin with Webster's definition for the term watershed. Webster states that a watershed is simply "*the area drained by different rivers or river systems.*" On closer inspection, however, we find that this simple definition merely alludes to a complex system. A recent publication on watersheds by the Agricultural Research Service reminds us "*that it is easy to look at a quiet, meandering creek and not remember that it is connected to larger streams and rivers that eventually drain into lakes and oceans*" (Corliss, *Agricultural Research*, April 1993). Perhaps the difficulty many have in '*seeing the big picture*' can be attributed to the fact that in recent decades direct regulation, focusing on specific aspects of the environment, has been the norm. "*So it would appear that while issues swirling around water quality and use are increasingly complex and provocative, the fundamental importance of watersheds is recognized anew*" (McElreath, *Agricultural Research*, April 1993).

Dennis Nelson, Director of National Project WET at Montana State University, reminds us of the cyclic nature of water:

"On its journey from the Yellowstone it (water) will wet the lines of fly-fishermen and slake the thirst of bison and bears. Eventually it will moisten the roots of soybeans and alfalfa. Water will flow from reservoirs through turbines to generate power for urban dwellers. Contributing to rivers it will carry barges that share the wealth of the watershed with the nation" (*Water Resources Update*, Autumn 1993).

The recent trend towards integrated watershed management acknowledges and in fact embraces the interconnectedness between the water and land systems within the river basins.

"The integrated watershed approach looks for the critical balance among water and land use activities, with a keen eye toward preventing water quality degradation" (Nelson, *Water Resources Update*, Autumn 1993). This approach enables planners to take a step back and evaluate how actions taken will affect the system as a whole. "*The ecosystems inside the watershed are often very complex and intervention in one part of the ecosystem will affect other segments of the ecosystem. The watershed approach places the water resources planner more in the role of bringing diverse specialties together with the local people to get a consensus on resource management*" (Burt, *Water Resources Update*, Autumn 1993).

Historical Perspectives

The Autumn 1993 *Water Resources Update*, published by the Universities Council on Water Resources, focused on watershed planning and management issues. Dr. James Heaney of the University of Colorado edited the issue and discussed the chronology of water resources planning and management tactics in the United States. Heaney noted that "*...watershed planning has followed cycles of interest and disinterest for more than a century*" (*Water Resources Update*, Autumn 1993). Heaney attributes the "*current wave of interest*" to a variety of factors, including: "*frustration with the fragmented command and control approach which has been in favor for more than a decade; withdrawal of federal support for planning activities; growing concern over cost-effectiveness; and the advantages of the watershed planning approach from a technical and economic point of view*" (*Water Resources Update*, Autumn 1993).

Also within this issue of *Water Resources*, the USDA Soil Conservation Service (SCS), U.S. Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA) and others discuss agency efforts to change the emphasis from a multi-purpose management of river basins to a comprehensive approach. Daniel Farrow and Blair Bower of NOAA discuss the historical trends of management: "*...it is important to emphasize that, from the mid-1930's to mid-1960's, the focus of planning and implementation efforts in watershed management was multi-purpose management of river basins, with primary emphasis on water quality, i.e., municipal and industrial water supply, hydroelectric energy generation, irrigation, and flood damage reduction*" (*Water Resources Update*, Autumn 1993).

This multi-purpose approach gave way to a systems approach, developed in the late 1950's, that Heaney describes as emerging from a group of faculty that included engineers, economists and public policy specialists. The Harvard Water Program was

created in conjunction with federal water agencies "to evaluate the applicability of newly emerging computer-based techniques of systems analysis for solving water resources problems" (Heaney, *Water Resources Update*, Autumn 1993). The interest in a systems approach to water resources planning and management continued to grow, largely at the university level.

However, application of this approach faced skepticism in the field, where many water managers and policy makers felt the analytical approach "excluded more relevant information-based approaches" (Heaney, *Water Resources Update*, Autumn 1993). The attention was then turned to more user-focused descriptive approaches." Heaney says that "...interest in watershed and environmental planning waned in the 1980's as the federal government moved forward with more aggressive regulatory approaches. This regulatory approach does not consider the area-wide or watershed implications of its actions" (*Water Resources Update*, Autumn 1993).

Hope for the New or Revitalized Approach:

As tides turn again and we attempt to integrate the watershed approach into resources planning and management, what are some of the hopes and obstacles that we face?

- ✓ Heaney suggested that technologically we are at a much better stage to implement expert systems or decision support systems thanks to "concurrent developments in hardware and software, e.g. Geographical Information Systems (GIS), object-oriented database management systems, etc... Thus, a formidable arsenal of tools is available to examine contemporary water resources problems" (*Water Resources Update*, Autumn 1993).
- ✓ John Burt of the Soil Conservation Service described the strains on the Federal, state and local agencies to address the vast range of environmental issues and the existing programs and policies. He suggests that watersheds can be the "common point of interest" around which the different interests can coordinate the existing laws and programs; after all, "water is one of the major driving forces in the ecosystem and the watershed boundary is a convenient boundary for most environmental issues." This approach has several requirements in order for success: "local people must be involved; a broad spectrum of expertise is needed; and a major informational, education and technical assistance support system will be necessary" (*Water Resources Update*, Autumn 1993).
- ✓ Robert Wayland of the EPA detailed the experiences of a watershed management team in West Virginia. The team evolved from "a series of most adversarial public meetings" into "a forum for listening to one another." Wayland hopes that as more watershed groups convene across the nation they too can establish this "sense of trust," in which the participants, who may not initially agree, "can work together toward

their common goals" (*Water Resources Update*, Autumn 1993). Forums that provide a setting in which different interests have an opportunity to communicate their perspectives and listen to others have emerged throughout the State of Colorado, as well. Some of the forums are:

Upper Colorado Headwaters Forum
Upper Arkansas Watershed Forum
South Platte Forum
Arkansas River Forum
Water Quality Forum
Governor's Front Range Forum
Agricultural Outlook Forum
Colorado Water Workshop

Naturally there are obstacles that must be overcome before the benefits of integrated watershed management can be seen. A hurdle mentioned by most is the fact that "political and hydrologic boundaries seldom coincide." Heaney says that "...we need to change our attitudes regarding the nature and purpose of the watershed management and planning activities" by redirecting "our energies from trying to 'solve the problem' to focus on continuous process improvement with frequent feedback" (*Water Resources Update*, Autumn 1993).

In addition, we need funding sources to make it happen. Farrow and Bower say that "...the process of integrating knowledge, technology, interests, and institutions for decisionmaking remains the fundamental obstacle to better watershed management." Additionally, they suggest that "one of the most difficult parts is finding individuals skilled in integrating the analysis" between the many disciplines and interests involved. Currently there is a "splintering of responsibilities" between the many agencies involved in water resources, they recommend that "...formal linkages... be developed among agencies so that a reasonable degree of management integration will be achieved" (*Water Resources Update*, Autumn 1993).

Information Available

Dennis Nelson of Project WET knows the importance of water education at all levels. In fact, a great deal of the success of adopting the watershed approach lies on our ability to educate ourselves and others. Additionally, "information on water resources is of little value unless it is relevant and presented in an accurate, unbiased and inspiring manner" (*Water Resources Update*, Autumn 1993).

So, what are some of the sources available on watershed planning and management?

- ✓ The Universities Council on Water Resources Autumn 1993 issue of *Water Resources*, cited throughout this article, is an excellent guide to past experiences and new directions in water resources planning. Contact: *Water Resources Update*, UCOWR, 4543 Fanar Hall, Southern Illinois University at Carbondale, Carbondale, IL 62901 for subscription information.

✓ *Nonpoint Source NEWS-NOTES* is an exceptional compilation of watershed planning information from around the nation. The features describe the struggles and triumphs of various watershed programs being implemented. Several articles that may be of interest include:

"*Ecosystem Management by Watersheds*," describing the changes taken place within the USDA Forest Service (October 1993);

"*Entering the Watershed: An Action Plan to Protect and Restore River Ecosystems, A Report to Congress*," summarizing the Pacific River Council's appeal to adopt this conservation act as an extension of the Clear Water Act after its reauthorization (August/September 1993);

and "*EPA Issues Annual Report 1992 on the Watershed Protection Approach*" (June/July 1993). To add your name to their mailing list, write to *NPS News-Notes*, c/o Terrene Institute, 1717 K Street, NW, Suite 801, Washington, DC 20006 or fax your request to 202/260-1517.

✓ The October 1993 issue of *Small Flows* is a Special Watershed Issue. In addition, future issues of *Small Flows* will include articles related to specific technologies, site considerations and training efforts related to the watershed management approach. The feature article in the October 1993 issue reminds us that "*there is no doubt that we will see a continued emphasis on managing water quality by a watershed or systems approach as we enter the twenty-first century. If we are to make the most of limited resources (natural, financial, and human), a systems approach is the only logical answer to the complex environmental issues we face*" (Miller and Jantrania).

For subscription information contact: Editor, *Small Flows*, National Small Flows Clearinghouse, West

Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064, Phone: 1-800/624-8301.

Other publications that frequently feature articles related to a watershed approach include:

✓ *NWQEP NOTES* (Judith Gale, Editor, NCSU Water Quality Group, North Carolina State University, 615 Oberlin Road, Suite 100, Raleigh, NC 27605-3723, Phone 919/515-3723, Fax 919/515-7448.

✓ *Runoff Report* (National NonPoint Source Federation, P.O. Box 30101, Kansas City, MO 64112, Phone 800/795-3634.

✓ *The Water Monitor* (Alice Mayo, Editor, AWPD (WH-533), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, Phone (202) 260-7018, Fax 202/260-7024.

✓ *The Volunteer Monitor* (Eleanor Ely, Editor, 1318 Masonic Avenue, San Francisco, CA 94117, Phone 415/255-8049.

✓ *Watershed Events* (Janet Pawlukiewicz, Office of Wetlands, Oceans and Watersheds, U.S. EPA (WH-556F), 401 M. Street SW, Washington, DC 20460.

✓ *The Watershed Protection Annual Report 1992* (NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242, Fax 513/891-6685, Report No. EPA/840/S-93/001.

Subscription prices vary and in a few cases there is no subscription fee.

In addition, Mr. Robert Doppelt of the Pacific Rivers Council will be speaking at CSU as a part of the 1994 Water Resources and Engineering Spring Seminar Series. Mr. Doppelt's presentation is entitled "*Entering the Watershed: A Holistic Approach to Watershed Management*," and it is scheduled for 12:10 pm on May 2nd in room 206 of the Lory Student Center (CSU Campus).

Sources

Lester R. Brown et al., *State of the World 1992*, A Worldwatch Institute Report on Progress Toward a Sustainable Society, W-W-Norton & Company, New York, NY, 1992.

David B. Guralnik, Editor in Chief, *Webster's New World Dictionary of the American Language*, Second College Edition, Simon and Schuster, New York, NY, 1982.

"*Agricultural Research*," U.S. Department of Agriculture, Agricultural Research Service, Greenbelt, MD, April 1993.

"*Water Resources Update*," The Universities Council on Water Resources, Issue No. 93, Carbondale, IL, Autumn 1993.

DRINKING WATER WEEK IS MAY 1-7

Take an active role in assuring safe drinking water!

A NEW FACE FOR URBAN RIVERS: RECLAIMING A LOST RESOURCE

by Heather Ward

Cities and towns in Colorado evolved along the river's edge. Rivers were a part of life, something people could not take for granted. Waterfront areas flourished as the centers for commerce and industry and were the hub of social and recreational pursuits. As cities and towns grew in size and populace, many rivers were used as big, yet convenient sewers out the back doors of businesses and residences. Now, with the advent of pollution awareness and fitness awareness, people are trying to reclaim these rivers, get back "in touch" with nature, and enjoy the aesthetic pleasures of waterways.

People visit rivers in urban settings for the same reasons people visit rivers in pristine settings: to get away from urban pressures, to get back to nature, to enjoy natural scenery, to enjoy privacy and solitude, and to enjoy a safe environment. Rivers encountered in either setting influence our music, literature, science, and language; mold our history, heritage, and philosophers. Some people cannot always get away from the city to enjoy nature and, due in part to the trend in urban river corridor enhancement and protection, city dwellers do not have to retreat to the mountains to be inspired by nature and enjoy a pretty view.

Cities can reclaim and protect their river corridors and continue to develop economically. Protection of the environment and development work together in the case of the urban river corridor. Urban river corridors can offer more than a pretty view. An enhanced river corridor can also offer an alternative path of transportation: biking, skating, walking, jogging, boating. These alternative transportation modes can decrease air pollution, decrease traffic hassles, and provide exercise and health benefits for the participants. As people protect nature and save themselves money by not driving, they may also learn something about nature and appreciate it in a new light.

Once the historic center of a city is renewed and appreciated and connected via corridors to other parts of the city, the river corridor and the river itself develop a constituency. The city residents develop a sense of community and pride in that community as they identify with the river and consider it a charming characteristic of their hometown. In return, the river is maintained and guarded against pollution. In short, an enhanced river corridor can:

- link people with nature resources close to home;
- provide alternative transportation venues;
- provide recreational opportunities;
- enhance nature awareness/appreciation;
- protect habitat and species in a limited land area;
- enhance human interaction with heritage;
- stimulate and diversify local economy;
- create local pride and celebration in the community and river;
- improve landmark aesthetics;
- reduce flood/erosion losses;

- protect and upgrade city property values;
- build partnerships among private enterprise, landowners, and local governments in recreation and conservation, and
- provide for treatment of urban non-point sources of pollution.

The Platte River Greenway through Denver is an example of an urban river corridor project that brought many of the above benefits to the city of Denver. The Platte River before the project was a veritable dumping ground and the land surrounding the river was riddled with storage yards.

"While the Denver greenway started out as an urban linear park (10 miles) for recreation and boating and passive enjoyment and wildlife, its main function now is alternative urban transportation, an amenity which decreases air pollution," said Ken Wright, one of the designers of the greenway.

A fenced off quarry was turned into a golf driving range and six acres of native wildlife habitat and two ponds. A highway maintenance yard with metal buildings and piles of salt and sand and trucks and road equipment was moved to a more practical site away from the river and its view. A city dump became a six-acre stretch of green grass along the river, part of which can be used as a natural classroom. A tributary to the Platte was full of old auto tires, garbage, dead Christmas trees, and old refrigerators. This tributary was slated to become a concrete flood control canyon. Now, it is a small green park with a mural painted on the riverside wall of an industrial building. A public works storage area was relocated. Another stretch of river was banked by broken concrete, twisted old iron and trees. This bank was packed with earth and became a place to sit and watch a band in a new amphitheater. An automobile wrecking yard became tennis courts and a bicycle track. Greenway Rangers patrol the trails and the river to keep it clean.

The Platte River Greenway was put together one piece at a time. The developers used what they called a build, demonstrate, and celebrate approach. They built the first piece of the river restoration project. They invited the city and the press to the grand opening of that piece of the river to show it off and celebrate. This method helped the public become aware of the river and appreciate its potential.

A number of factors leads cities to begin to discover and seize the opportunity presented by dilapidated, overlooked river corridors. Among these factors are: environmental clean up, preservation ethic, downtown comeback, federal assistance (urban renewal), recreation and fitness, tourism, pioneering citizens (dedicated, farsighted individuals), and a festival marketplace trend.

Some Colorado locales including Boulder, Fort Collins, Glenwood Springs, Aspen, Estes Park, Loveland, Pueblo, and Grand Junction have river corridor projects. Most of these cities

had other reasons for starting their river project. The most common were: economic diversification via tourism -- getting people to walk around town and shop and consider the town a destination rather than a rest stop; and to connect parks and other recreation facilities throughout town. Each of these urban river corridor projects required a diversity of planning, developing, and funding processes to get the job done or at least started.

The most important lesson in planning urban river corridor development is: You cannot protect everything. A community should work together to identify community or regional features that are prime assets--setting goals to protect and enhance those natural, historic, scenic or economic resources that make each area unique.

Different cities will have different amounts of enthusiasm (political climates) and funding. Therefore, the first step for a planning committee should be: to look at cities which have characteristics and political environments similar to its own. Then, the planners should follow the sister city's plan with whatever modifications necessary while avoiding the sister city's mistakes. For example, Boulder had a different political environment than Denver and Boulder had different problems to address.

In Boulder, a riparian corridor and stream channel were narrowed and realigned and severely channelized many times due to urban and agricultural development since the late 1800's. Boulder Creek faced problems of channelization and water flow fluctuation. Boulder's city council was strongly in favor, as was its constituency, of rehabilitating the Boulder Creek environs and connecting existing parks throughout town.

The City of Boulder with the help of the county, grants, donations, and the state lottery spent over \$3 million on its corridor project. The project accomplished: a bike trail complete with bridges and underpasses, two sculpture parks, eight pocket parks, kayak chutes, fish habitat restoration, and renovation of two stocked trout ponds.

Planners of the Platte River Greenway chose an area which had the biggest potential for change. If a city has a limited budget to start the river corridor project but doesn't have enough to finish the project, a small, dramatically improved and finished area will inspire funding, charity, and volunteer support from the town.

Planners should also consider who should be involved in the project in order to attain the most funding and support. Funding does not have to determine whether a project gets off the ground

or continues, especially with so much local and federal assistance available. Listed below are just a few available assistance sources.

Local governments and coalitions should take the lead in:

- goal setting, inventories, and priorities;
- implementation: landowner contact, and management coordination; and
- major funding and sweat equity.

The national government can help:

- champion and market the concept (urban renewal);
- fund the project through challenge grants, innovation grants, and conservation/environment protection funds;
- provide technical assistance and information to local groups; and
- enforce existing statutes on environmental quality and property rights.

Other interested people ready to help are:

- non-profit conservation organizations and local land trusts;
- recreation, sport, and wildlife groups;
- civil associations;
- commerce and tourism agencies;
- state and local highway agencies;
- state fish and game, forestry, and recreation agencies; and
- local park districts and planning boards.

Lastly, planners need to set deadlines that will urge them out of the planning stage and into action. It only becomes more difficult to receive funding when year upon year is spent on planning without any execution. The Platte River Greenway project won public approval once only a small portion of the project was completed.

The Boulder Creek Corridor Project started in 1985 and the Platte River Greenway started in 1974 represent two sides of the same finished and functional coin. Denver's river corridor project was inspired by one person with a vision for a better river environment. He proceeded to solicit local government and community funding and assistance.

Boulder, on the other hand, had political support from the very beginning. The city had funds generated and set aside specifically to improve the river corridor. While the funds were accruing, the city studied and planned to: provide off-street transportation, preserve/enhance fish habitat, preserve/enhance riparian wetlands, expand recreational use, protect existing water rights, and to maintain and improve creek flood-carrying capacity.

Sources

- Adams, L. W., & Dove, L. E. (1989). *Wildlife Reserves and Corridors in the Urban Environment: A guide to Ecological Landscape Planning and Resource Conservation*. National Institute for Urban Wildlife: Columbia, MD.
- Breen, A., & Rigby, D. (1994). *Waterfronts: Cities Reclaim Their Edge*. Macgraw-Hill, Inc.: New York.

- Evans, H. E., & Evans, M. A. (1991). *Cache La Poudre: The Natural History of a Rocky Mountain River*. University Press of Colorado: Niwot, CO.
- Eugster, G. (1983). *Greenline Parks: Land Conservation Trends for the Eighties and Beyond* (M. R. Corbett, Ed.). "Planning for Protection" National Parks and Conservation Association: Washington, D. C.
- Eugster, G. (1988). *Steps in State and Local Greenway Conservation Planning*. Seminar on Multiple-Objective Greenways and Coordination of Wetland and Floodplain Programs. Washington, D. C.
- Frieden, B. J., & Segalyn, L. B. (1989). *Downtown, Inc.: How America Rebuilds Cities*. MIT Press: Cambridge, MA.
- Ferguson, B. K. (1991). Urban stream reclamation. *Journal of Soil and Water Conservation*, Vol. 46, No. 5, pp. 324-329.
- Moncrief, L., & Canup, J. (1974). *Forgotten Rivers*. Parks and Recreation, Vol. 9, pp. 30-34.
- Proceedings of the National Wetland Symposium: Urban Wetlands. The Association of Wetland Manager, Inc. Omnipress: Madison, WI.
- Quinlan, B., & Simmons, C. (1993). *Exploring Land-Use Alternatives*. Water Environment and Technology. November 1993. pp. 44-50.
- The Report of the President's Commission on Americans Outdoors: *The Legacy, The Challenge*. Island Press: Washington, D. C. (1987).
- Robertson, R. A. (1989). *Recreational Use of Urban Waterways: The Illinois and Michigan Canal Corridor*. Western Wildlands, Fall.
- Shoemaker, J. (1981). *Returning the Platte to the People*. The Greenway Foundation (publ.).
- Whyte, W. H. (1988). *City: Rediscovering the Center*. Doubleday: New York.

CHEAP WATER: A COST-EFFECTIVE TOOL FOR RURAL DEVELOPMENT IN INDIAN COUNTRY?

Robert A. Young and Roger Mann

Editor's Note: The following is a summary of a paper by the authors which appears in Indian Water in the New West (McGuire, Lord, Wallace, eds, University of Arizona Press, fall 1993).

The belief that development of water supplies for irrigation in the semiarid West is a sufficient condition for rural prosperity forms the basis for the continuing bitter struggles to control water rights in the region. Native American tribes share the conventional wisdom that irrigation development creates important social and economic benefits and is an assured path to rural economic development. Three related theses are frequently proposed: (1) irrigation projects provide numerous additional jobs on farms; (2) irrigated agriculture generates significant spinoffs of employment and business activity in nearby communities; and (3) irrigation projects provide a high rate of return to public capital. These three propositions, combined with an assumption that irrigated agriculture can help create the self-sufficient local communities of the Jeffersonian vision have served to justify public subsidies to irrigation.

In this chapter, we advance an alternative set of hypotheses that assert that, even if the above propositions might once have been accurate, they have been overtaken by the technological and organizational realities of contemporary agricultural production. This contrary thesis maintains that in the century or more since the federal government began its policy of encouraging western irrigation, the economy of agriculture has changed considerably. Most agricultural output occurs on large, technically advanced and labor-efficient farms. Second, the regional spillovers from farm production have declined as machinery and chemicals purchased elsewhere have substituted for local labor and nearby purchases of farm and household needs. The lack of additional sites with productive soils and climate, together with the continuing downtrend in inflation-adjusted crop prices, reduces the opportunities of high-return investments.

Resolution of these competing hypotheses will have important economic consequences, not only for a number of Native American tribes, but also for the federal and state taxpayer. Many western tribes have based their claims for federally reserved water rights on the Practicably Irrigable Acreage (PIA) concept established by the federal courts. The PIA principle appears to grant rights to water based simply on a claim of economic feasibility of proposed irrigation projects. The federal government's cheap irrigation water policy provides (even more than it has for non-Indian developments) most of the funds for capturing, storing and transporting the water that may result from successful Indian claims.

Much of the impetus for irrigation development on Native American reservations is due to this policy of requiring no-cost sharing by beneficiaries on capital expenditures, and limited repayment of operating and maintenance costs. Under this policy, perhaps the major tribal expense is for lobbyists, attorneys and consultants to assemble and put forth a claim of economic feasibility. Since their costs are but a small fraction of claimed economic benefits, it would be irrational for the tribes to respond other than as they have, petitioning the courts for entitlements and the Congress for construction and operation funds. Public subsidies can be justified if the resulting activities generate legitimate benefits to society unavailable without the subsidy. This policy of extensive public subsidy of irrigation deserves more examination than it has yet received. Moreover, enhancing the economic status of Native Americans can perhaps be better served by channeling scarce federal funds for Native Americans toward more productive activities. A review of both the changing conditions of agricultural production and previous experience with western irrigation will help in this assessment.

Changes in the Agricultural Economy

The U.S. Government has since the mid-nineteenth century pursued policies that increased the productive capacity of the agricultural sector. Until the early twentieth century, more food was needed to support a growing and more prosperous population. But by the end of World War I, technological advances and new land development had brought about excess capacity, a situation which has persisted, except for a few interludes, until now. Beginning in the Great Depression, federal policies have attempted to control output of basic commodities and raise farm incomes. The Interior Department's policies to encourage irrigated agriculture thus run counter to the Agriculture Department's supply control policies.

Although the Interior Department's irrigation development programs are intended to produce numerous small independent farms, today's profitable farms must be large enough to be cost-efficient and need to employ up-to-date managerial expertise and technology. Seventy percent of farm revenues is produced on the "commercial" farms, which account for but 14 percent of farms. Most of the income of families on the remaining non-commercial farms comes from off-farm sources. The majority of these farms tend to lose money from operations, their primary focus being lifestyle values.

Irrigation project planning has tended to be overoptimistic in not anticipating a continued decline in inflation-adjusted farm commodity prices. Technological advances, larger farms and international competition all have and will continue to play a role in this process.

Productive sites for developing significant new irrigation water supplies have largely been utilized. Most prospective projects are relatively expensive to build and require high energy costs to move water to sites with productive potential.

Many advocates of Native American irrigation envision emphasis on specialty vegetable and fruit production, because such products appear to generate a high return over operating costs and employ large amounts of labor. However, the high profits are largely illusory--representing a return to the high market and production risks are inherent in specialty crop production. Specialty crops rarely account for more than a small fraction of irrigated crops in the West, so there is little reason to assume a shortage that the government needs to fill.

In modern farming, both on-farm and related off-farm labor needs are smaller than is generally believed. Mechanized farms require much less labor than in earlier years and income of farm workers tends to be low, erratic and seasonal. Regional off-farm

employment related to agriculture has also declined with the changing economy. Increasingly, the purchases of farmers for both production and consumption take place in regional centers, limiting the local economic impact, a point illustrated by the decline of rural communities throughout the nation.

Experience with Irrigation in Indian country

The above assessment of the limited rural development potential of irrigation projects is confirmed by a review of actual performance of Interior Department irrigations projects. The Central Arizona Project, with a price tag approaching five billion dollars, is in deep financial crisis from lack of demand for its water. The farmer beneficiaries are being bankrupted by the requirement to pay only a small fraction of their share of the total Project costs, and urban populations in the region would have to more than triple to absorb the full supply.

On the Navajo reservation, both small-scale and modern large-scale irrigation have been attempted. Of about 80 traditional small irrigation developments, delivery works have deteriorated and less than 40 percent of the original acreage remains in production. The total market value of production from the small family plots--averaging but seven acres each--could rarely exceed a few thousand dollars per year, and yield not even a subsistence income. The still-under-construction Navajo Irrigation Project would bring modern water and agricultural management techniques to over 100,000 acres. However, continuing Bureau of Indian Affairs and Tribal subsidies have been necessary to keep it in operation, and only a few hundred Navajos find employment on Project lands. It is ironic that a few years ago, the largest single land use category (23 percent) was for fallow or federal set-aside programs.

Conclusions

A public subsidy policy for irrigation made sense in an era when food supplies were often inadequate and when the agricultural economy was such that agricultural development was an effective mechanism for regional economic growth in this arid west. Today, economic and technical evolution have made obsolete these justifications for a cheap water policy. Public funds would be much more effectively spent on "people-oriented" rather than "place-oriented" programs for Native Americans. In view of the escalating costs and limited returns of the irrigation approach, tribal, state and federal governments would do well to rethink the whole issue of how to assure future Native American access to a fair share of the scarce western water, and to an acceptable standard of living without wasteful expenditures on the outdated irrigation water development program.

COLORADO RIVER DEPLETIONS PROJECTED BY DOI

The Quality of Water, Colorado River Basin, Progress Report is prepared every two years by the United States Department of the Interior. The report provides a description of the basin; discusses salinity as a major water quality issue within the

basin; and summarizes projected depletions, used to estimate the effects of water use throughout the basin. The projections are intended to represent the best available estimate of water use over the next twenty years and do not interpret the

Colorado River Depletion Projections

COLORADO 1991 2010
(units in 1000 acre-feet per year)

Comprehensive Framework Study (1965)

	1707	1707
Miscellaneous		
Irrigation	24	24
M&I	6	10
Fish & Wildlife	1	1
Minerals	1	1
Exports		
Denver expansion	54	100
Homestake expansion	28	48
Independence Pass expansion	0	0
Pueblo expansion	4	4
Colorado Springs expansion	0	5
Englewood	10	10
Fryingpan-Arkansas	69	69
Windy Gap	20	54
Miscellaneous	5	5
Reclamation Projects		
Animas-La Plata	0	38
Bostwick Park	4	4
Dallas Creek	7	17
Dolores	37	81
Fruitland Mesa	0	0
San Miguel	0	0
Savery-Pot Hook	0	0
Upper Gunnison Basin	5	15
West Divide	0	1
Municipal, Industrial & Domestic		
Blue Mesa Contracts	5	10
Bluestone Project	4	4
Green Mtn Contracts	2	10
Wolford Mountain	0	15
Ruedi Contracts	2	15
Stagecoach/Yamcolo	2	4
Taylor Draw Reservoir	2	7
Oil Shale	0	0
Thermal-Electric Powerplants		
Craig-Hayden	13	19
Colorado-Ute Southwest	0	6
Evaporation from Storage Units		
	269	269
Total	2289	2560

provisions of the treaties and compacts which allot the water of the Colorado River. The original depletion projections were developed from the *Upper Colorado Region Comprehensive Framework Study* published in 1971.

The comprehensive framework study established normalized depletion levels for the 1965 level of water resource development. The following projects in the State of Colorado are accounted for in the Interior's January 1993 Progress Report:

- **Moffat Tunnel and Roberts Tunnel Diversions** -- increased by 62 percent of acre-feet (af) to the cities of Denver and Englewood.
- **Homestake Phase I Project** -- averaged 27,670 acre-feet annually (1988-90). Phase II -- on line by 2010, with an additional 20,000 af annually. Increased diversions to east slope averaging 56,000 af (1981-90).
- **Fryingpan-Arkansas Project** -- diversions through Boustead Tunnel averaging 51,000 af (1981-90).
- **Colorado-Big Thompson Project** -- delivers water through Alva B. Adams Tunnel, averaging 241,270 af in the 1981-90 period.
- **Windy Gap Project** -- pumps an average of 17,000 af per year (1988-90) to Grandby Reservoir. Diversions expected to increase by 54,000 af per year due to the Colorado-Big Thompson Project.
- **Miscellaneous exports** by 12 small transmountain diversion ditches have increased by 5,417 (27 percent) af since 1965.
- **Animas-La Plata Project** -- depletions scheduled to begin late 1990's. The plan provides for a total depletion of 154,800 af per year for irrigation and M&I use (120,700 af in Colorado and 34,100 af in New Mexico). Due to endangered fish flow requirements, recommendation is to limit total depletions to 57,100 af.
- **Silver Jack Dam** -- completed in 1971, with average depletions of 4,200 af annually.
- **Dallas Creek Project** -- total annual depletion of 17,100 af should be reached by 2010.
- **Dolores Project** -- total project depletions of 80,900 af should be reached by 2010.

- **Fruitland Mesa Project** -- project depletions have been deferred until after 2040 for planning purposes.
- **Savery-Pot Hook Project** -- project depletions have been deferred until after 2040.
- **San Miguel Project** -- feasible plan has not yet been found; project depletions have been deferred until after 2040.
- **Wayne N. Aspinall Unit** -- beneficial development of waters up to 60,000 af is planned for. Currently, 39,000 af is available for depletion. In the progress report somewhat arbitrary levels of development were used for the period 1990-2010.
- **West Divide Project** -- advanced planning stage, with depletions deferred until 2040 for planning purposes.
- **Taylor Draw Dam** -- filled in 1984. Depletions are projected to reach 7,000 af by 2010.
- **Stagecoach Project** -- projected to supply about 4,000 af for irrigation, 1,000 af for municipal uses and 9,000 af for thermal powerplant uses.
- **Ruedi Reservoir** -- projected depletions increase from 9,000 af in 1990 to the ultimate contractible yield of 44,700 af by 2020.
- **Blue Mesa Reservoir** -- projected to use its full 10,000 acre-feet allotment for industrial uses by 2000.
- **Oil Shale Development** -- highly uncertain, assumed that development will be deferred by one decade.
- **Wolford Mountain, Bluestone and Green Mountain Sales** -- projects will provide water for transmountain exchanges, west slope uses, recreational, industrial, oil shale and snowmaking purposes.
- By 1987 two units at Hayden Powerplant and three units at Craig Powerplant were on line. The present combined use of water is estimated at 13,000 acre-feet with ultimate depletions of 19,000 acre-feet by 2000.
- Colorado-Ute Electric Association planned construction of two 400-megawatt units in Western Colorado. Plans have been delayed indefinitely. For planning purposes, the Bureau of Reclamation has assumed one unit will be on line by 2000 and the other unit by 2020.

WATER SUPPLY

This summary is prepared by the Soil Conservation Service (SCS) of the U.S. Department of Agriculture and the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce, March 1, 1994.

Despite above to well-above average precipitation during February, spring and summer streamflows are still expected to be below to well below average across most of the western states. Near to above average runoff is forecast for areas in the Rocky Mountain states, British Columbia and northeastern Oregon. Snowpack conditions improved slightly but still remain near to well below average west-wide. Reservoir storage is near to above average in most states.

Arkansas Basin--Conditions indicate below average amounts of runoff for the mainstem of the Arkansas River and about the same for its tributaries. Volume totals are predicted to be 75 to 91 percent of average along the mainstem and 75 to 93 percent of average along the tributaries.

Colorado Basin--Below average runoff is expected from the Upper Colorado Basin and much below median to near median runoff is forecast for the lower basin. March 1 forecasts are generally higher than those issued February 1, reflecting greater than average February precipitation. March 1 snowpacks have also improved from last month. For the Upper Colorado Basin, snowpacks range from 90 percent of average on the Upper Colorado mainstem to 75 percent of average on the Green River Basin.

Rio Grande Basin--The Rio Grande Basin water supply forecast is variable. Below average runoff is predicted along all of the mainstem and much of the upper portion of the basin in Colorado, with amounts ranging from 60 to 95 percent of average. In New Mexico, many of the tributaries are forecast to be above average, ranging from 105 to 150 percent of average. However, the Pecos and Jemez drainage forecasts are 74 to 86 percent of average.

IS NATURAL GAS DRILLING IN COLORADO RIVER BASINS CONTAMINATING WELL WATER?

by David Williams

U.S. Geological Survey Study Results...

The occurrence of natural gas in shallow groundwater in the Animas River valley between Durango, Colorado and Aztec, New Mexico and the sources and migration of that gas are described in a new report* by the U.S. Geological Survey (USGS), U.S. Department of the Interior. The report presents results of a USGS study made in cooperation with the Colorado Oil and Gas Conservation Commission, La Plata County, and the Southern Ute Tribal Council.

Dan Chafin, USGS hydrologist and author of the report, describes some of the results of the study: "Our analyses indicate that 70 of the 205 groundwater sites sampled in the valley in 1990 had measurable methane concentrations, with the largest concentration being 39 milligrams per liter. Gas analyses and ancillary information suggest that most of the natural gas in shallow groundwater beneath the Animas River valley during 1989-1991 originated from leaky casings of conventional gas wells or from uncemented annuli of conventional gas wells along coals in the Fruitland Formation."

Chafin added, "Release of natural gas from uncemented coals is enhanced by depressurization caused by coal-bed-methane development." Chafin concluded, "Chemical and geological evidence suggests that gas flow from gas producing formations to the near-surface environment by diffusion or along natural fractures is unlikely to account for substantial quantities of near-surface gas."

And in the Media...

Amoco Production Company and others tapping the Fruitland formation reserve have said that naturally occurring gas is contaminating water, not the drilling (Kerwin, 1994). Amoco has stated that "...the river controls the water table in the valley, and its fluctuations are the probable explanation for the methane" (Associated Press, 1994). Chafin has said that his study "contradicts the oil companies' claims," (Kerwin, 1994). He contends that "while gas can migrate to the surface on its own, gas wells are the primary culprit," (Kerwin, 1994).

A related conflict exists in the Denver-Julesburg Basin. At issue is the proposed rule that would require oil and gas operators to line wells with steel pipe all the way through deep fresh-water aquifers in the basin. In areas where the aquifer is deep, oil and gas companies now use a cheaper method of sealing wells called "stage cementing." State regulators say that stage cementing "does not protect groundwater as well as the steel 'surface casing'" (Taughner, March 19, 1994). They also contend that if a well does leak, the leak is easier to detect and fix if surface casing is used. Taughner (March 19, 1994) reports that industry members claim stage cementing to be safe and more cost-effective in areas where the aquifer is very deep. Additionally, they argue that only twice in the area that would be affected by the proposed rule has water pollution been tied to oil and gas operations. Those leaks led to an explosion in LaSalle in 1984, and to two explosions in a water well pump house in Adams County (Taughner, March 17, 1994).

Sources:

Associated Press. 1994. "Consultant links methane seepage in Durango to Amoco wells." *Grand Junction Daily Sentinel*, Grand Junction, Colorado, February 12, 1994.

Kerwin, Katie. 1994. "Gas drilling fouls well water, study says: Industry officials dispute report that lucrative operations cause contamination." *Rocky Mountain News*, Denver, Colorado, March 22, 1994.

Taughner, Mike. 1994. "Sides line up for oil/gas confrontation: Surface casing rule at heart of debate." *Greeley Tribune*, Greeley, Colorado, March 17, 1994.

Taughner, Mike. 1994. "Oil/gas panel reaches impasse: Groundwater protection policy debated." *Greeley Tribune*, Greeley, Colorado, March 19, 1994.

* The report is "Sources and migration pathways of natural gas in near-surface groundwater beneath the Animas River valley, Colorado and New Mexico," by Daniel T. Chafin, published as U.S. Geological Survey Water-Resources Investigation Report 94-4006. Microfiche and black and white paper copies of the report may be obtained from the U.S. Geological Survey, Earth Science Information Center, Open-File Reports Section. When ordering, please use the U.S. Geological Survey Water-Resources Investigations Report number and full title of the report. Prepayment is required. Check or money order for the exact amount should be made payable to the U.S. Geological Survey, Earth Science Information Center, Open-File Reports Section, Box 25286, Mail Stop 517, Denver Federal Center, Denver, CO 80225 or call (303) 236-7476.

WATER PUBLICATIONS, DATABASES

NEW CWRRI REPORTS

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

Impact of Irrigation Water Use on Water Quality in the Central Colorado Water Conservancy District

This report summarizes the results of a two-year study sponsored by the Colorado Water Resources Research Institute, the United States Geological Survey, and the United States Environmental Protection Agency. The study was primarily comprised of intensive field work over the course of the 1992 and 1993 growing seasons near Greeley, Colorado to perform a water balance on each of the fields, collect water quality data, and observe the water management techniques. The water balance involved measuring the inflow and outflow of irrigation water during each irrigation event and a continual recording of precipitation and evapotranspiration throughout the season. In addition, nitrate levels present in the surface irrigation water, groundwater and the tailwater runoff water were monitored. The data were used to generate irrigation application efficiencies and deep percolation ratios for each of the monitored fields. The deep percolation ratio is fundamental to evaluating the potential for the leaching of nitrates and pesticides into the groundwater. This study represents a foundation to be used in further steps that are needed to address groundwater quality. It is the authors' recommendation that the development of best management practices for the area confront the weak financial incentives faced by farmers when implementing more aggressive water conservation measures or reducing chemical applications.

MISCELLANEOUS PUBLICATIONS

The National Research Program of the Water Resources Division, U.S. Geological Survey, Fiscal Year 1992--This report provides information about the National Research Program (NRP) of the USGS's Water Resources Division (WRD) during fiscal year 1992. The NRP, a part of the WRD since the late 1950s, encourages the pursuit of research topics that will provide new knowledge and insights into hydrologic processes that are not well understood. It is divided into six disciplines: Ecology, Geomorphology and Sediment Transport, Groundwater Chemistry, Groundwater Hydrology, Surface-water Chemistry, and Surface-water Hydrology. This volume contains a summary of each project's problem, objective, approach, and progress. It also contains bibliographic information covering a five-year period.

The NRP's Regional Research Branch located at the Federal Center in Denver plays a prominent role in this research. Nine

of 22 Ecology research projects currently underway are located in Denver. One project, *Limnological Phenomena in Impounded Rivers*, is investigating the basic processes that mediate water quality in Lake Powell and will apply that understanding to management of water quality in the Colorado River in Grand Canyon National Park. Lake Powell stores about 27 million acre-feet of water in the upper basin of the Colorado River for controlled release according to the Colorado River Compact, and to generate electricity for sale to consumers in the southwestern U.S. Phenomena that control the quantity and quality of reservoir waters are not understood. The objective of the research is to continue ongoing field reconnaissance and to develop long-term monitoring and research in conjunction with the National Park Service and the Bureau of Reclamation, agencies responsible for management and regulatory control of Lake Powell.

Denver also hosts eight out of nine of the NRP's Geomorphology and Sediment Transport research projects, nearly a quarter of the Groundwater Hydrology projects, and over half the Surface-water chemistry projects.

Copies of the 1992 report can be purchased from: U. S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

Environmental Mitigation at Hydroelectric Projects, Vol. II, Benefits and Costs of Fish Passage and Protection. Jan. 1994. DOE/ID - 10260(V2). U.S. Government Printing Office, Superintendent of Documents, 710 N. Capitol St., NW, Washington, DC 20402. Phone: 202/275-2051.

Proceedings of the First National Conference on Climate Change and Water Resources Management. Mar. 1994. Department of the Army, Corps of Engineers, Water Resources Support Center, Institute for Water Resources, 7701 Telegraph Rd., Alexandria, VA 22310-3868.

Wetland Policy Issues, published by CAST (Council for Agricultural Science and Technology). Available from CAST, 4420 W. Lincoln Way, Ames, IA 50015-3447; Phone 515/292-4512. Price \$12 plus \$3 shipping and handling.

New Publications of the U.S. Geological Survey, List 1021. Available from USGS Survey Map Distribution, Box 25286, MS 306, Federal Center, Denver CO 80225.

WRI 92-4053. COLORADO. Limnological characteristics, nutrient loading and limitation, and potential sources of taste and odor problems in Standley Lake, CO by D.K. Mueller and B.C. Ruddy. Prepared in cooperation with the Cities of Arvada, Golden, Northglenn, Thornton, Westminster; and Jefferson County.

EDITOR'S IN-BASKET

LEGISLATIVE WATER FESTIVAL SCHEDULED APRIL 21ST AT STATE CAPITOL

The first ever Legislative Water Festival will be held on Thursday, April 21 in the House Hearing Rooms of the Colorado State Capitol Building. Governor Romer has indicated that he will proclaim April 21st "Water Education Day."

Three activities are scheduled for the festival:

Carl Crookham, teacher in the Denver Public Schools, will have several at-risk teenagers from Denver teaching about local surface water quality, water history and water lore.

Scott Elementary School 5th graders from Greeley will face legislators in a *Water Wizards* competition regarding Colorado water facts.

Water officials and legislators will join in a game about Colorado water allocation.

The festival also provides an opportunity to reflect upon the eight murals in the Capitol Rotunda that tell the story of Colorado's water history from the perspectives of artist Allen True and poet Thomas Ferril.

The Legislative Water Festival is sponsored by the Senate and House Agriculture and Natural Resources Committees and the Central Colorado Water Conservancy District. Lunch will be provided by Bette Blinde and the Colorado Foundation for Agriculture. For additional information contact Tom Cech at 330-4530 or Metro 825-0474.

LEAGUE OF WOMEN VOTERS OF COLORADO SPONSORS GROUNDWATER PROTECTION TELECONFERENCE

Special event planned for National Drinking Water Week-- On Wednesday, May 4, 1994 from 11:30 a.m. to 3:30 p.m., the League of Women Voters of Colorado will sponsor a groundwater protection teleconference at the Douglas County Executive Building, 101 Third Street, Castle Rock, Colorado. The teleconference, a "National Town Meeting on Groundwater Protection--Looking at Solutions," is part of a national effort that will highlight:

- the latest on national legislation
- what states and local communities can do
- how businesses, farmers and communities can cooperate to protect groundwater

National panelists will be:

Dr. George Hallberg, Chief of Environmental Research, University of Iowa Hygienic Laboratory (nonpoint source pollution from agriculture)

Jon Witten, President, Horsley & Witten, Inc. (developing effective wellhead programs)

Susana Almanza, Director, People Organized in Defense of Earth and Her Resources (PODER)

Becky Cain, Chair, League of Women Voters Education Fund and USEPA National Drinking Water Advisory Council

Susan Seacrest, Founder and Director, Groundwater Foundation
Robert Perciasepe, Assistant Administrator for Water, EPA

Representative Mike Synar (D-OK), Chairman of the Environment, Energy and Natural Resources Subcommittee.

Local panelists include:

Kathleen Reilly, Colorado Health Department, Wellhead Protection

Herman Wooten, Colorado Rural Water Association

Marian Law, Lower South Platte Water Conservancy District

Ralph Curtis, Rio Grande Water Conservancy District

Pat Mulhern, Manager, Inverness Water and Sanitation District

John Ford, Consultant, Leonard Rice Consulting

Attendance is free. For more information and to register to attend, please call Kate Hatten or Dru Campbell at 660-7400 or Jeannette Hillery (LWV) at 494-7718.

The U.S. Geological Survey (USGS) is one of several cosponsors, along with the Environmental Defense Fund, Environmental and Energy Study Institute, the Environmental Protection Agency, Friends of the Earth, The Groundwater Foundation, USDA/Cooperative Extension System, and the Water Environment Federation.

Eaton to be Sworn in as USGS Director

On the eve of the U.S. Geological Survey's 115th anniversary, Gordon P. Eaton was confirmed as the agency's director by unanimous consent of the U.S. Senate. His swearing-in ceremony was held for March 14. Eaton is a distinguished earth scientist, administrator, and former employee of USGS. His most recent post was as director of the Lamont-Doherty Earth Observatory of Columbia University. Eaton follows in the footsteps of Dallas Peck, who held the post from 1981 to 1993, and interim director Robert M. Hirsch, who followed Peck. On March 3, USGS celebrated 115 years of serving as the nation's largest Earth and water science and civilian mapping agency. Its mission is to provide Earth Science to the public service. The survey employs 10,000 in 200 regional and field offices in the United States and abroad.

Source: EOS, American Geophysical Union, 3/8/94

EESI to Hold Briefings on Groundwater

On March 7, 1994 the Environmental and Energy Study Institute initiated a series of briefings on groundwater contamination problems and opportunities for resolving them through legislation before Congress. The first briefing featured Rep. Mike Synar (D-OK) who has been in the forefront of efforts to protect groundwater. Others included Bill Alley, chief of the USGS's Office of Groundwater, who discussed the interrelationships between groundwater and surface waters and sources and persistence of groundwater contamination; Paul Jehn, Associate Director of the Water Resources Institute at the University of Idaho who presented specific instances of contaminated groundwater polluting surface waters; and Suresh Rao, Soil and Water Science Department, University of Florida, who discussed results of a recent study on groundwater vulnerability by a National Research Council committee of which he was a member.

Subsequent briefings in this series will focus on:

- practices and technologies to prevent groundwater contamination from agricultural, industrial and other sources;
- new technologies to clean up groundwater more effectively and economically; and
- opportunities and options for improving groundwater protection in currently pending legislation.

For further information call 202/628-1400.

AWRA-Colorado Section Announces New Board

Congratulations to the new Board of Directors of the AWRA, Colorado Section: **President**--Jerry Kenny, Boyle Engineering Corporation; **Past President**--David H. Merritt, Colorado River

Water Conservation District; **President-Elect**--Keith Little, Woodward-Clyde Consultants; **Vice President**--Steve Forvilly, Metro Wastewater Reclamation District; **Secretary**--James Kunkel, Advanced Sciences, Inc.; **Treasurer**--Neil Jaquet, Coors Brewing Company; and **Directors at Large** Marie Del Toro, City of Colorado Springs; and Dick Wolfe, Office of the State Engineer.

AWRA Colorado Section Scholarship Program

Qualified Applicants - To be considered for the scholarship, the applicant must meet the following criteria:

1. Enrollment as a student in a degree program at any accredited Colorado public or private college or university.
2. Involvement 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.

Applications - Abstracts of research should be sent to: Chairman, AWRA-Colorado Section Scholarship Committee, P.O. Box 9981, Denver, CO 80209-0881. Abstracts shall include a resume of the applicant and a letter of reference from the applicant's faculty advisor.

Stipend - The amount of the scholarship will be \$1000 for one academic year and include a one-year membership in the AWRA-Colorado Section. The stipend will be paid in three equal installments as follows:

1. Initial payment within two weeks of selection.
2. Intermediate payment in January upon submission of a progress report by the grantee.
3. Final payment within two weeks of acceptance of final report by the Board of Directors AWRA-Colorado Section.

Schedule - Abstracts should be submitted no later than June 1 prior to the beginning of the academic year.

Selection Committee - A standing committee of the AWRA-Colorado Section will review applications and select the top three applicants. The AWRA-Colorado Section Board of Directors will select the grantee from the top three candidates. Announcement of the selection will be made by August 1 and announced in the AWRA-Colorado Section newsletter. The selected candidate will receive written confirmation of selection.

Reports - A progress report will be submitted regarding the study and/or research on January 15. The final report will be submitted on June 1. The grantee shall submit one copy of the report to the president of the AWRA-Colorado Section. An abstract of the report will be published in the AWRA-Colorado Section newsletter and the report will be available to AWRA-Colorado Section members.

EVOLVING FROM CONFLICT TO COOPERATION: THE OWENS VALLEY EXAMPLE

Editor's Note: The summary of the Owens Valley's efforts to manage its water in a consensus fashion (presented below as published in Owens Valley Water Reporter, Vol. 6, No. 3, Dec. 1993), can be instructive to a number of post-Two Forks water "forum" efforts in Colorado. It is, apparently, feasible for conflict to give way to cooperation and a generally accepted water policy. Such a history, while not complete, does indicate that efforts to seek win-win water management solutions can be fruitful.

- 1913:** The City of Los Angeles completes an aqueduct with the capacity to carry 480 cubic feet per second (cfs) of surface water from the Owens Valley to Los Angeles.
- 1970:** Los Angeles completes a second aqueduct with 300 cfs capacity, and begins pumping groundwater in the Owens Valley to supply the aqueduct.
- 1970:** The California Environmental Quality Act (CEQA) is passed.
- 1972:** Inyo County sues Los Angeles over the City's water gathering operations in the Owens Valley, claiming increased groundwater pumping is harming the environment. Inyo County seeks a court order requiring that Los Angeles prepare an environmental impact report in accordance with CEQA.
- 1973:** The Third District Court of Appeal rules that Los Angeles must prepare an EIR.
- 1976 and 1979** Los Angeles prepares first one EIR, which the appellate court rules inadequate, and then another, also ruled inadequate.
- 1980:** Inyo County Board of Supervisors draft, and Inyo County voters pass, "An Ordinance to Regulate the Extraction of Groundwater Within the Owens Valley Groundwater Basin." The ordinance calls for the regulation of groundwater pumping in the valley in accordance with groundwater management plan to be implemented through a groundwater pumping permit procedure. A primary purpose of the ordinance is to protect the environment, citizens and economy of the Owens Valley from adverse effects resulting from the export, extraction and use of its water resources. The ordinance establishes the Inyo County Water Commission and the Inyo County Water Department.
- 1980:** Inyo County passes a resolution that provides for the appointment, compensation and meetings of the Inyo County Water Commission, and appoints five commissioners.
- 1982:** Inyo County, Los Angeles and its Department of Water and Power enter into a Memorandum of Understanding which creates the Technical Group and Standing Committee to work together to solve disputes between the parties.
- 1983:** As a result of litigation commenced by Los Angeles and its DWP, the Inyo County Superior Court issues an opinion that finds the groundwater ordinance unconstitutional, invalid and preempted by law.
- 1983:** Inyo County and Los Angeles begin attempting to develop a groundwater management plan whose purpose would be to settle the litigation between parties.
- 1984:** Inyo County and Los Angeles approve a five-year interim agreement. The parties agree to: settle property tax litigation; temporarily suspend court judgement on the groundwater ordinance; temporarily suspend CEQA litigation, and mandatory court-imposed pumping restrictions and substitute them with jointly developed annual pumping programs; lease Owens Valley town water systems to Inyo County, thus reducing water rates; conduct cooperative studies along with impartial third parties including the United States Geological Survey; implement enhancement/mitigation projects; provide financial assistance to Inyo County from Los Angeles to cover costs of studies and the county's water-related activities; negotiate a long-term groundwater management plan; resume the appellate court CEQA litigation and the superior court litigation over the groundwater ordinance's validity if the parties do not develop and adopt a long-term groundwater management plan.

- 1984:** The appellate court allows Los Angeles and Inyo to implement the interim agreement. The court says Los Angeles must still prepare a third EIR, and that if Inyo and Los Angeles agree on a long-term groundwater management plan, it must be included in the EIR.
- 1985:** Inyo County Board of Supervisors adopt a resolution containing policies and procedures to govern Inyo County's performance of its duties and obligations under the interim agreement. The resolution modifies the role of the water commission.
- 1989:** Inyo County, Los Angeles and DWP reach preliminary agreement on long-term water management and begin preparation of an EIR. (Since then, Inyo County and DWP have been managing the water resources of the Owens Valley in accordance with the long-term agreement.)
- 1991:** In October the Inyo County Board of Supervisors approve the long-term agreement and certify the completed EIR. At the same time, Los Angeles and DWP approve the agreement and the EIR. Los Angeles presents the EIR to the appellate court, together with requests that the court find the EIR adequate and discharge the order requiring the preparation of an EIR.
- 1993:** The appellate court declines to discharge its order and seeks views of amicus curiae concerning the EIR's adequacy.
- 1993:** Standing Committee adopts a Statement of Intent to, among other things, manage Owens Valley water resources under the long-term agreement and a drought recovery policy.

Federal Agencies Sign Agreement on Wetlands

On January 6, 1994, the Departments of the Army, Agriculture, the Interior, and the Environmental Protection Agency signed a Memorandum of Agreement (MOA) that recognizes the Soil Conservation Service (SCS) as the lead federal agency for wetlands delineations on agricultural lands. Specifically, the MOA articulates the policy and procedures to be used in the determination of wetlands jurisdiction for purposes of both Section 404 of the Clean Water Act and Subtitle B of the Food Security Act (also known as the Swampbuster program). The MOA, which establishes minimum training requirements and requires the use of standard interagency approved methods, will improve the quality and consistency of wetlands determinations on agricultural lands. The actual text of the MOA is published in the January 19th Federal Register.

SCS Publishes Water Management Action Plan

The water management mission of the Soil Conservation Service, U.S. Department of Agriculture, is to: *help people manage water quality and quantity to meet society's evolving needs and sustain healthy ecosystems*. The SCS has published a **Water Management Action Plan**, outlining improvements in its program administration, that will help the agency apply its resources in the most effective way. The plan includes:

Leadership: *SCS will strengthen its performance as a national leader in water management.*

Assistance Process: *SCS will provide water management assistance through integrated resource planning and management on a watershed basis.*

Technology: *SCS will use, develop, and transfer appropriate technology to provide water management assistance.*

Organization: *SCS will organize and staff for enhanced water management policy development and program delivery.*

Marketing: *SCS will develop and implement a comprehensive marketing plan to promote water management based on integrated resource planning.*

For additional information about the plan contact Galen S. Bridge, Acting Chief, Soil Conservation Service, P.O. Box 2890, Washington, DC 20013.

EPA Reports Improvement in Wastewater Treatment

The U.S. Environmental Protection Agency recently completed a review of the national environmental benefits of the secondary treatment requirements of the Clean Water Act. According to the EPA report, based on 14 case studies across the country, there has been significant progress in improving water quality through secondary (and advanced) treatment of municipal wastewaters since the initiation of the CWA.

HYDATA, March 1994

Western Region SARE Program Transferred to Utah

The Western Region Sustainable Agriculture Research and Education (SARE) program has transferred from the University of California to Utah State University as part of a larger effort to decentralize direct program management. The transfer followed a regional selection process directed by the program's

Western Administrative Council and was approved by Cooperative State Research Service.

The SARE program, authorized by Congress in the 1990 Farm Bill and managed by USDA since 1988, is a competitive grants program to expand knowledge and adoption of food production and farming practices that are environmentally sound, economically viable and socially acceptable. UC was host to the Western SARE program since its beginnings in the late 1980s under the leadership of David E. Schlegel. His successor is department head of Agricultural Systems Technology and Education Philip Rasmussen at Utah State University.

Upper Colorado River Included in NAWQA Program

The National Water Quality Assessment (NAWQA) Program was initiated in 1990 to assess the quality of the Nation's surface and groundwater resources. The major activities of the program take place within hydrologic systems called study units. Study unit investigation results are then synthesized on a regional and national basis. In 1990 the South Platte basin was designated as one of 20 study units, and in 1991 the Rio Grande Basin was added. Now, in 1994, the Upper Colorado River basin is included in this national effort. The first meeting of the liaison committee, formed by the Upper Colorado River NAWQA team, was held March 2, 1994 in Frisco, Colorado. For additional information contact Nancy E. Driver, Upper Colorado River NAWQA Project Manager, Water Resources Division, Colorado District, U.S. Geological Survey, at 303/236-4882, ext. 268.

Rocky Mountain Section of ASAE Established

As of November 17, 1993, the Rocky Mountain Section of the American Society of Agricultural Engineers became a reality. The new section is composed of approximately 200 ASAE members from the states of Colorado and Wyoming. Gary Frasier, USDA/ARS, Fort Collins, will serve as Interim Chair until the election of officers. The first Annual Rocky Mountain Section Meeting is scheduled for Saturday, April 23, 1994, in the Fort Collins area. For additional information contact Gary Frasier at 303/498-4232 (Phone) or 303/482-2909 (FAX).

British Journal Seeks Authors for Water Issue

In July 1994, the British journal *Disaster Management* will publish a theme issue concentrating on water and its global effects. Probable topics include water shortages, flooding and possible links to deforestation, effects of the search for and provision of water on the environment, and other relevant topics. Interested contributors should contact the editors, Norman Anderson or Emily Hough, Disaster Management, Queensway House, 2 Queensway, Redhill, Surrey RH11QS, UK; tele: (0737)768611, FAX (0737)761685/760467, telex 948669 TOPJNL G. Additionally, in 1995 *Disaster Management* will publish a theme issue on the great floods that occurred in the United States during 1993.

USGS National Water Summary Provides State-by-State Analysis of Stream Quality

The latest National Water Summary prepared by the U.S. Geological Survey says that water quality, overall, is holding its own or even improving slightly -- although it still falls below desirable levels in many places. A review of the report will be included in the June issue of *COLORADO WATER*.

CDOH Newsletter Provides Information on Rocky Flats Studies

UPDATE, a quarterly publication produced by the Colorado Department of Health, features the most recent information on the state's health studies related to Rocky Flats. For additional information on the studies call Norma Morin, Project Director, Rocky Flats Health Studies, or Ann J. Lockhart, Senior Public Information Officer, Colorado Department of Health at 303/692-2640 or 692-2652.

UPDATE TO LIST OF WATER-RELATED EDUCATIONAL MATERIAL

February 1994 edition of
COLORADO WATER

For EPA publications that do not list a contact, call USEPA Hotline in Denver, 800/227-8917.

Colorado contacts for National Project WET are:

Chris Bridges
Colorado Office of Water Conservation
Colorado Water Conservation Board
Phone 866-3441, Ext. 311;

Don Hollums
Colorado Department of Education
Phone 866-6787; and

Lynn Almer
Bureau of Reclamation
Phone 236-8633.

("National Project WET" and
"WET: Education for Teachers" are
one and the same)

WATER NEWS DIGEST

WATER ALLOCATION

CWCB Reveals Plan To Control Colorado River Flows

The Colorado Water Conservation Board (CWCB) is crafting a strategy to secure instream flows for endangered fish while preserving Colorado's ability to develop the water it's entitled to on the Colorado River. The plan calls for the CWCB to file for instream flow water rights to help the fish, but to leave options open for future water diversions if the fish recover. It provides certainty that some portion of the flows will be dedicated to the fish, but for the flows to be modified in the future if the water is needed for development in Colorado. Filings will be made on the Gunnison, White, and Yampa rivers, where water is available for fish, but the focus will be on the mainstem of the Colorado in the Grand Valley. At Palisade, irrigation diversions can dry up the river for a 15-mile stretch to the confluence with the Gunnison. This stretch is critical for fish recovery according to the U.S. Fish and Wildlife Service. In the short-term the water could be supplied by Ruedi and Wolford Mountain reservoirs. In the long-term water may come from lining irrigation canals to make diversions more efficient. The CWCB is seeking public comment on the plan.

Grand Junction *Daily Sentinel* 2/12/94

Colorado-Nevada Water Plans Face Big Hurdles

Nevada will not ignore any of the 27 proposals currently afoot to augment the state's water supply, but offers from Colorado companies are up against "significant obstacles," according to one Nevada official. Both state and federal politics place hurdles in front of the Colorado proposals. Nevada expects to use its 300,000 acre-foot allocation of Colorado River water by 2015, and is seeking water for growth after that. Officials say it is currently impossible for Nevada to import water from the upper basin states of New Mexico, Colorado, Wyoming, and Utah. Currently the "law of the river" which divides the water among the seven basin states does not allow re-allocation of water between the upper basin and lower basin states. In addition, there is substantial opposition on the part of the state of Colorado to allow interstate water marketing.

Grand Junction *Daily Sentinel* 2/11/94

WATER PROJECTS

Panel Backs Land Sale for Reservoir

An Open Space Advisory Committee has recommended the Jefferson County Commissioners sell the city of Westminster

county land where a reservoir could be built to protect the city's drinking water from possible radioactive pollution from the Rocky Flats Nuclear Weapons Plant. Preliminary plans call for locating the new 80-acre reservoir near 96th Avenue and Indiana Street on Woman Creek upstream from Standley Lake. In all 475 acres are needed for the \$1.1 million project, which would catch any pollution of the creek resulting from environmental cleanup at the plant, thus preventing contamination of Standley Lake. If approved construction could begin later this year.

Denver *Post* 1/21/94

Tentative Solution Found for Wolford Mountain Salinity

A tentative deal over salinity from Wolford Mountain Reservoir on Muddy Creek calls for the federal court in Denver and state water court in Glenwood Springs to keep the town water cases open for 10 years after the reservoir fills. Through 2007 salinity impacts on the Colorado River will be measured when water is released from Wolford Mountain. If the salinity then jumps measurably at Palisade, the courts will require impacts are reversed or compensation is made. The Colorado River Water Conservation District and the city of Denver have argued Wolford's more saline water won't make a measurable difference in the river's salinity in the Grand Valley. The Clifton Water District and the city of Grand Junction disagreed. Both entities wanted the cases left open for 20 years after filling, but settled on 10 years. The deal must still win approval from the Grand Junction city council and the boards of three water agencies.

Grand Junction *Daily Sentinel* 2/23/94

Conejos District Takes Over Platoro Reservoir

The Conejos Water Conservancy District has taken over control of Platoro Reservoir. Previously controlled by the U.S. Bureau of Reclamation, it will now be managed by the water district in exchange for a \$450,000 loan by the Colorado Water Conservation Board. The money will be paid back over 40 years at 5 percent interest. The purchase price represents the construction costs of the reservoir and dam when it was built in 1951. Until 1985, Platoro had to be emptied annually to fulfill Colorado's Rio Grande Compact obligations to New Mexico and Texas. In 1985, Elephant Butte Reservoir in New Mexico spilled over, erasing Colorado's accrued debt. Following this, the conservancy district suggested it buy the reservoir from the federal government. These efforts failed, but the district was allowed to purchase the operation and maintenance responsibilities.

Pueblo *Chieftain* 2/2/94

Rancher Fighting Dam Plan

A rancher on whose land Eagle County officials want to build a \$12 million reservoir is fighting the plan. Dick Scudder, owner of the East Lake Creek Ranch claims the Upper Eagle River Valley Water Authority took the action without informing him and others affected by the proposed reservoir. The water authority filed in December of 1993 for water rights to build the 5,780 acre-foot reservoir, which is not scheduled for construction for at least another 12 years. The water authority has the legal right to condemn land for water projects. Scudder plans to oppose the reservoir on environmental and legal grounds.

Montrose Daily Press 2/23/94

WATER TRANSFER

Northern District Ponders Next Move in Thornton Project

In February 1994 Judge Robert Behrman issued a long-awaited decision on Thornton's Northern project which will divert water from northern Weld and Larimer county farms. But Northern Colorado Water Conservancy District (NCWCD) and other water officials question the amount of water that Thornton officials say the decree allows. Thornton believes the decree allows the city to withdraw an average of 56,000 acre-feet of water per year, with a firm annual yield of more than 33,000 acre-feet assured in very dry years. NCWCD officials say the rights held by Thornton are conditional rights that are junior to rights held by the water district and the city of Fort Collins, among others.

The backbone of Thornton's project are the water rights from the 100 or so farms it purchased which are irrigated by water from the Water Supply and Storage Company. On average, the court determined that the annual consumptive use of water applied to the Thornton farms is somewhat in excess of 14,000 acre-feet. Thornton's claims to 33,000 acre-feet are more than 18,000 acre-feet more than the transferable consumptive use amount from the farms. Thornton plans to appeal several aspects of the original court ruling. The NCWCD is studying those appeals to determine what cross appeals it may need to file. NCWCD officials question the amount of water Thornton says the decree allows.

Greeley Tribune 3/6/94

NATIVE AMERICAN WATER RIGHTS

Tribe Bills Water District \$33 Million

The Uintah and Ouray Indian tribe has recently billed the Central Utah Water Conservancy District \$33 million for use and delivery of 60,000 acre-feet of water diverted from Rock

Creek into the Strawberry Reservoir system since June of 1989. The water was used to maintain minimum stream flows in the Bonneville Basin, thus damaging the Rock Creek fishery, according to the tribe. The bill is for a total of 300,000 acre-feet at \$120 per acre-foot per year. The water district is the multi-county agency responsible for completion of the Central Utah Project.

At issue is the state's attempts to agree on a compact with the tribe to quantify their water rights and how the tribe will be compensated. The tribe has yet to endorse the compact, believing it has been short-changed on its water rights. Instead, the tribe has recently met with members of the Southern Nevada Water Authority to discuss leasing surplus reservation water to Las Vegas. A spokesman for the state said if the tribe attempts to market its water out of state, they are going to face numerous institutional problems to do so.

Denver Post 2/3/94, Western States Water 2/4/94

WATER QUALITY

Salinity Program to Receive Scrutiny

The U.S. Bureau of Reclamation will undergo intensive public review of its salinity-control program before deciding whether to ask Congress for more money to continue the program. The USBR has \$59 million remaining from a \$301 million budget for projects in the upper Colorado basin. Work in progress will continue until 1995; meanwhile no new contracts will be let for salinity-control work. Questions the USBR hopes to answer: (1) Why does the federal government have a special program in the Colorado River basin to control salinity? (2) What are the river salinity standards, are they correct, and is the program meeting them? (3) How can the USBR approach the problem more efficiently?

Grand Junction Daily Sentinel 1/27/94

ENVIRONMENT

EPA Orders River Repair

The Environmental Protection Agency has ordered three New Mexico men to restore a portion of the San Juan River they allegedly damaged in an attempt to redirect the river. The men, who own property on the river in a development called the San Juan River Estates, contracted for unauthorized "dredge and fill" activities. Material was dredged from the bottom of the river and its banks in November of 1992. The material was placed in the river to construct dikes intended to redirect the flow, causing the original channel to dry out and result in severe erosion to its wetlands. The EPA has ordered the men to develop a plan to remove the dredged material, restore the area, and revegetate the damaged area to prevent or reduce erosion of the river's banks.

Montrose Daily Press 1/28/94

State Calls for Stricter Rules for Mining

The environmental disaster at Summitville Mine has led the state to propose new restrictions on metal mines. The regulations were prompted by new statutes enacted by the state legislature in 1993 in the weeks after the mine's holding pond spilled copper-laced water into the Alamosa River, killing fish for 17 miles downstream. Key points of the regulations are: all phases of design, engineering and construction will be closely monitored by the state; "grandfather" exclusions for existing mines no longer apply and those mines must come into compliance; reclamation bonds will be set to reflect the real cost of putting mined land back into useable condition and high-risk mining must have a greater share of their bonds made in cash. The result will be tougher requirements all around for high-risk mines.

Grand Junction Daily Sentinel 2/12/94

WILDLIFE

Greenback Cutthroat Becomes State Fish

The greenback cutthroat trout has become Colorado's state fish. In the nineteenth century the species swam and spawned in abundance throughout Colorado's major rivers and tributaries. But as Colorado's population grew industrialization and pollution took its toll on the fish. In addition, other introduced species of non-native trout -- primarily brown and brook trout -- took over much of the greenback's habitat. By 1937 the native fish had nearly disappeared, and the species was listed as endangered. Today the greenback cutthroat thrives in 48 different locations around the state.

Denver Post 3/20/94

Four Fish Species Win 1,980-Mile Haven

The U.S. Fish and Wildlife Service (FWS) has designated 1,980 miles of stream in the Colorado River basin as critical habitat for four endangered fish species. The designation will set minimum year-round stream flows on portions of the river and its tributaries. The designation was a result of settlement of the Sierra Club Legal Defense Fund suit. The fish affected are the razorback sucker, humpback chub, bonytail sucker, and Colorado sucker. In Colorado large portions of the Yampa, White, Gunnison, Colorado, and San Juan rivers fall under the critical habitat designation. According to a defense fund lawyer small farmers and irrigators won't be affected by the designation, and new water projects will be able to proceed, although releases from large USBR dams may be adjusted for year-round flows.

Rocky Mountain News 3/23/94

Drawdown of Brush Hollow Reservoir Kills Fish

Brush Hollow Reservoir was recently drained for dam repairs and resulted in the death of hundreds of large-mouth bass and other species. Fishermen are upset the state Division of Wildlife (DOW) did not ask for volunteers to help clear out fish before the reservoir was drained. The DOW responded that division workers tried to save as many of the fish as possible. Unfortunately the fish remained in the nearly empty reservoir as long as possible, making a run for the drain into Brush Hollow Creek all at once, blowing out fish screens and overwhelming workers netting the fish. Most of the fish died of oxygen deprivation. Those fish successfully caught were trucked to Lake Pueblo. Now drained, Brush Hollow Reservoir will be examined for dam repairs and will begin refilling during fall of 1994.

Pueblo Chieftain 2/22/94

Wyoming, Nebraska, Colorado Seek Platte Water Solution

Over the past decade, Colorado, Wyoming, and Nebraska have discussed at various times how to manage the North Platte, South Platte, and Platte rivers so that all water users -- including wildlife -- might be served. The three states are likely to agree in the next few months to create a program to look at ways to meet the water needs of endangered species along the South Platte River. The current stimulus for an interstate accord in the Platte basin is the impending expiration of U.S. Forest Service special-use permits for operation of some 250 water projects on federal lands in Colorado, including the city of Greeley's high mountain reservoirs.

Greeley officials have challenged a draft opinion by the U.S. Fish and Wildlife Service that two of the city's mountain reservoirs indirectly harm downstream habitat for whooping cranes and other endangered species in Nebraska. The Forest Service wants the reservoirs to release bypass flows as requirements for renewal of the permits. The city has appealed to the U.S. Forest Service, which will be determining conditions to be placed on renewal of 20-year permits for the reservoirs. Similar water projects with expiring permits provide water to millions of Coloradans, including the two million residents of the Denver metropolitan area. It appears the U.S. Fish and Wildlife Service appears willing to work with the three states to attempt a cooperative solution.

U.S. Water News 2/1994, Greeley Tribune 3/18/94

PEOPLE

Glenwood Water Lawyer to Succeed Salazar

Glenwood Springs water lawyer James Lochhead has been nominated to succeed Ken Salazar as director of the Colorado Department of Natural Resources. In an unusual move, Lochhead will work out of his Glenwood office two days each

week, and be in Denver the other three days. Governor Roy Romer agreed to the situation when he convinced Lochhead to leave private practice and take the state position. Lochhead has served the Department of Natural Resources on a contract basis since 1987 as Colorado's commissioner on the Upper Colorado River Commission. Salazar, chairman of the Great Outdoors Colorado board of directors, left Romer's cabinet to return to private law practice in Denver.

Pueblo Chieftain 2/25/94

Windsor Man Named to NCWCD Board

Kenton Brunner, a Windsor native and operator of Bruner Farms, was named to the Northern Colorado Water Conservancy District Board of Directors. He replaces Sam Telep of Greeley who died in January. Brunner, who graduated from Colorado State University with a degree in business finance, has 15 years experience in water issues. He is currently secretary of the Windsor Water and Sewer Board.

Greeley Tribune 3/17/94

WATER RATES

Denver Water Bills to Rise

The Denver Water Board ignored the objections of some residents and ordered a 28 percent increase in the water bills of a typical Denver homeowner. The rate increases are scheduled to take effect in two stages -- June 1, 1994 and January 1, 1995. The new charges are less than the 46 percent increase over three years proposed earlier in the year. Critics complain the system still fails to deal with complaints that commercial users pay less for water than residents, and that the water department is not operating as efficiently as possible. In response, the water board ordered a study of ways the department could shave costs.

Denver Post 3/2/94

RECREATION

Arkansas River Stretch Closed to Rafters

The Colorado Division of Wildlife is closing a work-famous stretch of whitewater on the Arkansas River to boaters. Chaffee County commissioners granted a perpetual easement to the division for a section of the river known as Pine Creek Run. The easement permits fishing in the area but prohibits boating. The Arkansas Headwaters Recreational Area is negotiating with state wildlife officials to regain access for rafters, kayakers, and other boaters.

Montrose Daily Press 2/1/94

LITIGATION

State's Loss from Kansas Ruling Estimated

Colorado may lose as much as 30,000 acres of farmland and \$20 million in land values because of a ruling awarding Kansas water from Colorado on the Arkansas River. Approximately one-tenth of the 300,000 acres of farmland in the lower Arkansas Valley is endangered by a Special Master's ruling on February 4, 1994. The ruling states Kansas is entitled to be reimbursed for well-depletion by Colorado in the lower Arkansas Valley since 1948. One estimate is Colorado owes Kansas between 14,000 and 25,000 acre-feet for each of those 36 years, but the amount was not specified in the ruling. The ruling could result in shutting down all wells dug in the lower Arkansas Valley since 1948 for which the well owner does not also have surface rights. The ruling is expected to be reviewed by the U.S. Supreme Court sometime next year, and a final decision is believed to be three years away.

Montrose Daily Press 2/23/94

Nebraska, Wyoming Will Seek Settlement

Nebraska and Wyoming have agreed to negotiate a settlement of a longstanding lawsuit over the North Platte River. The two states have been involved in a court battle over how much water each state is entitled to from the river. In 1986 Nebraska sued Wyoming in the U.S. Supreme Court over several projects and proposed projects in Wyoming that threatened to undermine a 1945 decree apportioning North Platte River water between the states. Governors of each state will name a three-member team to negotiate a settlement.

Montrose Daily Press 2/23/94

Justice Department drops appeal in water case

In a victory for Colorado water providers, the U.S. Justice Department has dropped an appeal in a water-rights case in which the U.S. Forest Service sought to claim water from four national forests in the state. The Justice Department had appealed a 1993 ruling made by the District 1 water court in Greeley. In the case, the Forest Service stated it had a right to thousands of acre feet of water that originated on the agency's property. The agency said the water was needed to maintain stream and river channels and offered no payment for the water. The Forest Service's claim was quickly opposed by 33 state and local agencies and water providers. The opponents contended that if Forest Service claims were approved the agency would claim nearly all the spring runoff and all the flows in some streams.

Coloradoan 3/30/94

1994 AWRA-COLORADO SECTION MEETING
BIODIVERSITY AND ECOLOGICAL INTEGRITY -- MEETING TOMORROW'S CHALLENGES TODAY
by Jennifer Roberts and Greg Silkensen

The 1994 annual meeting of the AWRA (American Water Resources Association) Colorado section, was held in Denver on March 18, 1994. While the national organization is over 30 years old, the Colorado section of the AWRA was founded within the last 10 years. The Colorado section focuses on three principal goals: 1) to advance water resource planning, development and education; 2) to establish a common meeting ground for the physical and biological sciences; and 3) to collect, organize and disseminate information.

The 1994 annual meeting was clearly an effort toward these goals, as it addressed the very timely and multi-disciplinary topic of biodiversity and ecological integrity. The sessions began with an introduction to biodiversity and ecological integrity and progressed to how they relate to water resources development and the various techniques and approaches to achieve these goals. The event concluded with a panel discussion on specific issues in the South Platte River and its role within the Platte River basin.

Bob Jacobson, Assistant Regional Director for Ecological Services of the U.S. Fish and Wildlife Service, gave the keynote address. Jacobson discussed the fact that no single agency manages an entire ecosystem. Therefore, functioning partnerships between federal, state, local, tribal, public and private organizations are essential to preserve biodiversity (*the variety of life in all its processes, including the communities & ecosystems to which it belongs*) and ecological integrity (*the interrelationships between and within the various dynamic communities*). Furthermore, Jacobson advised that biodiversity and ecological integrity should be integrated across the disciplines as a philosophy, and management goals should be clearly established prior to any action. These were words that were to be echoed throughout the remaining sessions.

Following the keynote address, Robert Ward, CWRRI Director, and John Stednick, Department of Earth Resources at CSU, described an ongoing effort at Colorado State University to coordinate and write a usable definition of ecological integrity. The multidisciplinary effort, a CWRRI-funded project, involves thoughtful discussion and debate in an attempt to form a consensus. Indirectly, the importance of functioning partnerships was again emphasized by Ward and Stednick. Although the group had a common denominator (*water*) upon which to base their efforts, the different disciplines speak a very different language. For example, *base flow* may not have the same meaning to a biologist as it does to an engineer.

Several speakers discussed the possibility that revisions to federal legislation (primarily the Clean Water Act and the Endangered Species Act) may serve as a focal point around which efforts to achieve biodiversity and ecological integrity can be centered.



Panel members from left: Skip Underwood, Alan Berryman, Doug Robotham, Bennett Raley, Zach Miller, Chair Steve Dougherty, and Dennis Buechler.

Steve Dougherty of ERO Resources Corporation explained that Colorado's focus, in terms of wildlife, has been on discrete species (big game, sport fish and threatened or endangered species.) Dougherty stated that the goal of ecosystem management should be to displace the emphasis on individual elements and instead focus on: (1) maintaining plant and animal species and restore them if needed; (2) monitoring the ecological processes by choosing appropriate indicators; and perhaps most importantly; (3) integrating the human factor (economics, politics, social aspects) into the equation.

The day ended with a panel discussion that addressed the Platte River basin and problems involving endangered species along the mainstem of the river in Nebraska. Panelists were: Skip Underwood, US Forest Service; Alan Berryman, Colorado Division of Water Resources; Doug Robotham, Colorado Department of Natural Resources; Bennett Raley, Hobbs, Trout and Raley; Zach Miller, Davis, Graham & Stubbs; Panel Chair Steve Dougherty, ERO Resources; and Dennis Buechler, US Fish and Wildlife Service (substituting for Bob Jacobson). As part of its mitigation efforts, the U.S. Forest Service has proposed requiring additional water releases from mountain reservoirs on federal land along Colorado's Front Range to help restore lost habitat in Nebraska. Opponents argue the water may never reach Nebraska due to geography, South Platte River characteristics, and Colorado water law.

It was apparent from the panel discussion that a solution will require exactly what the day's speakers had emphasized; namely, a willingness on the part of the broad interests involved to work together and reconcile environmental goals with the governing economics and policies.

MEETINGS

PMWPCA Safety Committee 8-hour Safety Seminar, Colorado Springs, CO, May 6 (tentative)

- ✓ OSHA Regulations
- ✓ Process Safety
- ✓ Confined Spaces
- ✓ Vendor Demonstrations

For more information, call Tim Grotheer, Plum Creek WWTP, (303) 660-9830.

Water Policy and Management: Solving the Problems, May 23-26, 1994, Denver, CO--The Water Resources Planning and Management Division, American Society of Civil Engineers, will hold its 21st Annual Conference May 23-26, 1994, in Denver, Colorado. The theme will be "Water Policy and Management: Solving the Problems." For information contact: Technical Program Chair Harry N. Tuvel, Boswell Engr., 330 Phillips Ave., So. Hackensack, NJ 07606. Phone 201/641-0770; FAX 201/641-1831.

Fifth International Symposium on Society and Resource Management, *Creating Research, Education, and Management Partnerships Among Natural Resource Professionals*, June 7, 1994, Fort Collins, CO--The overall theme of the symposium is creating education, research and management partnerships among natural resource professionals. Participants will have the opportunity to attend a wide range of professional development programs--three concurrent sessions of lecture/poster presentations, lecture-style presentations, and dialog sessions.

Hosted by **The Human Dimensions in Natural Resources Unit** of the College of Natural Resources, Colorado State University. For program information contact: Jennifer Pate, Symposium Coordinator, College of Natural Resources, Human Dimensions in Natural Resources Unit, 245 Forestry, Colorado State University, Fort Collins, CO 80523 Phone 303/491-2077; FAX 303/491-2255.

To register contact: 5th International Symposium, Office of Conference Services, Colorado State University, Fort Collins, CO 80523, FAX 303/491-0667.

Regulatory Takings and Resources: What Are the Constitutional Limits?, June 13-15, 1994, University of Colorado School of Law, Boulder, CO--The Natural Resources Law Center of the University of Colorado School of Law will offer this three-day conference. Governmental regulation for environmental protection purposes can affect the manner in which land and natural resources are developed and used. The U.S. Constitution prohibits the government from "taking" property without compensation. This conference will address

the law of takings and its application in the areas of mining, public lands, water, wetlands, and endangered species. Cost: \$475 through June 6, or \$525 thereafter, with discounts available for government, academics, and public interest groups. Inquiries should be directed to: Katherine Taylor, Conference Coordinator, Campus Box 401, Boulder, CO 80309-0401. Phone 303/492-1288; FAX 303/492-1297.

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

ASCE 2nd International Ground Water Symposium, July 17-22, 1993, Orlando, FL, Walt Disney World Swan--The Second International Symposium on Artificial Recharge of Ground Water provides a forum for international technology transfer relating to all aspects of artificial recharge. Papers will be presented from over 22 states and 23 countries, and will include recharge by wells or spreading basins with various qualities of potable water, surface water, and reclaimed wastewater into consolidated and unconsolidated, confined and unconfined aquifers. Issues will include technical as well as legal, environmental, economic and other considerations that comprise successful recharge projects. The symposium is convened jointly by the American Society of Civil Engineers' Special Standards Division and Irrigation and Drainage Division. Co-Sponsors are the U.S. Bureau of Reclamation, U.S. Geological Survey, and U.S. Environmental Protection Agency. For registration information, contact: David Pyne, CH2M Hill, P.O. Box 147009, Gainesville, FL 32614-7009; phone 904/331-2442.

Annual RMSAWWA/RMWPCA Conference Update, Crested Butte, CO, Sept. 11-14, 1994--The 67th Annual Meeting of the Rocky Mountain Section of the American Water Works Association and the 57th Annual meeting of the Rocky Mountain Water Pollution Control Association will be held September 11-14 in Crested Butte, Colorado. This year's program will feature keynote speakers Mr. Richard Underwood of Space Panoramas on "A view of the World's Environment from Space," and Mr. Cliff Brockman on the "Biosphere Project." Specialty workshops are scheduled for **Watershed Management Approaches, Diversity on the Workplace, and Arsenic in Drinking Water Supplies**. Special lodging rates are available. To volunteer to help or for more information contact the Conference Coordinator, Mark Van Nostrand (303) 825-5999 or the Registration Coordinator, Lavonne Atkins (303) 727-8990.

Upcoming RMWPCA Seminar--The Rocky Mountain Water Pollution Control Association is conducting a seminar on the Principles and Practice of Nitrogen and Phosphorus Removal from Wastewater on July 14 at the Clarion Hotel in Boulder. Presenters will be H. David Stensel, David Jenkins,

Glen T. Daigger, and W. Wesley Eckenfelder Jr. The presenters are known nationwide for their expertise in the field. Call Norman Henderson at the City of Broomfield 303/466-5185 for details.

CALLS FOR PAPERS

Public Works and the Human Environment, Seattle, Washington, April 19-21 1995. Sponsored by the American Public Works Association (APWA) Washington State Chapter. Authors are invited to submit four copies of a 1-2 page abstract for each paper. The work should focus on practical applications of public works principles and solutions in addressing future needs. Topics include, but are not limited to: transportation, ports, water resources, wastewater, air pollution, solid waste management, hazardous waste, infrastructure management and environmental finance. The abstract should be in English and include a clear description of the work; authors' names, affiliations, addresses, telephone and fax numbers, and an e-mail address if available. One author should be identified with an asterisk as the contact person. Abstracts should be mailed to:

APWA Symposium
University of Washington
Engineering Professional Programs, XD-51
3201 Fremont Avenue North
Seattle, WA 98103 USA
TEL: (206) 543-5539
FAX: (206) 543-2352
e-mail: kvamme@u.washington.edu

International Conference on Water Resources Management in Arid Countries--March 12-16, 1995 in Muscat, Sultanate of Oman. Interested persons should submit an abstract for a paper of poster before June 1, 1994. A comprehensive one-page abstract is desired on the management of limited water resources in arid climates for regions of rapid growth in population, economic development and agricultural production. Please include a one-page vitae. Submit original abstract and vitae to:

Mr. Saif bin Rashid Al Shaqsi
Acting Director General WRM
Ministry of Water Resources
P.O. Box 2575, Ruwi - 112
Sultanate of Oman
Telefax: (968) 799563

and a copy to:

Dr. Glenn E. Stout
International Water Res. Assoc.
University of Illinois
1101 W. Peabody
Urbana, IL 61801, U.S.A.
Telefax: (001) 217-244-6633

2-Day Stormwater Model Users Conference, June 30-July 1, 1994, University of Colorado, Boulder, CO--An estimated 24 papers will be presented at this conference, each of 20 minutes' duration. Proposed papers should be described in a one-page abstract mailed or faxed by April 25, 1994 to Penn Gildersleeve, care of Greenhorne & O'Mara, Inc., 3131 So. Vaughn Way, Suite 428, Aurora, CO 80014. Contact Penn Gildersleeve for conference technical information at Phone 303/755-9000 or FAX 303/755-2765. Conference registration: \$225 before June 17; \$275 after.

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

Water Resources and Environmental Hazards: Emphasis on Hydrologic and Cultural Insight in the Pacific Rim, June 25-28, 1995, Honolulu, Oahu, Hawaii--Submit three copies of 250-word abstract to: Raymond Herrmann, Symposium Technical Program Chairperson, National Biological Survey, Colorado State University, Fort Collins, CO 80523, Phone 303/491-7825. Deadline: Oct. 28, 1994.

Northwest Regional Riparian Symposia: Diverse Values--Seeking Common Ground, Dec. 8-9, 1994--The Idaho Cooperative and Co-sponsors are soliciting authors and papers to be presented at a major symposia on riparian management issues impacting land users, managers, researchers and policy makers in the Northwest region, including Canada. Author and Title are due by June 15, 1994. Abstracts are due by September 15, 1994. Indicate poster or oral presentation. Submit title and abstract to:

Idaho Water Resources Research Institute
106 Morrill Hall
University of Idaho
Moscow, ID 83844-3011
Phone 208/885-6429;
FAX 208/885-6431

ANNOUNCEMENT AND CALL FOR PAPERS

INTEGRATED WATERSHED MANAGEMENT IN THE SOUTH PLATTE BASIN: STATUS AND PRACTICAL IMPLEMENTATION

October 26-27, 1994
The Ramkota Inn
Greeley, Colorado

The fifth annual **South Platte Forum** will explore the practical implementation issues associated with an integrated approach to watershed management in the South Platte Basin. Last year's event laid the conceptual foundation; this year's agenda will specifically address the status of integrated watershed management efforts, and propose implementation alternatives and methodologies.

What information base is needed to support an integrated management approach to the river? What is the current status of research and regulatory activity in the basin? What process will work? What are the key factors influencing management of the resource? The **1994 Forum** will provide a setting for discussing these questions and defining the legal and political structure needed to implement an integrated approach to management of the South Platte River.

You are invited to submit a one-page abstract to the organizing committee for a planned 15-minute presentation. Topics of interest include:

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

Abstracts are due July 1, 1994. Authors whose papers are selected for presentation will be notified by August 1, 1994. The abstracts should be one page or shorter in length, and be submitted both in hard copy and Wordperfect or ASCII format on disk if possible. All submitted abstracts will be published in conference proceedings.

Submit materials to:

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

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

SHORT COURSES

Design of Water Quality Monitoring Networks Short Course, June 6-10, 1994 Colorado State University, Fort Collins, Colorado

This short course will present detailed procedures for designing a water quality monitoring system. Design procedures will apply to the design of any monitoring system, regardless of the location of the water in the hydrologic system. The information goals covered include ambient conditions, trends and excursions beyond a limit.

Following a review of basic statistics, the Short Course will address the use of statistics in the analysis of water quality data and the ramifications of such analysis on the design of the entire monitoring system. These ramifications involve sampling frequency, measurement techniques, data reporting formats, data storage and retrieval methods, and sampling locations. Analyzing and redesigning an existing monitoring network will be emphasized citing case studies. In addition, biological monitoring and nonpoint source monitoring, both urban and rural, will be covered. A new topic will be covered this year,

a case study combining the efforts of 51 separate monitoring agencies into a statewide monitoring cooperative.

The Short Course is directed to persons actively involved with the design, operation and/or management of a water quality monitoring network for both surface and subsurface monitoring. It was developed assuming that attendees will have little or no background in statistics. Each participant will receive a text written by the course instructors, **Design of Networks for Monitoring Water Quality**, a copy of software **WQSTATII** and a users manual. Participants should bring a calculator as it will be needed during the problem sessions. For additional information, please contact: Thomas G. Sanders, Program Leader, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone 303/491-5448; FAX 303/491-7727.

Activated Sludge Process Control Short Course, June 20-24, 1994 Colorado State University, Fort Collins, Colorado

Will present the methodologies and laboratory techniques to generate process control parameters for operating an activated sludge process. Application of the process control methods can result in improved efficiency of the activated sludge process and a savings of thousands of dollars annually in operating costs alone. The course will be valuable to engineers and other

professionals who design, operate or manage activated sludge treatment processes. For additional information, please contact: Thomas G. Sanders, Program Leader, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80521. Phone 303/491-5448; FAX 303/491-7727.

Water Resources Development and Environmental Protection: Problems, Issues and Solutions Short Course, June 27-July 1 1994 Colorado State University, Fort Collins, Colorado

Focuses on the complicated relationships and controversies between water resources development, characteristics of the hydrologic cycle at a particular location, and environmental quality and protection. Topics include effects of water resources development, conservation, control and protection on the resulting environmental quality and the need for environmental protection. It addresses given characteristics of hydrologic formation and humans' attempt to control various aspects of the hydrologic cycle. The course helps participants develop an

understanding of the complex and extraordinary interdependence of environmental quality, protection and improvement and various types of water resources developments. The focus on controversies, issues and problems and their solutions helps when preparing environmental impact reports and other documents. For additional information, please contact Vujica Yevjevich or Thomas G. Sanders, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Phone 303/491-5448; FAX 303/491-7727.

QUENCHING THE URBAN GIANT

Mark Your Calendar!

July 20-22, 1994

19TH ANNUAL COLORADO WATER WORKSHOP

Western State College
Gunnison, Colorado

How will Colorado meet the water needs of its growing urban population?
Can systems integration and conservation reduce demand for new supplies?
Will farms dry up to slake our cities? How could bypass requirements,
public trust initiatives and environmental concerns affect urban supplies?

Registration information will be mailed in early June.

Contact: Lucy High 303/943-7156

CLE and academic credits available

1994 SHORT COURSES

INTERNATIONAL GROUND WATER MODELING CENTER

Practical Methods for Assessment and Remediation of Hydrocarbon Spills, May 23-26, 1994, San Diego, California--Instructors will cover principles of modeling subsurface hydrocarbon behavior in soils and groundwater and present several modeling tools ranging from simple analytical models to state-of-the-art numerical models. Lectures will cover uses and limitations of models for assessment and design of free product recovery; dissolved plume migration and control; and soil vacuum extraction and air sparging. Course Instructors: Drs. J.C. Parker, A.K. Katyal (Env. Systems & Technologies, Inc.), and Ms. S. Paschke (IGWMC). For more information contact EST, phone 703/552-0685.

Fundamentals of Stochastic Modeling of Flow and Transport in Porous Formations, June 13-17, 1994, Golden, Colorado--Based on the book, *Flow and Transport in Porous Formations* by G. Dagan. Drs. G. Dagan (Tel Aviv University) and Y. Rubin (Univ. of California at Berkeley) will discuss the fundamentals of stochastic theory and modeling. Exercise solving and using computer codes will help with understanding the concepts. The codes that will be used comprise computer simulation of random properties, generation of random velocities, and solute particle motions and conditioning by measured data.

POSITION AVAILABLE

Utah Water Research Laboratory, College of Engineering, Utah State University -- Applications invited for the position of Administrative Associate Director to assist the UWRL Director in management and coordination of administrative affairs, manage support areas, and provide research project field logistics and program management. A BS degree in a technical field and five years management experience in a technical operation is preferred. Position will remain open until filled. To apply please send application letter, resume and names of three references to:

Administrative Associate Director Search Committee, Utah Water Research Laboratory
Utah State University, Logan, Utah 84322-8200

CALENDAR

- Apr. 27-29 WILDLIFE WATER DEVELOPMENT: INTEGRATED APPROACHES TO WILDLIFE MANAGEMENT AND CONSERVATION, Laramie, WY. Contact: Susan Powell, P.O. Box 3972, Laramie, WY 82071-3972. Phone 800/484-7801.
- May 11-13 DROUGHT MANAGEMENT IN A CHANGING WEST: NEW DIRECTIONS FOR WATER POLICY, Portland, Oregon. Contact: Western Drought Conference, International Drought Information Center, 236 Chase Hall, University of Nebraska, P.O. Box 830728, Lincoln, NE 68583-0728. Phone 402/472-6707; FAX 402/472-6614.
- June 7-9 1994 ANNUAL MEETING, GREAT PLAINS AGRICULTURAL COUNCIL, Bismarck, ND. Contact Melvin Skold at 303/491-7370.
- June 7-10 FIFTH INTERNATIONAL SYMPOSIUM ON SOCIETY AND RESOURCE MANAGEMENT, Fort Collins, CO. Contact: Office of Conference Services, Colorado State University, Fort Collins, CO 80523. FAX 303/491-0667.
- June 9-12 IGWMC GROUNDWATER MODELING CONFERENCE 1994, Golden, CO. Contact: Janet Montera, Dept. of Civil Engr., Colorado State University, Fort Collins, CO 80523. Phone 303/491-7425; FAX 303/491-7727.
- June 6-17 INTERNATIONAL DAM SAFETY, OPERATION AND MAINTENANCE SEMINAR AND STUDY TOUR, Denver, CO., San Francisco CA and Sacramento CA. Contact: American Water Foundation, PO Box 480632, Denver, CO 80248-0632.
- June 13-15 CONSTITUTIONAL LIMITS ON ENVIRONMENTAL REGULATION: LAND, WATER, AND RESOURCES DEVELOPMENT AND USE. For information contact Kathy Taylor, 303/492-1288.
- June 26-29 EFFECTS OF MAN-INDUCED CHANGES ON HYDROLOGIC SYSTEMS, Jackson Hole, WY. Contact: David Naftz, USGS, Salt Lake City. Phone 801/975-3389.
- July 12-15 SUSTAINING THE ECOLOGICAL INTEGRITY OF LARGE FLOODPLAIN RIVERS: APPLICATION OF ECOLOGICAL KNOWLEDGE, LaCross, WI. Contact: Dr. K.S. Lubinski, US Fish & Wildlife Serv., Environ. Mgmt. Tech. Ctr., 575 Lester Ave., Onalaska, WI 54650.
- July 20-22 QUENCHING THE URBAN GIANT, 19th Annual COLORADO WATER WORKSHOP. Contact: Lucy High at 303/943-7156.
- Aug. 7-12 STORMWATER NPDES RELATED MONITORING NEEDS, Crested Butte, CO. Contact: Barbara Hickemell, 345 E. 47th St., New York, NY 10017. Phone 212/705-7836.
- Sept. 11-14 11TH ANNUAL CONFERENCE OF ASDSO (ASSOCIATION OF STATE DAM SAFETY OFFICIALS, INC.), Boston, MA. Contact ASDSO at Phone 606/257-5146.

CALENDAR

WILDLIFE WATER DEVELOPMENT: INTEGRATED APPROACHES TO WILDLIFE
MANAGEMENT AND CONSERVATION, Laramie, WY. Contact: Susan Howell, P.O. Box 3072,
Laramie, WY 82071-3072. Phone: 800/644-7881.

DROUGHT MANAGEMENT IN A CHANGING WEST: NEW DIRECTIONS FOR WATER POLICY,
Portland, Oregon. Contact: Western Drought Conference, International Center, 125
Chase Hall, University of Nebraska, P.O. Box 80702, Lincoln, NE 68580-0702. Phone: 402/473-6707,
FAX: 402/473-6614.

1994 ANNUAL MEETING, GREAT PLAINS AGRICULTURAL COUNCIL, Bloomington, MN. Contact:
Melvin Stahl at 609/451-3371.

FIFTH INTERNATIONAL SYMPOSIUM ON SOCIETY AND RESOURCE MANAGEMENT, Fort
Collins, CO. Contact: Office of Continuing Education, Colorado State University, Fort Collins, CO 80523.
FAX: 970/461-0467.

IOWMC GROUNDWATER MODELING CONFERENCE 1994, Fort Collins, CO. Contact: John Menden,
Dept. of Civil Engg., Colorado State University, Fort Collins, CO 80523. Phone: 970/461-7433; FAX:
970/461-7327.

INTERNATIONAL DAM SAFETY, OPERATION AND MAINTENANCE SEMINAR AND STUDY
TOUR, Denver, CO. Contact: San Francisco CA and Sacramento CA. Contact: American Water Foundation, P.O.
Box 48033, Denver, CO 80248-0033.

CONSTITUTIONAL LIMITS ON ENVIRONMENTAL REGULATION: LAND, WATER, AND
RESOURCES DEVELOPMENT AND USE. For information contact: Kelly Taylor, 970/461-1389.

Colorado Water Resources Research Institute
410 University Services Center
Colorado State University
Fort Collins, CO 80523

Bulk Rate
U.S. Postage
PAID
Ft. Collins,
Colo.
PERMIT NO 19

Morgan Library
Documents